

Multistate Research Coordinating Committee and Information Exchange Group

Project Number: NCCC_TEMP170
Title: Research Advances in Agricultural Statistics
Duration: October 2006 to September 30, 2011
Administrative Advisor(s): [[John Boyer, Jr.](#) (research)]
CSREES Reps:

Statement of Issue(s) and Justification

Statisticians who consult and do research in an Agricultural Experiment Station environment have a unique relationship with the University. Their multi-disciplinary, collaborative role is generally more extensive than that of other faculty within the University and often cuts across several departments or units. Collaboration of statisticians and scientists allows land grant institutions to perform their agricultural research missions more effectively and efficiently than would otherwise be possible. Statisticians at each station tend to specialize in specific areas. This multi-state committee provides a mechanism that brings together statisticians from many stations working in related areas. The resulting exchange of ideas and the sharing of knowledge is of benefit to all committee members and to the institutions they represent.

As State and Federal appropriations continue to fall short of levels needed for research, and grants become more competitive, it becomes even more imperative that research dollars go as far as possible. This requires Experiment Station statisticians to keep abreast of the latest statistical research as well as work to develop methodology appropriate to their consulting roles. With the increased availability of high speed computers, many new computationally intensive statistical methods and relevant software have become available.

Never has the charge to remain current in the statistical profession been more challenging. Assessing the utility of the new statistical methods and software is increasingly important. Further, dissemination of the information to agricultural researchers must be made in a timely manner. Thus, it is critical that Station statisticians work cooperatively to determine the best current approaches to common statistical problems and to help guide future directions of statistical research and software development.

In this respect, Experiment Station statisticians can work together to provide more effective assistance to the agricultural researchers of their respective states. This NCCC committee can play an extremely important role by serving as a focal point for the development and implementation of sound statistical practice. Thus this committee is a support project, that assists agricultural researchers in other disciplines in their efforts to accomplish the national research priorities. The members of this NCCC are committed to this goal.

Objectives

1. To identify, foster and coordinate cooperative research efforts in statistics among statisticians serving food and agriculture research programs.
2. To address the statistical design and analysis issues associated with studies involving technologies which typically produce a large number of spatially or temporally observations per sample but few samples (e.g., gene and protein arrays, mass spectroscopy, chromatography and precision agriculture).
3. To continue the assessment and development of statistical methodologies, both in design and analysis, used by statisticians and researchers for studies with spatially correlated data.
4. To continue addressing concerns associated with the development and implementation of mixed model techniques used by statisticians and researchers.
5. To facilitate the rapid transfer of new statistical methodologies and developments to statisticians and

researchers, with emphasis on those methodologies associated with correlated data and mixed model techniques.

Procedures and Activities

Since its inception, NCR-170/NCCC-170 has addressed a series of broad statistical topics using the following general procedure.

At each annual meeting, the members discuss current research projects at their university or research station and the statistical issues associated with them. These topics are compiled and when appropriate, the members use this information to decide on a statistical topic to be addressed by the group in the next project cycle. Once that decision is made, a three or four year cycle begins.

The first and, if necessary, second years are devoted to educating all project members on the chosen topic. This is accomplished primarily through the annual meeting technical programs presented by knowledgeable project members and, on occasion, by non-members (usually located at that year's meeting site). Once this phase has been completed, materials are developed for members to use in their research, education and outreach activities. These could include workshop materials for subject matter audiences, software and usage instructions for data analysis, and statistical material for project members own continuing education. Material development is carried out by a subcommittee of volunteers from the project membership. A draft of their work (e.g., a dry-run of a workshop) is presented at the next annual meeting to obtain feedback from the entire group. A decision is made as to whether or not a final version needs to be presented the following year.

Over the past thirteen years, project members have dealt with statistical aspects of on-farm trials, mixed models and spatial statistics. They have developed mixed model workshops for both statistical and subject matter audiences and a spatial workshop for subject matter audiences. These workshops have been successful and continue to be further developed and offered even though the project focus has moved to a new topic.

In addition to these group outputs, these discussions have also impacted project members' collaborations at their own institutions and have led to numerous refereed and non-refereed publications, participation in competitive grants and presentations at professional meetings. The Literature section of this proposal lists the publications from the NCCC-170's 2005 Annual Report as an example of these individual outputs. The book by Littell et al. (1996) remains an important reference for the analysis of mixed models.

At their 2005 annual meeting, project members selected the current topic to be a more wide-ranging problem rather than a statistical area of research. As consulting statisticians, we are becoming more and more involved in projects in which the data can be characterized by a limited number of samples, each of which has a large number of spatially and/or temporally related observations. Examples include problems in the area of precision agriculture, biotechnology (e.g., gene and protein array data), and chemometrics (e.g., mass spectroscopy and chromatography data). Despite this underlying common theme, there are a number of different statistical methodologies which may be applicable for a given study (c.f., Meek and Singer (2005), Nguyen and Rocke (2002), Rosa et al. (2005) and Tempelman (2005) for recent examples). To deal with this broader set of issues, the cycle for this topic may require an additional year to complete.

Expected Outcomes and Impacts

- Education of members leading to cooperative research efforts and improved consulting and teaching by individual members.
- Education of all members on valid statistical design and analysis approaches to this type of situation, development of cooperative research among some members and outreach efforts among all members.
- Cooperative research efforts among some members and information exchange on new developments among all members in the area of spatial statistics.

- Cooperative research efforts among some members and information exchange on new developments among all members in the area of mixed models.
- Continued offering of mixed model and spatial statistics workshops to educate subject matter scientists on valid design and statistical analysis of studies involving these topics.

Projected Participation

Include a completed [Appendix E](#)

Educational Plan

Members will educate their individual clientele of subject matter scientists and students in one-on-one and group settings as they deem appropriate. Workshops will continue to be offered to regional and national subject matter groups.

Organization/Governance

The Chair and Secretary are elected by the members present at the annual meeting. The meeting Local Arrangements Chair for the next year is the member from the state in which the meeting will be held. The meeting Program Chair for the next year is a volunteer from among the members present at the annual meeting.

Literature Cited

From the 2005 NCCC-170 Annual Report:

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Hartsock, N.J., T.G. Mueller, A.D. Karathanasis and P.L. Cornelius (2005). Interpreting soil electrical conductivity and terrain attribute variability with soil surveys. *Journal of Precision Agriculture*, 6, 53-72.

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Agriculture. G.A. Milliken (ed). Manhattan, KS: Kansas State University. 270-278.

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Singer, J.W., R.W. Malone, D.W. Meek, and D. Drake (2004). Predicting yield loss in indeterminate soybean from pod density using simulated damage studies. *Agronomy Journal*, 96, 584-589.

Singer, J.W. and D.W. Meek (2004). Repeated biomass removal affects soybean resource utilization and yield. *Agronomy Journal*, 96, 1382-1389.

Tempelman, R.J. (2004). Experimental design and statistical methods for classical and bioequivalence hypothesis testing with an application to dairy nutrition studies. *Journal of Animal Science*, 82 (E. Suppl.), E162-E172.

Tempelman, R.J., G.J.M. Rosa (2004). Empirical Bayes approaches to mixed model inference in quantitative genetics. In *Genetic Analysis of Complex Traits Using SAS*. A. Saxton, (ed). Cary, NC: SAS Institute, Inc.149-178.

Tempelman, R.J. (2005). Assessing statistical precision, power, and robustness of alternative experimental designs for two color microarray platforms based on mixed effects models. *Veterinary Immunology and Immunopathology*, 105, 175-186.

Tomer, M.D., D.W. Meek, and L.A. Kramer (2005). Agricultural practices influence flow regimes of headwater streams in Western Iowa. *Journal of Environmental Quality*. In press.

Zhu, J., Huang, H.-C., and Wu, C.T. (2005). Modeling spatial-temporal binary data using Markov random fields. *Journal of Agricultural, Biological, and Environmental Statistics*, 10, 212-225.

Additional References:

Littell, R.C., G.A. Milliken, W.W. Stroup and R.D. Wolfinger (1996). *SAS System for Mixed Models*. Cary, NC: SAS Institute, Inc.

Nguyen, D.V and D.M. Rocke (2002). Tumor classification by partial least squares using microarray gene expression data. *Bioinformatics*, 18, 39-50.

Attachments

none

Internal Linkages

AR, FL, ID, IL, IN, IA, KY, MD, MI, NV, OH, SD, UT, WA, WI

External Linkages

NPA, Pioneer Hi-Bred International, USDA-ARS-NSTL, USDA-ARS/TX

Appendix E: Format for Reporting Projected Participantion

Part 1: Participant List

Station/Institution and Department	Participant	Objective No.	Research						Extension	
			RPA	SOI	FOS	SY	PY	TY	FTE	Program
Arkansas - University of Arkansas	Edward Gbur *	1,3,5	901	7310	2090	0.20	0.00	0.00	0.00	• not specified
Florida - University of Florida	Mary C Christman *	1,2,3,4,5	901	7310	2090	0.10	0.00	0.00	0.00	• not specified
Idaho - University of Idaho	Bahman Shafii *	unknown	901	7310	2090	0.10	0.00	0.00	0.00	• not specified
Illinois - University of Illinois	German Bollero	1,2,3,4,5	901	7310	2090	0.10	0.00	0.00	0.00	• not specified
Illinois - University of Illinois	Donald Bullock *	1,2,3,4,5	901	7310	2090	0.10	0.00	0.00	0.00	• not specified
Indiana - Purdue University	Bruce A Craig *	1,2,3,4,5	901	7310	2090	0.00	0.00	0.00	0.00	• not specified
			903	7310	2090					
Iowa - Iowa State University	Theodore Bailey *	1,2,3,4,5	901	7310	2090	0.00	0.00	0.00	0.00	• not specified
Iowa - Iowa State University	Kenneth J Koehler	1,4,5	901	7310	2090	0.00	0.00	0.00	0.00	• not specified
Kentucky - University of Kentucky	Paul Cornelius *	unknown	901	7310	2090	0.00	0.00	0.00	0.00	• not specified
Maryland - University of Maryland	Bahram Momen *	1,2,5	0	0	0	0.10	0.00	0.00	0.00	• not specified
Michigan - Michigan State University	Robert Tempelman *	1,2,4,5	901	7310	2090	0.25	0.00	0.00	0.00	• not specified
Nevada - University of Nevada	George C. Fernandez *	1,2,3,4,5	0	0	0	0.00	0.00	0.00	0.00	• not specified
Northern Plains Area	Mark West *	1,2,3,4,5	901	7310	2090	0.10	0.00	0.00	0.10	• not specified
Ohio - Ohio State University	Bert L. Bishop	1	901	7310	2090	0.00	0.00	0.00	0.00	• not specified
Pioneer Hi-Bred International	Mark Hinds	unknown	0	0	0	0.00	0.00	0.00	0.00	• not specified
South Dakota - South Dakota State University	Cuirong Ren *	1,2,3,5	0	0	0	0.00	0.00	0.00	0.00	• not specified

USDA-ARS-NSTL	David Meek	1,2,3,4,5	901	7310	2090	0.10	0.00	0.00	0.10	● Natural resource and environmental management
USDA-ARS/TX	Sara Duke	1,2,3,4,5	901	7310	2090	0.00	0.00	0.00	0.00	● not specified
Utah - Utah State University	Susan L Durham *	1	901	7310	2090	0.10	0.00	0.00	0.00	● not specified
Washington - Washington State University	Richard Alldredge *	unknown	901	7310	2090	0.10	0.00	0.00	0.00	● not specified
Washington - Washington State University	Hao Zhang	1,2,3,4,5	901	7301	2090	0.10	0.00	0.00	0.00	● not specified
Wisconsin - University of Wisconsin	Jun Zhu *	1,2,3,4,5	901	7310	2090	0.10	0.00	0.00	0.00	● not specified

Part 2: Research Summary

Combination of RPA, SOI, and FOS	Total SY	Total PY	Total TY
0-0-0	0.100	0.000	0.000
901-7301-2090	0.100	0.000	0.000
901-7310-2090	1.350	0.000	0.000
903-7310-2090	0.000	0.000	0.000
Grand Total:	1.550	0.000	0.000

Part 3: Extension Summary

Program	Total FTE
Natural resource and environmental management	0.10
Grand FTE Total:	0.20