RITA HOGAN MUMM

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EDUCATION

Ph.D. in Genetics and Plant Breeding, University of Illinois at Urbana-Champaign, Department of Agronomy, 1993. Major Advisor: John W. Dudley. Thesis Topic: Molecular Markers Applied to Maize Breeding.

Jonathan Baldwin Turner Fellowship
Burlison Award from the Illinois Seed Dealers Association

B.S. in Agricultural Science, University of Illinois at Urbana-Champaign, 1989
Bronze Tablet Recognition [top 3% of graduating class]

A.S. with emphasis in Agriculture, Joliet Junior College, Joliet, Illinois, 1987
Student Achievement Award

EXPERIENCE

Principal, GeneMax Services, Champaign-Urbana, IL /Chapel Hill, NC, May 1999 - September 2002 and August 2005 - present

- Providing consulting services to the seed industry organizations as well as the public sector on the application of biotechnology and genomic information to plant genetic improvement.
- Areas of specialization include seed product development, deployment of biotech applications, quality assurance/quality control to ensure transgenic identity and purity, genomics-assisted breeding, scientific consulting/expert testimony in the legal arena, and continuing education. Engaged to provide review and overall evaluation of a number of commercial research programs and public sector breeding programs; contributed to *Bt* corn launch in the Philippines.
- Educational contributions: lead in establishing and directing the UC-Davis African Plant Breeding Academy, a continuing education vehicle for MS-and PhD-level scientists to impact food security in Africa; also core instructor for the UC-Davis Plant Breeding Academy outreach to America and Europe; developed and delivered workshops to private companies on select topics as continuing education to research workforce.

Emerita Assoc. Professor of Quantitative Genetics and Plant Breeding, University of Illinois, Urbana, IL, March 2013 – present.

- Education and Training Lead for the USAID Soybean Innovation Laboratory, aimed at developing high yielding soybean varieties for Africa and the value chain for small shareholder farmers. The main goal in this role is partnering with the University of Ghana/West African Centre for Crop Improvement to establish a MS degree program for Plant Breeding and develop graduate level courses in Plant Breeding, Statistics, and Genetics.

Board of Trustee Member, International Maize and Wheat Improvement Center (CIMMYT), Texcoco, Mexico, April 2014 – present. Co-chair of the (Scientific) Program Subcommittee; Chair of the Nominations Committee.

Visiting Professor, Iowa State University, Ames, IA. November 2016 – present.

- Coordinating MS curriculum development for Plant Breeding for E-Learning in Africa and creating an e-learning course in Cultivar Development.

Assoc. Professor of Quantitative Genetics and Plant Breeding, University of Illinois, Urbana, IL, June 2008 – February 2013.

Conducted research in areas of 1) quantitative genetics (the inheritance and manipulation of traits controlled by many genes), including abiotic stress tolerance and dry milling yields in maize for human food; 2)

applications of genomics (information obtained at the DNA, RNA, and protein levels) to aid in development of improved hybrids and varieties, including genomics-based prediction to guide choice of parents and to enhance selection; 3) effective deployment of value-added traits created through genetic engineering, including efficient breeding strategies, 4) Analysis of US land usage for corn-based ethanol.

- Developed 2 new graduate level courses in the Genetics/Plant Breeding curriculum: CPSC419 Midwest Agricultural Practices and CPSC 553 Advanced Plant Breeding.
- Primary accomplishments: Secured and directed $1M+ in research support funding to provide numerous project deliverables by multidisciplinary teams. Directly supervised 3 MS and 1 PhD students through to graduation and gainful employment; additionally have served on 3 PhD and 2 MS student committees. Made List of Teachers Ranked as Excellent for all 4 courses developed and taught at UIUC.

Director, Illinois Plant Breeding Center; University of Illinois, Urbana, IL, June 2008 – November 2012

- Led efforts with 27+ faculty to establish the IPBC to meet the acute shortage of plant breeders, aiming to increase both numbers of graduate students and the quality of education in plant breeding, and foster research that promotes these educational goals.
- Primary accomplishments: Successfully established the IPBC as a premier center for plant breeding education in the world, increasing graduate student enrollment nearly 3-fold (to 67 students as of Fall 2012), with the mean GPA of applicants at 3.7/4.0; instrumental in establishing industry/academic collaborations supporting campus-wide research portfolios; coordinated $5M in gifts to support education and student research; numerous educational enhancements and curriculum improvements initiated and implemented together with faculty and industry partners.

Head / Director, New Trait Development, Syngenta Biotechnology, Inc., Research Triangle Park, NC, October 2002 – July 2005

- Established/led global teams to facilitate value-added trait product development in wheat, barley, rice, and cotton, and plant-made pharmaceuticals in safflower; provided oversight to the establishment of facilities, systems, and strategies to expedite field testing to select the best source of a specified trait, to incorporate traits in elite germplasm in concert with conventional varietal improvement programs, and to coordinate with internal and external groups key to commercialization.
- Co-designed and directed implementation of Quality Assurance/Quality Control for transgenic trait product pipelines across all crops to ensure event identity and purity, and the stewardship of transgenic events in keeping with governmental standards; guided development of IT support to the QC system, including the archiving of data and analytical results.
- Served as a member of the senior management committee which reviewed the technical approaches and scientific methods planned with each transgenic trait project across all crops.
- Primary accomplishments: Positioned Syngenta for upcoming targeted market launch of cotton and wheat seed products incorporating value-added traits; upgraded QC systems to ensure event identity and purity via DNA-based techniques and efficient seed monitoring strategies; facilitated establishment of QA program in product development.

Director, Molecular Breeding, Informatics, Monsanto Company, Savoy, IL, January 1999 - April 1999

- Led group focused on new quantitative applications of molecular data in crop improvement and in the development of proprietary informatics tools and data management systems to facilitate such applications.
- Charter extended to all crops on a global basis.
- Supervised 4 Ph.D. scientists; managed interfaces with Information Technology and Genomics groups.
- Primary accomplishment: Played a key role in integrating and restructuring the molecular breeding effort represented across several acquired seed companies globally and in developing a strategic plan to maximize value to the organization.

Director / Project Director, Genomics Application, DEKALB Genetics Corporation, Savoy, IL, October 1995 - January 1999

- Directed program to utilize genomic data [particularly molecular marker data] in plant improvement, leading a multi-disciplinary team responsible for statistical research to facilitate breeding applications, the development of proprietary data analysis software, data management, intellectual property interests, marker lab operations, new DNA-profiling technology development, the interfaces with the Genomics Program and the Information Technology group, project coordination with plant breeders, and breeders' education on marker applications for new line/hybrid development and transgenic product development.
- Provided leadership to a team of approximately 20, with 4 Ph.D. scientists reporting directly.
- Primary accomplishment: Established a high-throughput, high-efficiency system that enabled breeders to use molecular markers on a wide scale basis in their breeding programs as a powerful tool in the

EXPERIENCE (Cont.)

development of corn hybrids with key performance characteristics, positioning DEKALB as an industry leader in implementing genomic information in seed product development.

Project Director / Program Manager, Value-Added Maize Product Development, DEKALB Genetics Corporation, Savoy, IL / Thomasboro, IL, July 1993 - September 1996

- Managed the Transgenic/Value-Added Product Development Program with responsibilities for breeding, regulatory compliance, and the design, implementation, coordination, and analysis of testing to evaluate transformant sources and corn hybrid conversions.
- Interfaced with molecular scientists, breeders, Marketing, Sales including dealer groups, and with Foundation/Production to facilitate the transfer of regulated materials and to develop appropriate Quality Assurance testing for purity.
- Developed strategies for marker-aided backcrossing to accelerate the conversion process.
- Supervised technical and management personnel located at company facilities in Illinois and Hawaii.
- Primary accomplishment: Facilitated commercial launch of 4 types of special trait corn products, 3 of which positioned DEKALB as first to market or among the first to market for the specific trait, by establishing new breeding and testing systems appropriate to the needs of these types of products to complement those already in place for conventional new line development. Awarded the Chairman's Quality Award, an internal recognition of superior achievement, in 1998 for contributions to the development of Roundup tolerant corn event GA21 and commercial launch of RR corn hybrids.

PATENTS ISSUED

US Patent No. 7,314,970. Method for plant breeding. Inventors: Michael Spencer, **Rita Mumm**, Jefferson Gwyn, David McElroy, Michael A. Stephens. Issued January 1, 2008.

European Patent No. EP 0975778B8. Use of glyphosate resistant maize lines. Inventors: Jefferson J. Gwyn, David McElroy, **Rita Mumm**, Michael T. Spencer, Michael Stephens. Issued November 21, 2007.

US Patent No. 6,762,344. Method of plant breeding. Inventors: Michael Spencer, **Rita Mumm**, Jefferson Gwyn, David McElroy, Michael A. Stephens. Issued July 13, 2004.

US Patent No. 6,395,966. Fertile transgenic maize plants containing a gene encoding the pat protein. Inventors: **Rita Hogan Mumm** and Michael T. Spencer. Issued May 28, 2002.

US Patent No. 6,040,497. Glyphosate resistant maize lines. Inventors: Michael Spencer, **Rita Mumm**, Jeff Gwyn. Issued March 21, 2000.

PEER-REVIEWED PUBLICATIONS

Butts-Wilmsmeyer, C., **R.H. Mumm**, and M.O. Bohn. 2017. Concentration of beneficial phytochemicals in harvested grain of US yellow dent maize (*Zea mays L.*) germplasm. J. Agricultural and Food Chemistry. (In press).

Macke, J.A., M.O. Bohn, K.D. Rausch, and **R.H. Mumm**. 2016. Genetic factors underlying dry milling efficiency and flaking grit yield examined in U.S. maize (*Zea mays* ssp. *mays* L.) germplasm. Crop Science 56:1-11. doi: 10.2135/cropsci2016.01.0024

Sun, X., and **R.H. Mumm**. 2016. Method to represent the distribution of QTL additive and dominance effects associated with quantitative traits in computer simulation. BMC Bioinformatics 17: 73. DOI 10.1186/s12859-016-0906-z.

Sun, X., and **R.H. Mumm**. 2015. Optimized breeding strategies for multiple trait integration: III. Parameters for success in version testing. Molecular Breeding 35:201. DOI 10.1007/s11032-015-0397-z.

PEER-REVIEWED PUBLICATIONS (Cont.)

Mumm, R.H., Goldsmith, P.D., Rausch, K.D., and H.H. Stein. 2014. Land usage attributed to corn ethanol production in the United States: sensitivity to technological advances in corn grain yield, ethanol conversion, and co-product utilization. Biotechnology for Biofuels 7:61. DOI: 10.1186/1754-6834-7-61.

Lambert, R.J., B.D. Mansfield, and **R.H. Mumm**. 2014. Effect of leaf area on maize productivity. Maydica 59: 58-64. http://www.maydica.org/articles/59_58.pdf

Mansfield, B.D., and **R.H. Mumm**. 2014. Survey of plant density tolerance in U.S. maize germplasm. Crop Science 54(1): 157-173. DOI 10.2135/cropsci2013.04.0252.

Peng, T., X. Sun, and **R.H. Mumm**. 2014. Optimized breeding strategies for multiple trait integration: I. Minimizing linkage drag in single event introgression. Molecular Breeding 33:89-104. DOI 10.1007/s11032-013-9936-7.

Peng, T., X. Sun, and **R.H. Mumm**. 2014. Optimized breeding strategies for multiple trait integration: II. Process efficiency in event pyramiding and trait fixation. Molecular Breeding 33:105-115. DOI 10.1007/s11032-013-9937-6.

Mumm, R.H. 2013. A look at seed product development with genetically modified crops: Examples from maize. J. Agricultural and Food Chemistry 61(35): 8254-8259. DOI: 10.1021/ jf400685y.

Sun, X., P. Ma, and **R.H. Mumm**. 2012. Nonparametric method for genomics-based prediction of performance of quantitative traits involving epistasis in plant breeding. PLoS ONE 7(11): e50604. doi:10.1371/journal.pone.0050604.

Choe, E., C. Hayot Carbonero, K. Mulvaney, A.L. Rayburn, and **R.H. Mumm**. 2012. Improving *in vivo* maize doubled haploid production efficiency through early detection of false positives. Plant Breeding 131: 399-401. http://onlinelibrary.wiley.com/doi/10.1111/j.1439-0523.2012.01962.x/pdf

Sun, X., T. Peng, and **R.H. Mumm**. 2011. The role and basics of computer simulation in support of critical decisions in plant breeding. Molecular Breeding 28 (4):421-436. http://www.springerlink.com/openurl.asp?genre=article&id=doi:10.1007/s11032-011-9630-6

Moose, S.P., and **R.H. Mumm**. 2008. Molecular plant breeding as the foundation for 21st century crop improvement. Editors' Choice. Plant Physiology 147: 969-977. Ranked by the journal as 2nd most-read article during October 2011 thru September 2012.

Mumm, R.H., and D.S. Walters. 2001. Quality control in the development of transgenic crop seed products. Crop Science 41:1381-1389.

Spencer T.M., L.C. Wilson, R.J. Daines, P. Julstrom, **R.H. Mumm,** and C.E. Flick. 1995. Characterization of transgene insertion and expression in a glufosinate-resistant maize line. In Vitro 31(3):72A.

Mumm, R.H., and J.W. Dudley. 1995. A PC SAS computer program to generate a dissimilarity matrix for cluster analysis. Crop Science 35:925-927.

Mumm, R.H., and J.W. Dudley. 1994. A classification of 148 U.S. maize inbreds: I. Cluster analysis based on RFLPs. Crop Science 34:842-851.

Mumm, R.H., L.J. Hubert, and J.W. Dudley. 1994. A classification of 148 U.S. maize inbreds: II. Validation of cluster analysis based on RFLPs. Crop Science 34:852-865.

Hogan, R.M., and J.W. Dudley. 1991. Evaluation of a method for identifying sources of favorable alleles to improve an elite single cross. Crop Science 31:700-704.

BOOK CHAPTERS

Mumm, R.H., Goldsmith, P.D., Rausch, K.D., and H.H. Stein. 2015. Land usage attributed to corn ethanol production in the United States: Sensitivity to technological advances in corn grain yield, ethanol conversion, and co-product utilization. *In:* B. Gikonyo (ed), Fuel Production for Non-Food Biomass: Corn Stover, Apple Academic Press, Waretown, NJ, USA.

INVITED PAPERS / PRESENTATIONS

Baenziger P.S., **R.H. Mumm**, R. Bernardo, E.C. Brummer, P. Langridge, P. Simon, and S. Smith. 2017. Plant Breeding and Genetics—A paper in the series on The Need for Agricultural Innovation to Sustainably Feed the World by 2050. Council for Agricultural Science and Technology (CAST), Issue Paper 57, Ames, Iowa. https://www.cast-science.org/file.cfm/media/products/digitalproducts/CAST_IP57_Plant_Breeding_and_Geneti_3AD033F3C1763.pdf

Mumm, R.H. 2017. Lessons learned in structuring postgraduate education. ACE (African Centres of Excellence) II Technical and Advisory Meeting. Addis Ababa, Ethiopia, April 28, 2017.

Mumm, R.H. 2016. Continuing education for plant breeders: A 21st century view. Seed World, November, 2016.

Mumm, R.H. 2016. Adopting African orphan crops to enhance local food security. 43rd Plenary Session of the United Nations Committee on World Food Security. Rome, Italy. October 17, 2016.

Boomsma, C. 2013. Standing on the shoulders of (industry) giants: Part 3. Interview with **Rita Hogan Mumm**, PhD. CSA News Magazine 58(10): 44-47. doi:10.2134/csa2013-58-10-18.

Potts, S.M., M.O. Bohn, and **R.H. Mumm**. 2013. Plant density tolerance: old premise, new research. *In* Proc. Agronomy Day Tour of the UIUC Research and Education Center, Urbana, IL. 15 August 2013. University of Illinois at Urbana-Champaign, Urbana, IL.

Potts, S.M., M.O. Bohn, and **R.H. Mumm**. 2013. Utilizing GBS data to dissect plant density tolerance. Corn Breeding Webinar Series, Citrix Online. Presented on 5 April 2013.

Mumm, R.H. 2012. A look at seed product development with genetically modified crops: Examples from maize. ILSI (International Life Sciences Institute) IFBiC (International Food Biotechnology Committee) Plant Composition Workshop, Washington D.C., USA. 13-15 September 2012. Presented on 14 September 2012. http://www.ilsi.org/FoodBioTech/Pages/2012PlantCompositionWorkshop.aspx

Mumm, R.H. 2012. The future of plant breeding. *In* Proc. 19th EUCARPIA General Congress, Budapest, Hungary, 21-24 May 2012. Presented on 21 May 2012.

Sun X., P. Ma, and **R.H. Mumm**. 2012. Genomics-based prediction of performance of quantitative traits involving epistasis using a nonparametric method. *In* Proc. 47th Annual Illinois Corn Breeders School, Urbana, IL. 5-6 March 2012. University of Illinois at Urbana-Champaign, Urbana, IL. Presented by X. Sun on March 5, 2012.

Mumm, R.H., X. Sun, T. Peng, and P. Ma. 2011. Computational tools for improving efficiency of breeding programs. *In* Proc. American Seed Trade Association Corn and Sorghum Seed Research Conference, Chicago IL. 7-9 December 2011. ASTA, Washington, DC. Presented by R.H. Mumm on December 9, 2011. http://www.digital-workshop.com/ASTA/chicago_11/index.html

Mumm, R.H., and S.P. Moose. 2009. Foundational aspects of 21st century crop improvement: Biotechnology, genomic applications, and traditional breeding practices. *In* Proc. 45th Annual Illinois Corn Breeders School, Urbana, IL. 2-3 March 2009. University of Illinois at Urbana-Champaign, Urbana, IL. Presented 2 March 2009.

INVITED PAPERS / PRESENTATIONS (Cont.)

Mumm, R.H., and S.P. Moose. 2008. Biotechnology and molecular markers: Tools in creating and exploiting genetic variation for crop improvement. *In* Proceedings of the Breeding 08 International Conference on Conventional and Molecular Breeding of Field and Vegetable Crops, Novi Sad, Serbia. 24-27 November 2008. Institute of Field and Vegetable Crops, Novi Sad, Serbia. Presented by R.H. Mumm on November 27, 2008.

Mumm, R.H. 2007. Backcross versus forward breeding in the development of transgenic maize hybrids: Theory and Practice. Presented 25 August 2006 at The 2nd International Plant Breeding Symposium, Mexico City, Mexico. 20-25 August 2006. Crop Science 47(S3): S164-S171.

Mumm, R.H. 2006. Practical considerations driving the balance between backcross and forward breeding in the development of transgenic maize hybrids. p.93-100. *In* Proc. 42nd Annual Illinois Corn Breeders School, Urbana, IL. 6-7 March 2006. University of Illinois at Urbana-Champaign, Urbana, IL. Presented 6 March 2006.

Molecular Markers: A Tool in Genomic Exploration and Application. Presented by **R.H. Mumm** as a part of the University of Illinois Extramural Short Course [CPSC 430] on Use of Molecular Markers in Breeding, June 2000 and June 2001. Urbana-Champaign, IL.

Marker-Aided Backcross Breeding: Theory and Practice. Presented by **R.H. Mumm** as a part of the University of Illinois Extramural Short Course [CPSC 430; formerly Agron 493] on Use of Molecular Markers in Breeding, June 1997, June 1998, June 1999, and June 2000. Urbana-Champaign, IL.

Johnson, G.R., and **R.H. Mumm.** 1996. Marker assisted maize breeding. p.75-84. *In* Proceedings of the 51st Corn and Sorghum Conference, Chicago, IL. 11-12 December 1996. American Seed Trade Association, Washington, D.C.

Mumm, R.H. 1996. The role of transgenes in hybrid development. p.37-39. *In* The 8th Annual Integrated Crop Management Conference Proceedings, Ames, IA. 19-20 November 1996. Iowa State University Extension, Ames, IA. Presented 20 November 1996.

Mumm, R.H. 1994. Genotype x environment interaction effects associated with markers for quantitative trait loci. p.103-112. *In* Proc. 30th Annual Illinois Corn Breeders School, Champaign, IL. 7-8 March 1994. University of Illinois at Urbana-Champaign, Urbana, IL. Presented 8 March 1994.

Hogan, R.M., and J.W. Dudley. 1992. Cluster analysis of 148 U.S. maize inbreds using RFLP-based estimates of genetic relationship. p.112-136. *In* Proc. 28th Annual Illinois Corn Breeders School, Champaign, IL. 2-3 March 1992. University of Illinois at Urbana-Champaign, Urbana, IL. Presented by R.M. Hogan on 3 March 1992.

Hogan, R.M., and J.W. Dudley. 1991. Evaluation of a method to identify germplasm sources useful for improving an elite maize hybrid. p.87-95. *In* Proc. 27th Annual Illinois Corn Breeders School, Champaign, IL. 4-5 March 1991. University of Illinois at Urbana-Champaign, Urbana, IL. Presented by R.M Hogan on 4 March 1991.

RFLPs and Their Use in a Breeding Program. Presented by **R.M. Hogan** at Illinois Foundation Seeds, Inc., 1991, Champaign, IL.

KEY PROFESSIONALSERVICE ROLES

Invited member of World Bank African Center of Excellence II Review Team for Haramaya University in Dire Dawa, Ethiopia. 2017.

Member of the Scientific Advisory Board of the MOBREED project (Enhancing training and research mobility for novel crops breeding in Africa), funded under the EU Intra-Africa Academic Mobility Scheme Call. 2017-present.

KEY PROFESSIONALSERVICE ROLES (Cont.)

National Association of Plant Breeders, Chair of the Awards Panel. 2014 – 2016.

Invited member of National Academy of Sciences, US – Egypt Science and Technology Joint Fund Cycle 17 Review Panel, 2015.

CGIAR Generation Challenge Program, Member of the Scientific and Management Advisory Committee. 2012-2014.

Invited member of USDA ARS 301 Program Review Panel, 2013.

National Association of Plant Breeders. President, May 2011 – August 2012; Vice President, August 2010 – May 2011; Secretary, August, 2009 – August, 2010, Past President, August 2012 – August 2013. Chair, Plant Breeding Coordinating Committee's (SCC080) Subcommittee on Education and Training of Plant Breeders. June 2008 – August 2009.

American Seed Trade Association, Program Chair for the 65th Corn and Sorghum Seed Research Conference, Seed Expo 2010 held in Chicago IL in December 2010.

Member of the Board of Directors for The Center for Bioethics and Human Dignity in Bannockburn IL, affiliated with Trinity International University. June 2002 – January 2007.

Invited panel member for USDA Cooperative State Research Education and Extension Service (CSREES), National Research Initiative Competitive Grants Program, 1998.