Title:
ENVIRONMENTALLY SOUND HIGH IMPACT FORAGE MANAGEMENT RESEARCH BASED DEMONSTRATIONS FOR INCREASED LIVESTOCK PROFITABILITY BY INCREASING FORAGE PRODUCTION AND QUALITY

Investigator(s):
Todd Lorenz, Rich Hoormann, Wendy Flatt, Gene Schmitz, and Rob Kallenbach

Objectives, including relevance of project to Missouri fertilizer/lime use:
Livestock producers and landowners read about basic forage plant, soil fertility, and animal management techniques that can improve pasture eco-systems, carrying capacity and ultimately farm profitability. However, many are not responsive to adopting these current forage management techniques. Many producers have not had access to research plots that demonstrate the short term and long term plant responses to fertility management changes. This project will combine multiple demonstrations of University of Missouri research based forage fertility management on strategically selected farmer field locations that will allow producers to follow changes in pasture eco-system and profitability per acre through on-site demonstrations and field days.

Of the nearly 10,000 forage field soil samples submitted to the University of Missouri Soil Testing Laboratory in 2005, only 37% fell within the optimal pH range. Other nutrients (such as P, K, Ca and Mg) were listed in the very low to medium range 50% to 70% of the time depending on nutrient. When producers can see results of field demonstrations on a familiar producer’s pasture, the effect of the demonstration seems to be more profound. Reading articles and going to seminars is always an important learning tool; however, actually seeing results on a producer’s farm is a much more applied way of learning and behavior change is more often adopted.

Procedures:
Low management pastures with high visibility will be selected for demonstration sites. The experiment will be a replicated split plot design with lime and no lime on the main plots and treatments to include a control check, soil test recommended fertility, a typical retailer recommended pasture fertility package, 30 lbs P only, and 50 lbs N only. A portion of the plot area will be over-seeded with legumes to simulate ergovaline dilution recommended practices. Plots will be harvested three times annually to follow annual forage response to management changes and long term economic impact from increased productivity and quality. Forage analysis will be conducted on each of the treatments during each of the harvest to show forage quality variations in a year round forage production system. Statistical analysis of data collected will be performed and compared to other research areas. Field days will be conducted twice annually for the duration of the grant to provide demonstrations of proven research based concepts. These concepts will include but not be limited to: soil testing, liming, fertilizer materials, fertilization timing, grazing heights, extended grazing using legumes, grazing frequency, environmental quality and economic benefit of implementing these practices.
Current status/importance of research area:
Soil fertility and forages are very integral to ruminant livestock operations. Without sufficient soil fertility, forages cannot grow to their full capability which greatly diminishes pasture stocking rates and animal productivity. When producers increase forage quality and quantity then stocking rates and health potential can be increased which improves the economic viability of their operation.

As extension specialists we see producers struggle everyday. Recently, a producer trying to grow pearl millet for his cattle experienced a poor stand. Upon further examination and an insistence on a soil test, the answer became quite obvious. Soil test results revealed a soil pH of 4.5 on this particular field and a soil fertility test recommendation at seven tons of lime per acre. It was obvious that this producer didn’t understand the importance of soil tests and doing the necessary liming to keep the soil pH in check. By understanding basic fertility and forage management practices, producers can utilize the data to make better informed decisions on fertilizer and lime usage. This information can be used to sustain and improve environmental quality and the natural resource base upon which agriculture depends.

Recent research at the University of Missouri by Dr.’s Blevens, Kallenbach, Davis and Crawford at Linneus, Columbia and Mt. Vernon has focused on the role of lime and phosphorus (P) on yield and mineral content of tall fescue pastures and stockpiled tall fescue. Increased calf gains during the summer, increased yields of stockpiled tall fescue and increased hay yields have been documented with P fertilization. Forage mineral concentrations of P and magnesium (Mg) have been increased in stockpiled tall fescue. Additional research is continuing on the effects of liming on yield and quality of tall fescue.

Through field demonstrations, Agronomy and Livestock Extension Specialists want producers to learn how proper fertilizer and lime management can make their pastures more profitable and sustainable. Also, the livestock will be more productive with less supplemental feed, minerals and even hay through stockpiling forages. With increased fuel and machinery costs and the current swing in grain and by-product costs, stockpiling forage is becoming more feasible then ever.

Livestock producers in the central-Missouri area would be the largest benefactors of the education program and field demonstrations. Another target group would be those involved with the Heart of Missouri Grazing Group. This group includes producers from 13 Mid-Missouri counties ultimately representing over 1.4 million grazing acres and $177,840,000 worth of cattle and calves (1997 Census of Agriculture-County Data USDA/NASS). The field demonstrations are open to other livestock producers and landowners as well. Participants would be able to observe comparative forage field trials on fertilizing and liming in a local setting.
Timetable for proposed research:

2007
Winter/Early Spring: Site selection and layout; treatment applications; soil Sample
Growing Season: Harvests; Forage quality analysis; data analysis
Periodic: Demonstrations and field days

2008
Repeat harvests and forage analysis
Final soil tests
Demonstrations and field days

2009
Finalize data analysis and publish outcome
Demonstrations and field days

Strategy for application/transfer of knowledge:
Our greatest tool will be field and demonstration days, work-shops and on-farm outreach seminars. Another component is “Pasture Walks” or “Twilight Tours” which can be done later in the evenings during the summer months which have been very effective ways of disseminating research findings and on-farm results. Educational information will also be distributed through publications of our regional newsletter “Ag Connection”, press releases to local newspapers and radio outlets.

Another strategy will include participating in the Mid-Missouri Grazing Conference which is a seminar devoted to livestock grazing producers. Results from our demonstration could be used to disseminate information in the form of educational seminars at this conference for those unable to attend our field days. The newly developed Heart of Missouri Grazing Group will benefit from this type of research as it will provide them with local outlets for educational opportunities.

The evaluation plan for this project will include presentation pre and post test for producers participating in our workshops related to their knowledge of the specific topic areas. A follow-up survey will be mailed to the participants to evaluate long-term behavioral changes to their management practices for economic impact analysis.

We appreciate your consideration of this grant.
Proposed budget by years and by category: salaries/operating/equipment/other

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TODD E. LORENZ

WORK ADDRESS
University of Missouri Extension
608 East Spring Street
Boonville, MO  65233
(660) 882-5661

HOME ADDRESS
207 Barnes St.
Pilot Grove, MO  65276
(660) 834-6969

LICENSE OR CERTIFICATES
Missouri Department of Agriculture, Plant industries division,
Missouri Certified Public Operators, Category 1A  License: P3450 1992-2003
Missouri Commercial Drivers License
Missouri Department of Health:  Registered Installer

EDUCATION
Major:  Agronomy.  Thesis Title:  Wheat Management for Red Clover

B.S.  May, 1986.  Central Missouri State University, Warrensburg, MO  64093.
Major:  Agriculture Business.  Awarded the CMSU Agriculture Sophomore of
the Year.  Major Professor:  Dr. Harold Van Cleaves.

WORK EXPERIENCE:
July 2000-  University of Missouri Extension, Boonville, MO 65233
Present  Regional Horticulture/Agronomy Specialist-Providing equal program leadership in the
fields of horticulture and agronomy in the Central Missouri 14 county region.
Responsibilities include needs assessment, facilitation of educational programs,
teaching, problem solving, assessing horticulture and agronomy related subject matter
for clientele and developing university, community, agency, business and extension
council linkages.  Provide educational leadership in the development of programs and
dissemination of research-based information related to agronomy and horticulture for
producers, agribusiness, homeowners and the general public.  As the Regional
Horticulture Specialist, I am responsible for program development and leadership of the
Central Missouri Master Gardener Program.  I am responsible for coordination of core
training modules, advanced education, meetings, field days, and conferences.  I have
modified the original Master Gardener program for correctional facilities to provide an
opportunity for inmates to participate and volunteer hours back to the community, now
titled Master Gardeners In Corrections (MaGIC).  Our intent is to provide them the
necessary education, skills and abilities to seek and keep job in the field of horticulture
upon release. I am responsible for identifying and developing positive relationships with agricultural leaders and assist in informing agribusiness and producers of program activities and current updates. In partnership with the University, I also serve on the Cooper County Soil and Water District board. I make all programs available to all audiences and promote the total mission of University of Missouri Extension using mass media, direct teaching methods, short courses, producer meetings, Internet capabilities, and individual consultations.

Nov. 1991- Soil Science Dept., University of Missouri, Columbia, MO 65211. July 2000 Senior Research Specialist-Conducted soil fertility and forage fertility research for the Missouri Agriculture Experiment Station. While primarily responsible for the management of historical Sanborn Field and the F.L. Duley-M.F. Miller Soil Erosion Plots, I was also responsible for forage research on native warm season grasses on farmer cooperative sites and both the Wurdack and Bradford Agronomy Research Centers. My duties included: establishment of research in cooperation with private land owners and farmers, site selection, experimental design and layout, independent field research, hiring and supervision of field staff and students, land preparation, equipment maintenance for both modern farm and research plot equipment, pest control, harvesting, soil and plant sample data management from collection to analysis and from electronic input to statistical analyses, annual report and grant proposal writing, maintaining web site, conducting tours for people with varied background in agriculture, participation in field days and outreach activities. My responsibilities included work with the National Onsite Demonstration Project at Rock Bridge State Park. Coordination of soils and engineering research activities including monitoring of treatment fields where innovative onsite wastewater treatment and modern dispersal technologies were used. I was involved with the Field day activities in coordination with the Show-Me Clean Streams and the Bonne Femme Watershed Partnership that allowed demonstration of the Missouri Wastewater Small Flows Research and Training Center. Additionally, active with the development of a Soil and Water Conservation Clinic and Tour cosponsored by Mo-Ag industries Council and the University of Missouri to provide Certified Crop Advisors continuing education units in soil and water management.

PROFESSIONAL MEMBERSHIP AND COMMUNITY ACTIVITIES

National Association of County Agriculture Agents
   North Central Region Vice Chair
Missouri Association of Agricultural Extension Professionals
   President
University of Missouri Extension Association
Fertilizer Agriculture Lime Advisory Council
University of Missouri Extension Agri-Business Counselor
Central Missouri Agriculture Category Chair
Central Missouri Regional Technology Committee
University of Missouri Farms and Centers Advisory Council
Pilot Grove C-4 School Board
Cooper County Soil and Water District; Moniteau and Cooper
Cooper County Local Emergency Planning Committee
Boonville Area Chamber of Commerce
Knight of Columbus, Cleer Creek Council 2261

AWARDS AND PROFESSIONAL ACCOMPLISHMENTS
CMSU Agriculture Sophomore of the year, 1984
University Outreach and Extension Gold Medal Award, 2001-2002
University of Missouri Extension Association, UMEA Rookie of the year, 2002
Community Development Academy, 2002
University of Missouri Programming Excellence Award 2004
Public Issues Leadership Development Conference, 2004
National Association of County Agricultural Agents, North Central Region Communication
    Award Winner - Computer Generated Program
Missouri Extension Leadership Development, 2004-05
Missouri Agricultural Extension Professional State Achievement Award
National Association of County Ag Agents National Achievement Award

Richard G. Hoormann
310 Salisbury St., Suite E
Montgomery City, MO 63361
Cell phone: 314-651-2640
hoormannr@missouri.edu

Summary:
I am a professional agronomy educator, with a strong record of combining consultation, research, field work and electronic tools with teaching, to meet the needs of the farm audience. I have experience in the farmer, USDA agencies and retailer education setting. Over my career I have demonstrated the ability to plan and follow through on education programming in a large geography. Successfully able to manage time and resources to achieve planned goals.
Major Career Responsibilities:

History of developing and implementing agricultural education programs for a diverse farm audience.  
Leadership of educational training, business strategies and sales staff programs for large farmers,  
retail staff and wholesale staff to enhance skill sets and performance.  
Develop and maintain business relationships with retailers leading to greater sales.  
Develop, organize, and implement agronomic sales staff training as the basis for retail sales.  
Provide agronomic product support for seed, crop protectant and fertilizer sales staff in a multi-state area.  
Assist key retail dealer employees with agronomy sales business plan development.  
Instruct retail staff how to use the discovery process, in combination with agronomy skills, to meet farmers needs as part of the sales process.

Career History and Selected Achievements:

**Region Agronomy Specialist,**  
University of Missouri  
2005-Present  
Responsibilities include identifying “teachable moment” opportunities, short term and long-term needs of clientele and implementing the plan-of-work as approved by the Regional Director.  
Responsible for the development of an overall agricultural education programs to meet the agricultural needs identified in the needs assessment process. Program management included developing logic models to produce desired changes and carry out the work necessary to evaluate markers identified in logic models.  
Programs involve using a series of learning events such as meetings, newsletters, web base electronic news, demonstrations, field days, consultation and workshops to achieve program goals as assigned.  
Responsible for developing and managing a long term relationship with partnered organizations and stakeholders to implement educational programs identified in needs assessment by assigned counties.  
Leadership of the Universities of Missouri’s mission in the assigned area of work includes working closely with a variety of stakeholders including: commodity groups and volunteer and/or elected boards.

**Agronomist,**  
RGH Associates  
St. Peters, MO  
2003-2005  
RGH Associates offered agronomy services to retail dealers. Services offered included: diagnostic services, field day support, on site retail staff training and field crop scout support. The key objective of training was to increase product and service sales with key growers by increasing the technical expertise of staff. On site training included obtaining certified education credits (CEU) for all technical training with sales agronomist.  
Represent Monsanto Company, as a contract employee, investigating crop seed re-plant and crop protectant re-spray claims for the southern Illinois sales team.
Region Agronomist,
Agriliance LLC
St. Paul, MN

As a region agronomist, I maintained close support of sales staff in states of MO, IL, KY and parts of IA. Duties included conducting proprietary product training for key customer staff and their key growers. Training was conducted in Field Days, plot tours, at retailer plants and one-on-one. The region agronomist facilitated business marketing planning with the sales team using the discovery process to position training and products. Cold calls were done in support of sales team identifying and targeting customers for new on site agronomic training business. Detailed regional agronomist business plans were done for the top 20 percent of Agriliance customers in assigned region and monthly reviews of progress were required on the topics of on site training of customer, technical staff, product sales, product performance calls and technical newsletters issued. Twenty key accounts, representing some thirty locations, made use of agronomy services as part of a coordinated support plan.
Field diagnostic work and product support was carried out for the Croplan Genetics seed division. This included teaching in demonstrations and research field days, dealer plot tours, and on site problem solving. In addition, field data collection and product performance issues were part of field duties.

Region Agronomist,
Farmland Industries, Inc
Kansas City, MO

The region agronomist position included working in support of sales staff in a ten state area including the province of Ontario Canada. Accounts targeted were those within the top 20 percent of company sales. Duties included crop diagnostics work of production problems, product support and technical training for dealers. Management authority was given to developing technical content, agendas and teaching materials for dealer level technical schools on a wide variety of topics. Management also required all paper work for obtaining industry continuing education credits from the industries certifying body, American Society of Agronomy. Training activities were conducted in 1, 2 and 2 1/2 day blocks using multi-media techniques.
Other duties included selling intern placement services for key accounts. Scheduling, interviewing, hiring, training and supervision of college interns placed at key retailers as part of the agronomist business responsibilities.
Field testing, customer training and general support of Farmland electronic tools such as GPS/GIS systems and field level Integrated Crop Management software was conducted for key customers involved in an industry setting environmental program titled AG•21. This support required team building with dealer staff in development of business plans for integrating new technologies. Coaching, counseling and follow-up facilitation of agronomy and environmental stewardship implementation plans required year round contact and planing with dealer general managers and key staff.
Technical writing of newsletters, electronic crop tips for Internet postings and DTN customers was another duty to keep clientele abreast of the latest information. Duties also included
communication with University Researchers key to future of the industry. This included selection of research in need of support and funding by Farmland Industries.

**Extension Region Agronomy/Natural Resources Specialist,** 1983-1995
University of Missouri Outreach & Extension
Duties include: Crops and soils technical support for small and commercial farmers and retail dealers. Responsible for the development of an overall agricultural education programs to meet the business and technical needs leading to the increased profitability of the agricultural community. Working with other disciplines on issued based programming topics to meet needs as identified by County Extension Council and other stakeholders. Program management included organizing the technical content and coordination of the meetings. Learning activities conducted and liaison with other organizations and stakeholders to implement the educational program included: NRCS, Soil & Water Districts in two counties, Missouri Corn Growers, Missouri Soybean Association, St. Louis County Vegetable Growers Association, Lincoln University, Missouri Botanical Gardens, Jefferson College, East-Central College, Missouri Department of Agriculture and other agriculture related groups.
I provided the leadership role for the Universities of Missouri’s Outreach and Extension mission, in my assigned territory as both a county staff member and as a CPD. Duties included working monthly with volunteer and elected boards, including county elected officials.

**Extension Instructor,** 1980-1983
University of Nebraska Cooperative Extension
**Research Assistant,** 1978-1979
Southern Illinois University at Carbondale

**Skills:** Developing and maintaining clientele relationships. Functioning as part of a team and adapting to new roles in business models within organizations as clientele needs change. Using the following skill sets to accomplish assigned goals: Managing research projects, office staff management, budgets, business plan development, customer service, technical education material development, technical writing, field diagnostic skills, field demonstrations management.
Training: Coaching for High Performance, Time and Territory Management, Selling Essentials, SGIS precision Ag software, AgInfo software
Certified Crop Advisor (ARPACS), 1996

**Education:**
**Bachelor of Science** Southern Illinois University at Carbondale 1978
Major: Plant & Soil Science

**Masters of Science** Southern Illinois University at Carbondale 1981
Major: Plant & Soil Science

**Background:** Family livestock, grain and turfgrass operations in Illinois.
Wendy R. Flatt, MS, P.A.S.

1017 Chouteau Lane, Boonville, MO 65233, Home: (660) 882-8992 Cell:
(573) 999-2348 e-mail: wendyflatt@hotmail.com

Education

December 2001 Master’s of Science in Animal Sciences, Colorado State University. Fort Collins, Colorado.

Title of Thesis: Effects of salt and phosphorus supplementation on growth performance, cost of gain, carcass characteristics and digestibility of finishing feedlot cattle.

May 1993 Bachelor of Science in Animal Sciences, University of Missouri - Columbia. Columbia, Missouri.

Work Experience (1989-present)

March ’03-present Regional Livestock Specialist/County Program Director- University of Missouri Extension, Mark Stillwell, Regional Director. David Baker, College of Agriculture, Food and Natural Resources, Program Leader.

Oct. 02-March 03 Area Sales Manager, Biozyme, Inc., Stockyards Expressway, St. Joseph, MO. Gus Kraijcek, National Sales Manager.

June -Sept. 2002 Temporary Research Associate, Bayer Crop Sciences, Bayer Research Park. Stillwell, KS. Terry Jenson, Supervisor

Jan.- March 2002 Senior Laboratory Technician, Department of Radiology. University of Missouri, Columbia, MO. Dr. John Lever.

1999-2001 Graduate Research Associate, Department of Animal Sciences. Colorado State University. Fort Collins, CO.

Fall 1998 Research Associate, Department of Animal Sciences. Colorado State University. Fort Collins, CO. Dr. Jack Whitter. Ranch-to-Rail Database.

Spring 1996  
Herd Health Manager. *Teague Diversified Incorporated*, Wiggins, CO.

1994-1996  
*Feed Truck Driver and Veterinary Technician*, *Monfort’s of Colorado-Kuner Feedlot*. Highway 34 Kersey, CO; Allen Gettman, Herd Health Supervisor.

Work Experience (1989-present) continued

1993-1994  

1993-1994  

Summer 1993  
**Research Associate**, Department of Animal Sciences. *Forage Systems Research Center, University of Missouri- Columbia*. Linneus, MO.

1991-1993  
**Undergraduate Laboratory Research Technician**, Department of Animal Sciences. *University of Missouri*. Columbia, MO.

1991-1993  
**Undergraduate Laboratory Research Technician**, Department of Animal Sciences. *University of Missouri-Columbia*. Columbia, MO (continued).

Summer 1992  
**Summer Intern**, *V-8 Ranch and Hudson Cattle Company*. Wharton and Bay City, TX.

1989-1994  
**Veterinary Assistant**, *Buttonwood Animal Hospital*. Columbia, MO.

Publications


Flatt W.R., T.L. Stanton, Davis J., T.E. Engle, and Schutz D. Effect of Dietary Phosphorus Levels on Serum Phosphorus Concentration, Growth Performance, Carcass Characteristics, and


Publications (continued)


Awards and Honors

UMEA “Rookie of the Year” 2004
USDA “Certificate of Appreciation” 2003
Alltech Dairy School Scholarship 2001
Alltech Symposium Graduate Travel Scholarship 2000-2001
Salt Institute Fellowship-Honorable Mention 2000
CSU Graduate Research Assistantship 1999-2001
Colorado State University Dean’s List 1998-2001
Marching Mizzou 1993
College of Agriculture Research Scholarship 1992
University of Missouri Dean’s List 1991-1993
Pre-Veterinary Club Officer 1991-1993
Missouri Department of Agriculture Scholarship 1988
Eugene G. Schmitz

Present Position – October 2004 to present
University of Missouri Extension Livestock Specialist serving Benton, Pettis, Cooper, Morgan and Moniteau Counties.

Programming Efforts in Central Missouri
- Beef cattle nutrition and management, primarily cow-calf production.
- Pasture and forage management and utilization.
  - Conducting bermudagrass variety, yield and quality demonstrations.
  - Conducting fall Nitrogen fertility demonstrations with tall fescue.
- Regional grazing schools in Central Missouri in cooperation with NRCS personnel.
- Show-Me-Select Replacement Heifer Development Program in Central Missouri.

Past Position – February 2003 to October 2004
Colorado State University Cooperative Extension Livestock Agent
Golden Plains Area – Yuma, Kit Carson, Phillips and Washington Counties

Responsibilities:
- Provide educational assistance to citizens of Northeast Colorado.
- Assist livestock producers through educational programming, on-farm consultations and research activities.
  - Special emphasis has been on irrigated cool-season forage selection and management and irrigated legume demonstration plots.
  - W-SARE grant obtained for irrigated forage education program.
- Assist other Extension staff and related agencies as needed.

Past Position – April 1995 to January 2003
University Outreach and Extension Livestock Specialist serving Mercer, Grundy, Livingston and Caldwell Counties in Northwest Missouri

Programming Efforts in NW Missouri
- Beef cattle nutrition and management, primarily cow-calf production.
- Pasture and forage management and utilization.
  - Conducted fall grazing demonstrations utilizing stockpiled tall fescue pastures.
  - Conducted research evaluating fall nitrogen fertilization programs for tall fescue pastures.
- Show-Me-Select Replacement Heifer Development Program in NW Missouri.
- Green Hills Premier Beef Marketing program.
- Northwest Missouri Performance Testing Program and Bull Sale.
- Swine and dairy nutrient management planning.
• Regional grazing schools in NW Missouri in cooperation with NRCS personnel.
• Grassland Evaluation Contests for area high school Vo-Ag departments in cooperation with NRCS and Missouri Department of Conservation.

Education

Associate of Arts – Colby Community College, Colby, KS – May 1980
B.S. – Animal Science – Kansas State University, Manhattan, KS – May 1982
Advisor: Dr. Jack C. Whittier.

Areas of Research
• Effects of various number of paddocks and stocking rates on steer and pasture performance in North Missouri.
• Evaluation of whole cottonseed as an energy-protein supplement for gestating beef cows

Professional and Community Memberships

• Benton County Soil and Water Conservation District Board of Supervisors
• Benton County Cattlemen’s Association

Past Work Experience

• Extension Associate II – 1990 and 1991 – Iowa State University, Agronomy Extension. Coordinated 22 on-farm pasture and forage management demonstrations relating to establishment, maintenance and utilization of forage resources in South Central Iowa.
• Graduate Research Assistant – 1987 through 1989 at the University of Missouri – Columbia.
• Feed mill and grain elevator superintendent – 1984 through 1987 at Hackney Farmers Union Coop, Winfield, KS.
• Sales representative – 1982 through 1984 for Vigortone Ag Products in Central Kansas.

Other relevant experience

• Raised on farm at Leoti, KS.
• General farm and ranch labor during college at Manhattan, KS.
• Sales experience, wholesale and retail.
• Personal computers – Microsoft (Word, Excel, PowerPoint, etc.), ration formulation programs, cattle record keeping programs.
Oral Presentations

Abstracts


Technical Reports


Robert L. Kallenbach

Associate Professor and State Extension Specialist
Plant Sciences Unit – 108 Waters Hall
University of Missouri
Columbia, MO 65211

Phone (573) 882-2801
Fax (573) 882-1467
email: kallenbah@missouri.edu

Education:
Ph.D., Agronomy, with an emphasis in statistics. 1994. Texas Tech University, Lubbock TX.
B.S., Agronomy. 1989. Southwest Missouri State University, Springfield, MO.

Professional Employment and Experience (Since 1994):

Professional Service, Honors and Awards (Since 2001):
2004: Young Crop Scientist award presented by the Crop Science Society of America (International award given to one scientist under 37 years of age annually).
2004: Gamma Delta Sigma Outstanding Extension Specialist Award.
2004: J.W. Burch Outstanding Extension Specialist Award.
2002: Merit Award for outstanding contributions to forage science presented by the American Forage and Grassland Council.
2001: Provost's Award for Creative Extension Programming by New Faculty.

Membership in Professional Societies:
American Society of Agronomy, 1990 to present
Crop Science Society of America, 1990 to present
American Forage and Grassland Council, 1990 to present
Missouri Forage and Grassland Council, 1998 to present
Gamma Sigma Delta Honor Society of Agriculture, initiated in 1988

Research Publications:
Refereed Journal Articles 28
Book Chapters 2
Proceedings and Abstracts 80

Extension Education (Since 1998):
Extension Manuals and Guides 24
Workshops and Short Courses taught 88
Extension education meetings and classes taught 235
Selected publications

Refereed Journal Articles (Since 2003):

Book Chapters: