Investigator(s):
Principal investigator: John A. Lory
Extension Associate Professor
108 Waters Hall
Plant Science Division
Commercial Agriculture Program
University of Missouri

Co-investigators:
Peter Scharf
Professor
Plant Science Division
Manjula Nathan
Extension Associate Professor
Plant Science Division

Peter Motavalli
Associate Professor
Soil, Environmental and Atmospheric Sciences
David Dunn
Supervisor, Delta Soil Testing Lab
Plant Science Division

Gene Stevens
Extension Associate Professor
Delta Research Center
Plant Science Division
Newell Kitchen
Soil Scientist
Water Quality Unit

Objectives, including relevance of project to Missouri fertilizer/lime use:
- Update and revise University of Missouri Soil Test Recommendations and the supporting publication “Soil Test Interpretations and Recommendations Handbook.”

University of Missouri (MU) soil test and fertilizer recommendations are used by the MU Soil Testing Laboratory to provide fertilizer recommendations for row and forage crops. These recommendations are also referenced and relied on by agencies such as the Natural Resources Conservation Service (NRCS) and Missouri Department of Natural Resources (MDNR) and by some private companies.

There have only been minor updates implemented in recommendations in the past 15 years. During that period there has been significant research in Missouri and other states on soil testing and crop fertilizer needs relevant to Missouri conditions. Some of that research was a direct result of support by the Missouri Fertilizer and Ag Lime Research and Education program.

The Soil Fertility Working Group is the campus committee charged with reviewing and approving changes to MU recommendations. This committee includes research and extension faculty working on soil fertility issues at MU and the heads Columbia and Delta soil testing labs. The core members of this committee are listed as investigators on this proposal. There is consensus on the current committee that significant updates are needed to many of our core soil test and fertilizer recommendations.
To change a recommendation a proposal must be submitted to the Soil Fertility Working Group and be approved with no more than two negative votes. Progress on implementing changes has been limited by ability of responsible faculty to devote the time needed to develop and move proposals through the approval process.

The objective of this proposal to the Missouri Fertilizer and Ag Lime Research and Education program is to provide support for a 0.5 FTE master’s trained position for two years to facilitate developing proposals for changes to MU soil test and fertilizer recommendations and help integrate those changes into an update of the Soil Test Interpretations and Recommendations Handbook.

Procedures:
The 0.5 FTE position will provide support to faculty developing proposals for changes to MU soil test and fertilizer recommendations. Responsibilities will include performing literature reviews, summarizing data from completed experiments and editing proposals. The individual will also help with edit changes to the Soil Test Interpretations and Recommendations Handbook and other extension materials used to educate clientele about changes to our recommendations.

The funds will not be used to conduct any new lab or field work. Instead they will be used to facilitate the integration of existing research into our current recommendations.

The position will be supervised by John A. Lory, the PI on this proposal, who has led the recent efforts to significantly revise our current recommendations. He will coordinate and prioritize the activities of the person hired in this position with input from the Soil Fertility Working Group.

Current status/importance of research area:
Missouri farmers statewide rely on MU soil test and fertilizer recommendations to provide science-based advice on fertilizer use. The incorporation of MU recommendations into the standards and regulations of agencies such as NRCS and MDNR has intensified the need to update and document our recommendations.

Our current recommendations are in need of significant revision. The consensus of members of the Soil Fertility Working Group is that many of our recommendations are out of date or need to be reviewed. This proposal seeks to facilitate a focused effort to complete updates of the forage recommendations, corn nitrogen recommendations, soil test phosphorus and potassium buildup equations and other recommendations as time allows.

In 2006-2007 John Lory completed a significant amount of groundwork towards a major revision of forage and row crop fertilizer recommendations. Changes that have been approved but not yet implemented include:

- Update of the soil test rating system for phosphorus and potassium.
- Revision of the lime and magnesium recommendations.
- Partial update of crop nutrient removal values.
- Preliminary draft revision of warm season grass fertilizer recommendations.
We sincerely hope the Fertilizer Lime Board will endorse and facilitate completion of this process by supporting this proposal. The requested support will insure completion of needed changes that will bring more credibility to the fertilizer recommendation system and economic benefits to our farmers through improved fertilizer recommendations.

**Expected economic impact of the project:**
In the past few years fertilizer prices have become more volatile and at times been three to four times higher than historic averages. A thorough review of our soil testing and recommendations system will lead to opportunities for farmers to improve their management of fertilizer on their farms. The benefits will include the more judicious use of fertilizers through better recommendations and more support of the recommendations through better supporting documentation.

**Timetable:**
Vicki Hubbard is already an MU employee and is available to devote 50% of her effort to the project when funding is approved. We are requesting funding for two years.

In 2009 primary focus will be on changes to the forage recommendations. In 2010 the focus will be primarily on row crop recommendations.

**Strategy for application/transfer of knowledge:**
This project’s sole focus is the incorporation of applied research into the official MU soil test fertilizer recommendations and supporting documents. Part of the Soil Fertility Working Group approval process includes soliciting input from regional faculty and faculty from affected commodities in the review process. For example, when we are working on forage fertility issues, Rob Kallenbach and/or Craig Roberts are included in the process. John Lory is a member of the Interagency Technical Working Group and he will solicit input from our partners in NRCS and MDNR and keep them updated on our progress. We also will actively seek feedback from industry representatives.

As changes are approved they will be integrated into MU extension soil fertility programs. This will include reports at extension events such as MU Extension’s Crop Management Conference. Approved changes will be integrated into a new edition of the Soil Test Interpretations and Recommendations Handbook. When needed, MU Extension guide sheets will be published or updated to reflect approved changes to our recommendations. For example, this year there will be a new extension publication developed on nutrient removal values for crops.

The focus of this project is approving changes to the soil fertility recommendations. Our intent is to seek funds in future years to integrate those changes into the software supporting the MU Soil Testing Laboratory.
Proposed Budget by years and category: Salaries/operating/equipment/other.

Two-year project budget.

<table>
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<tr>
<th>Category</th>
<th>2009</th>
<th>2010</th>
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<td>Salaries and benefits</td>
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<td>$18,900 (0.5 FTE)</td>
</tr>
<tr>
<td>Salaries</td>
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<td>$5,859</td>
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<tr>
<td>Operating</td>
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<td>0</td>
</tr>
<tr>
<td>Total</td>
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</tr>
</tbody>
</table>

Total two-year budget is $49,518.
Title: Updating University of Missouri Soil Test Recommendations

John A. Lory
Associate Extension Professor
and Environmental Nutrient Management State Specialist

Division of Plant Sciences
108 Waters Hall
University of Missouri
Columbia, MO 65211
Phone: (573) 884-7815
Fax: (573) 882-1467
email:LoryJ@missouri.edu

Education

    Thesis title: Quantification of symbiotically fixed nitrogen in the soil surrounding alfalfa
    roots and nodules. Advisor: Dr. M.P. Russelle.

    Advisors: Drs. M.P. Russelle and G.W. Randall.

Professional Positions
1986-1993 Graduate Research Assistant. University of Minnesota Department of Soil
    Science, St. Paul, MN.

1994-1995 Postdoctoral Research Scientist. USDA/ARS Soil and Water Conservation
    Research Unit, Lincoln, NE.
    Postdoctoral project considered nitrogen loss pathways from beef cattle
    feedlots and methods to reduce nitrogen losses.

1996-2004 Assistant Professor of Extension, University of Missouri Department of
    Agronomy and the Commercial Agriculture Program. Columbia, MO.

2004-present Associate Extension Professor, University of Missouri, Division of Plant
    Sciences and the Commercial Agriculture Program. Columbia, MO.

Member of an interdisciplinary team of professional-track extension faculty
addressing the competitiveness of Missouri agriculture. My program has
focused on nutrient management planning, decision support tools for nutrient
management, phosphorus loss from agricultural fields, impact of proposed
regulations on concentrated animal feeding operations and predicting nitrogen
need in corn using remote sensing. Audience for my program includes
farmers, agricultural businesses and consultants, commodity group members
and leadership, state and federal regulators and agency personnel. Key
products include the Spatial Nutrient Management Planner (SNMP), the
Missouri Phosphorus Index and the Animal Feeding Operation Site
Evaluation Tool.
Title: Updating University of Missouri Soil Test Recommendations

Selected Awards

Current National, Regional and State Assignments
- E-extension Manure Management Community of Practice, member and “ask the expert” resource person, 2007-present.
- Missouri Department of Natural Resources CAFO Rule Working Group. 2003-present.
- Senior Associate Editor, Agronomy Journal, American Society of Agronomy, 2008-present.

Refereed Journal Publications, last five years
Title: Updating University of Missouri Soil Test Recommendations

Software and Web Resources (selected)
Links to all tools on http://nmplanner.missouri.edu. Date is when the site was first available. Most sites continue to be maintained and updated.

Missouri Plant Available Nutrient Calculator. 2008. Web-based calculator. Creates a report of the available nutrients in manure based on manure test results, method of application and crop nitrogen need using the approach approved by Missouri Department of Natural Resources. Role: content and content design.


National Setbacks Database. 2007. Web-based database access for regulatory and Natural Resource Conservation Service required manure application setbacks for 34 states. Role: content and content design.


Recent Extension Publications-Paper


Peter Clifton Scharf
Nutrient Management Specialist and Associate Professor
Plant Sciences Division
210 Waters Hall
University of Missouri
Columbia, MO 65211

Research and Extension education interests
• developing, evaluating, and promoting tools to predict crop N needs, including variable-rate N management
• evaluating N management alternatives including source and timing
• minimizing environmental impacts of agricultural nutrients
• coordinated management of soil, fertilizer, and manure nutrients
• tailoring fertilizer and lime recommendations to account for soil properties
• economic comparisons of production alternatives

Education

<table>
<thead>
<tr>
<th>Degree</th>
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<th>Institution</th>
<th>Major</th>
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<tr>
<td>Ph.D.</td>
<td>May 1993</td>
<td>Virginia Polytechnic Inst. and State University</td>
<td>Crop &amp; Soil Environmental Sciences</td>
</tr>
<tr>
<td>M.S.</td>
<td>July 1988</td>
<td>Virginia Polytechnic Inst. and State University</td>
<td>Agronomy</td>
</tr>
<tr>
<td>B.S.</td>
<td>August 1982</td>
<td>University of Wisconsin</td>
<td>Biochemistry, Genetics</td>
</tr>
</tbody>
</table>

Recent Research Publications


Recent Extension Publications
Scharf, Peter. 2007. Flooded fields could come up short on nitrogen, MU specialist warns. Press release through MU Extension & Ag Information.
Scharf, Peter. 2007. New nitrogen fertilizer algorithm delivers the right rate for corn and lessens potential negative impact to the environment. Press release through MU Extension & Ag Information.
Resume of PETER P. MOTAVALLI

Associate Professor, Soil Nutrient Management
Dept. of Soil, Environmental and Atmospheric Sci.
School of Natural Resources
University of Missouri
302 ABNR Bldg.
Columbia, MO 65211

TELEPHONE: (573) 884-3212
FAX: (573) 884-5070
E-mail: motavallip@missouri.edu

EDUCATION:
Ph.D., 1989, Soil Fertility and Plant Nutrition
Cornell University, Ithaca, NY
M.S., 1984, Soil Fertility and Plant Nutrition
University of Wisconsin, Madison, WI
B.S., 1982, Agronomy
University of Wisconsin, Madison, WI
B.S.F.S., 1978, Foreign Service
Georgetown University, Washington, DC

RESEARCH, EXTENSION AND TEACHING EXPERIENCE:
University of Missouri, Columbia, MO (Mar., 1999 – present). Associate Professor of Soil Nutrient Management in the Dept. of Soil, Environmental and Atmospheric Sci., School of Natural Resources.

University of Guam, Mangilao, GU (Aug., 1994 – Mar., 1999). Associate Professor of Soil Science in the Agricultural Experiment Station, College of Agriculture and Life Sciences.


SELECTED PUBLICATIONS


Title: Updating University of Missouri Soil Test Recommendations


PROFESSIONAL ORGANIZATIONS:
Soil Science Society of America
American Society of Agronomy

SELECTED AWARDS AND FELLOWSHIPS:
2000 - present  Adjunct Assistant Professor, Division of Plant Sciences, Univ. of Missouri
2001 - 2006  Member of Editorial Board, Journal of Plant Nutrition
2002 - 2003  New Faculty Teaching Scholar, University of Missouri
2003  Junior Faculty Research Award, Gamma Sigma Delta
2003  Chair of USDA Regional Committee on Soil Organic Matter (NCR 59)
2004  Outstanding Teaching Award, CAFNR, Univ. of Missouri
2004  Chair of Environmental Quality Division (A-5), Amer. Soc. of Agronomy
Title: Updating University of Missouri Soil Test Recommendations

WILLIAM E. (GENE) STEVENS

EDUCATION

Mississippi State University  PhD  1992  Agronomy
University of Tennessee-Knoxville  M.S.  1982  Plant and Soil Science
Union University  B.S.  1979  Biology and Journalism

EMPLOYMENT AND PROFESSIONAL EXPERIENCE

1994-Present  Crop Production Specialist, Plant Science Div., University of MO, Columbia, MO
1990-1994  Soil Scientist, Agronomy, MS State University/Crop Simulation, Starkville, MS.
1984-1990  Research Associate, North MS Branch Expt. Station, Holly Springs, MS

SERVICE AND AWARDS

2002-Present  Rice Technical Work Group, Executive Committee
2002-Present  MU-CAFNR, Chairman, Professional Track Faculty Committee
2006-Present  MU-Plant Science Division, Promotion and Tenure Committee
2007  Co-chair Southern Plant Nutrition Planning Committee
2006  Pyeontaek, South Korea Agricultural Assessment Team
2001  Innovation in Agribusiness Award, Monsanto Company
1998  Conservation Partnership Award, Natural Resource Conservation Service

PUBLICATIONS DURING THE LAST FIVE YEARS


Title: Updating University of Missouri Soil Test Recommendations


Title: Updating University of Missouri Soil Test Recommendations

Resume of Manjula V. Nathan
Division of Plant Sciences, University of Missouri
23 Mumford Hall, Columbia, MO 65211
Email: nathanm@missouri.edu WEB: http://soilplantlab.missouri.edu/soil
Tel: (573) 882-3250 (work), FAX: (573) 884-4288

Education
Ph.D. in Agronomy (1989), South Dakota State University
Major: Agronomy- Soil Fertility Minor: Chemistry
M. Phil. in Agric. (1981), Post Graduate Institute of Agriculture
University of Peradeniya, Sri Lanka
Major: Soil Chemistry Minor: Statistics
B.S. (Hons.) in Agric. (1978), University of Peradeniya, Sri Lanka
Major: Agronomy Specialization: Soil Science

WORK EXPERIENCE
1994- to date: Extension Associate Professor/ Director of Soil Testing & Plant Diagnostic Laboratories –
University of Missouri, Columbia, MO.
1992-1994: Associate Soil Scientist - Land Reclamation Research Center, North Dakota State University, Mandan, ND.
1990 - 1992: Postdoctoral Associate - Dept. of Soil Science, University of Minnesota, St. Paul, MN.

Honors and Awards
● 2007: Promoted from Assistant to Associate Professor, University of Missouri

Professional Service and Activities
● National Science Foundation Graduate Fellowship Panel Chair for Division of Plant & Animal Sciences (2005)
● Chair and State representative for NCR-13 Committee on Soil Testing and Plant Analysis (Chair: 2002 – 2004; Secretary: 1999; State Rep: 1996 - to date)
● Soil Testing and Plant Analysis Committee of SSSA - S 877 (2003 – to date)
● North American Proficiency Testing Program Oversight Committee of SSSA – S 890 (2002 to date)
● Editorial Board for Communications in Soil Science and Plant Analysis Journal (2002 to date)

Membership and Affiliations
American Society of Agronomy
Soil Science Society of America
Soil Testing and Plant Analysis Council
Sigma Delta Epsilon
Gamma Sigma Delta
AOAC International

National, Regional and State Assignments
● National Science Foundation Graduate Fellowship Panel Chair for Division of Plant & Animal Sciences (2005)
● Chair and State representative for NCR-13 Committee on Soil Testing and Plant Analysis (Chair: 2002 – 2004; Secretary: 1999; State Rep: 1996 - to date)
● Soil Testing and Plant Analysis Committee of SSSA - S 877 (2003 – to date)
Title: Updating University of Missouri Soil Test Recommendations

Publications

Refereed

Book chapters:

Abstracts

Miscellaneous Publications:

**Extension Presentations and Publications**

**Field Days Presentations:**

**Program Implementation Experience and In Service Training**

**Workshops, Conferences, Short Courses and Certified Crop Advisor Training:**

**Extension Guides and Fact Sheets:**

**Extension Manuals:**
Title: Updating University of Missouri Soil Test Recommendations

CURRICULUM VITAE
DAVID J. (Dave) DUNN
University of Missouri
Delta Center, P. O. Box 160
Portageville, MO 63873
Phone (573) 379-5431
dunnd@missouri.edu

EDUCATION:
Degree: M.S. Geology (with emphasis in soils development) 1985
Institution: Iowa State University
Professor: Dr. Carl F. Vondra
Degree: B.S. Geology, 1980
Institution: Iowa State University

PROFESSIONAL EXPERIENCE:
Supervisor: Soil Testing Lab 1997-present
University of Missouri-Delta Center, Portageville, Missouri
Responsibilities:
1) Communicate to public the role of an integrated soil fertility program in crop production and environmental protection.
2) Provide relevant and understandable soil and plant analysis results to customers.
3) Maintain quality control of laboratory results while ensuring that results are available to customers in timely manner.
4) Supervise and train administrative and support staff, develop and implement annual working budget, maintain and purchase supplies and equipment as needed.
5) Develop and administer a soil fertility research program.
6) Provide research assistance to other multidisciplinary University of Missouri staff

Iowa State University, Ames, Iowa
Responsibilities:
1) Supervise and train student hourly workers.
2) Maintain equipment and purchase consumable supplies as needed.
3) Maintain quality control of laboratory results.
4) Communicate soil test results to customers.
5) Provide research assistance to other multidisciplinary Iowa State University staff, includes training of graduate students in use of analytical instruments.
Title: Updating University of Missouri Soil Test Recommendations

Iowa State University, Ames, Iowa  
Responsibilities:  
1) Supervise and train temporary and student workers.  
2) Maintain equipment and purchase consumable supplies.  
3) Maintain quality control of laboratory results.  
4) Maintain records of laboratory results for compliance with local, state  
and federal environmental laws.

RECENT PUBLICATIONS:

Refereed Publications:  
Stevens, G., A. Sheckel, E. Vories, M. Mulesky, M. Rhine, and D. Dunn. 2007. Irrigation to  
maximize vaccine antigen production in genetically modified tobacco Agron J. 99: 1271-1277  
Stevens, G., A. Wrather, M. Rhine, D. Dunn and E. Vories. 2007. Predicting rice yield response  
to midseason nitrogen with plant area measurements. Agron J (in press).  
Dunn, D. and G Stevens. 2007. Phosphorus Management in a Dry-seed, Delayed Flood  
Production System in Missouri, Better Crops International, 91: 20-21  
Aide, M., C. Aide, D. Dunn, and G. Stevens. 2006. Fragipan genesis in the eastern Ozarks of  
Missouri. Soil Sci. 171 (6): 483-491  
Dunn, D., G. Stevens, and A. Kendig. 2005. Boron fertilization of rice with soil and foliar  
http://www.plantmanagementnetwork.org/pub/cm/research/2005/boron/  
Conley, S., G. Stevens, and D. Dunn. 2005. Grain sorghum response to row spacing, crop  
effects on stand and yield in a rice monoculture system. Crop Management [Online]  
Measuring K⁺ in Rice Basal Stem Sap with a Cardy Meter. Crop Management (Online)  
Curriculum Vitae
Newell R. Kitchen, USDA-ARS Soil Scientist

Education:
1984   B.S.  Brigham Young University (Agronomy)
1986   M.S.  University of Missouri (Agronomy)
1990   Ph.D. Colorado State University (Agronomy/Soil Science)

Professional Positions:
1990-1996  Research Assistant Professor, Soil and Atmospheric Sciences Dept, University of Missouri, Columbia, MO
1996- current   Soil Scientist, USDA-ARS, Cropping Systems and Water Quality Research Unit, Columbia, MO
1996-2003  Adjunct Assistant Professor, University of Missouri, Columbia, MO
2003- current  Adjunct Associate Professor, University of Missouri, Columbia, MO

Professional Society Membership:
American Society of Agronomy
Soil Science Society of America
Soil and Water Conservation Society
Certified ARCPACS Professional Soil Scientist

Honors and Awards:
J. Fielding Reed Potash and Phosphate Institute Fellowship, 1989
USDA Outstanding Performance Award, 2001, 2004, 2005
Robert E. Wagner Potash and Phosphate Institute Award (Jr. Scientist), 2003

Professional Society Service:
Active member attending 20 ASA-SSSA-CSA annual meetings between 1982-2005. Presented
at least 1 paper each year and authored/co-authored as many as 8 papers per year. 51 total
papers authored/co-authored at annual meetings. Chaired oral paper sessions in 1997, 2000,
Special Editor for six 2000 ASA meeting symposium manuscripts on Application of Soil
Electrical Conductivity in Precision Agriculture, May-June, 2003, Agron. J.
Chair (by election), Integrated Agricultural Systems Division, ASA, 2001
Board Rep. (by election), Integrated Agricultural Systems Division, ASA, 2005-2008
Editorial Board Member, Journal of Precision Agriculture, 2001-present
Editor for a special issue of Computers and Electronics in Agriculture J. on the topic of
Emerging Technologies For Real-time Integrated Agriculture Decisions, current.

Achievements in Teaching and Extension:
Graduate Students Advisor, 6 MS and 4 PhD students
Graduate Student Committee Member, 4 MS and 5 PhD students
Co-organizer of course entitled Precision Agriculture Science and Technology, listed through 3
departments at the University of Missouri. Dr. Kitchen helped team-teach the class (Kitchen
Title: Updating University of Missouri Soil Test Recommendations

~ 30%) for 4 years (1997-2000, 2003) and taught the class for 2 years (2001-2002).
Enrollment: 20-30/year.
Invited presenter at regional and national extension workshops and conferences. Examples
include: Information Agriculture Conferences, 1996, 2001; North Central Extension-Industry
Agricultural Equipment Technology Conference, 2003, Louisville, KY.

Professional Contributions:

Book chapters ................................................................. 3
Technical papers, refereed.................................................... 45
Technical papers, non-refereed............................................. 65
Non-technical papers........................................................ 24
Patents ............................................................................. 0
Invited lectures, seminars or symposia presentations.............. 36
Other related oral, written, visual presentations or products...... 93

Recent Refereed Publications:

electrical conductivity and topography related to yield for three contrasting soil-crop systems.
57:518-524.
electromagnetic induction and direct sensing of soil electrical conductivity. Agronomy
Journal: 95:472-482.
CROPGRO-soybean model on Missouri claypan soils. Agricultural Systems Journal: 76:985-
1005.
environmental evaluation of variable rate nitrogen and lime application for claypan soil
Palm, D.G. Bullock. 2004. Relationships between soil bulk electrical conductivity and the
principal component analysis of topography and soil fertility values. Plant and Soil: 258:
269-280.
Comparison of remote sensing and crop growth models for estimating within-field LAI
electrical conductivity to soil properties across the north-central USA. Comp. and Electronics
in Agric. 46:263-284.
Title: Updating University of Missouri Soil Test Recommendations


