1. **Title:** The Influence of Calcitic and Dolomitic Lime and Phosphorus on Species Composition in Tall Fescue Pastures

2. **Investigators:** Randy Miles, Associate Professor of Environmental Soil Science and Dale G. Blevins, Professor of Agronomy, University of Missouri

3. **Objectives:** The goal of this study is to ascertain the effect that lime and phosphorus (P) has on species composition in tall fescue pastures. A large percentage of tall fescue acreage in Missouri is on acid soils with low to very low available P. Applying lime and P to these pastures would raise the soil pH and release sorbed P, providing an opportunity for a shift in species from oligotrophic species to those that prefer pH values closer to neutral. The benefits for producers could be two-fold, reducing pasture weeds (oligotrophic species) and increasing the presence of desirable forage legumes. Legumes increase the quality of forage in tall fescue pastures, especially during the summer months when tall fescue may go dormant; legumes also help decrease the incidence of fescue endophyte problems and grass tetany. On the other hand, pasture weeds, which cause a loss of about $2 billion in the United States (Di Tomosa, 2000), not only result in a direct cost to the producer when spraying and mowing are necessary control measures, but they also decrease the quality and quantity of forage. Hence, the application of lime and P could provide an alternative for improving pastures by encouraging legumes and discouraging encroachment of many of the common pasture weeds while increasing the forage yield and quality.

4. ** Procedures:** An established tall fescue pasture with a diverse plant community will be selected at the Southwest Center near Mt. Vernon, Missouri. Initial soil samples will be taken and analyzed for salt pH, Bray PI, organic matter, exchangeable K, Ca, and Mg, plus neutralizable acidity. The results will be used in final site selection and determining quantity of fertilizer and lime applications. In May, the botanical composition will be assessed in each plot to provide a baseline for initial species composition. The 10’ x 25’ plots with 10’ boarders between plots will be used. Liming treatments of calcitic and dolomitic lime from a source near Mt. Vernon at 0x, ½x, 1x, and 2x rates by the Woodruff Buffer will be used. The P treatments will be 0 and 50 pounds P/acre for each liming treatment. Maintenance potassium (K) additions to soil test recommendations will be added to each treatment. Each treatment will have a minimum of six replications. In late winter of 2006, a mixture of red clover and annual lespedeza will be overseeded into the plots. Species composition will be measured on each of the six replications of each treatment in May and August via percent cover, a representation of the amount of the plant canopy that is occupied by each species, and percent dry matter, a reflection of the amount of each species that would be consumed by a grazing animal. In January, March, May, August, and November of each
year, the forage quality will be assessed by NIR (near-infrared analysis) for ADF and NDF. The samples will also be digested and analyzed for percent P, K, magnesium (Mg), and calcium (Ca). This project will last three years (a reflection of the normal liming cycle) because of the slow dissolution process of lime and the time required for species shifts to occur.

5. **Current Status/Importance of Research Area:** Little research data on soil pH and available P is available for tall fescue producers to make management decisions relative to species composition and forage quality. Most of the “information” being used by producers is antidotal. Kroth and Mattas (1974) reported that a zero lime treatment had large amounts of weedy species, but three tons/acre of lime top-dressed yielded plots free of weedy plants. Work done by Peters and Lowance (1974) showed that broomsedge, a common pasture weed in Missouri, and broadleaf weeds can be decreased with the application of nitrogen (N), P, K, and lime. Their evidence also demonstrated that with the encouragement of legumes, N fertilization was not necessary. However, macronutrient content and the effects of dolomitic limestone were not evaluated. Most species of legumes need pH values near or slightly below neutral for nodulation and best growth, and the addition of lime should increase pH, add Ca and/or Mg, and optimize their growing conditions. Liming should also increase the availability of P that is already sorbed in the soil (this P shows up in the Bray II test, but not the Bray I) and decrease the amount of the fertilizer P that is sorbed. The increased level of fertility and the greater pH should encourage the growth of higher quality tall fescue and improve its ability to compete while encouraging legumes and discouraging many of the common pasture weeds. The proper utilization of agricultural limestone and fertilizer may provide a low cost, timely, and easy to implement management tool for producers to control weeds and increase the quality and quantity of forage in tall fescue-legume pastures.

6. **Timetable for Proposed Research:** This study would begin in the spring of 2005 with site selection and soil tests. In May 2005, the botanical composition of the plots will be determined and the plots will be mowed prior to the application of the lime treatments. Botanical composition will be measured in August of 2005 and legumes will be overseeded into the plots in the late winter of 2006. Species composition will then be assessed in May and August of year 2 and 3; forage quality will be assessed five times each year beginning in May 2005 and ending in August 2007. The study will be complete in the fall of 2007, and the final report and manuscript writing will occur in the winter of 2007.

7. **Strategy for Application and Transfer of Knowledge:** The results of this study will be disseminated at appropriate field days and workshops that center on cow-calf production, tall fescue pasture management, and aglime workshops such as at the state meeting of the Missouri Limestone Producers
Association. Also, a brief summary report similar to the reports for the Fertilizer/Ag Lime program will be written for sue by UOE, NRCS, and Missouri Department of Agriculture personnel as well as beef production groups. Pictures or PowerPoint slides of various weed/legume/tall fescue percentages will be developed to provide producers a visual baseline in making pasture management decisions. Additionally, a refereed journal (such as Agronomy Journal) publication will be written.

8. Budget:

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<tr>
<td>Salary</td>
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<td>Research Assistant (50%)</td>
<td>$9,000</td>
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<td>Benefits</td>
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Note: Research Assistant is budgeted for a 24-month period, depending on when funding is received and project is initiated; the term of the research assistant may transcend across all three calendar years but will not exceed 24 months. Travel is for transportation to research sites and to disseminate results and information obtained from the story to producers at field days and workshops.

References:
Resumes:

RANDALL J. MILES – Associate Professor of Soil Science

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School of Natural Resources
University of Missouri
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Education
B.S. in Agronomy (with Distinction), 1974, Purdue University
M.S. in Agronomy (Soil Genesis), 1976, Purdue University
Ph.D. in Soil Science (Soil Genesis), 1981, Texas A&M University

Professional Affiliations
Soil Science Society of America
International Soil Science Society
American Society of Agronomy
National Onsite Wastewater Recycling Association
Soil and Water Conservation Society
Missouri Association of Professional Soil Scientists
National Association of Colleges and Teachers of Agriculture
Missouri Smallflows Organization

Current Research
Dr. Miles’ current research deals with on-site wastewater treatment and disposal
and soil site characteristics. He is Director of Historical Sanborn Field, the third
oldest continuous research field in the world. He is also curator of the Historical
Duley-Miller soil erosion plots. Dr. Miles also works in the soils and archaeology
arena. He also works in the soil genesis, morphology and soil survey area. His
major emphasis in these areas has been in soil landscape and fragipan
formation. Additionally he has worked with land application of biosolids and
assessment of soil acidity and aluminum activity.

Selected Publications
49:702-708.
53:1514-1516.
Sievers, D.M., R.J. Miles, and D.G. Burk. 1989. On-site aeration treatment in
the Missouri Ozarks. Applied Eng. in Agri. 5:199-203.
James, H.R., M.D. Ransom, and R.J. Miles. 1995. Fragipan genesis in
59:151-160.

Special Professional Honors/ Awards
President, Missouri Association of Professional Soil Scientists, 1986-1987
Gamma Sigma Delta Superior Undergraduate Teaching Award, 1989
Special Commendation by Missouri Milk, Food, and Environmental Health Association for work in developing On-site Wastewater Treatment and Disposal Standards, 1990
Associate Editor, Journal of Agronomic Education, 1990-1992
Sigma Xi, President of Missouri Chapter, 1991-1992
Excellence in Teaching Award, College of Agriculture, Food, and Natural Resources, 1993
Governor’s Award for Quality and Productivity as member of the On-site Sewage team to write legislation and formulate education programs, 1996
Board of Directors, National On-Site Wastewater Recycling Association, 1999-2002, also Chair of the Government Relations committee
Most Inspiring Professor, MU Inter-Collegiate Athletics Counsel, 2000
MU Excellence in Education Award sponsored by the Division of Student Affairs and MU Parents Association, 2002
Executive Board Member of the Consortium of Institutes of Decentralized Wastewater Treatment (2003-present), Chair of the Legislative (2003) and University Curriculum (2004- present) Committees.
Most Outstanding Faculty Member, 2004, School on Natural Resources Student Council.

Dale G. Blevins - Professor of Agronomy
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Department of Agronomy Fax: 573 882-1469
University of Missouri email: blevinsd@missouri.edu
Columbia, MO 65211

Education
B.S. in Chemistry, Southwest Missouri State University, 1965
M.S. in Soils (Plant Nutrition), University of Missouri, 1967
Ph.D. in Plant Physiology, University of Kentucky, 1972

Experience
1985 - present, Professor, Agronomy Department, U. Missouri, Columbia
1980 – 1985 Associate Professor, Agronomy Department, U. Missouri, Columbia
1978 – 1980 Assistant Professor, Agronomy Department, U. Missouri, Columbia
1974 – 1977 Assistant Professor, Botany Dept., U. Maryland, College Park
1972 – 1974 Postdoctoral Research Associate, Department of Botany and Plant Pathology, Oregon State University, Corvallis

Awards
1982 Gamma Sigma Delta Superior Research Award for Junior Faculty in Agriculture
1983 Amer. Soybean Assoc./ ICI International Soybean Researchers Recognition Award
1983 Gamma Sigma Delta Superior Graduate Teaching Award
1992 Fellow of the American Society of Agronomy
1992 Fellow of the Crop Science of America
1992 Distinguished Faculty Award, UMC Alumni
1993 Kemper Teaching Award, UMC

Selected Publications


