1. Title: Phosphorus Fertilization of Tall Fescue Pastures Improves Rate of Gain and Weaning Weight of Beef Calves in Missouri

2. Investigators: Dale G. Blevins, Professor, Agronomy Department and David Davis, Director, Forage Systems Research Center, University of Missouri

3. Objectives: To increase the rate of gain and weaning weight of nursing beef calves in Missouri. Missouri is second in the nation (after Texas) in feeder calf production. Feeder calf production in Missouri is primarily based on our 13 million acres of tall fescue pastures. A majority of these pastures are on low phosphorus soils (Bray I), and our previous research has indicated that both forage production and nutrient quality are improved with P fertilization. We also have found that calf rate of gain over their first two months of growth was improved with P fertilization of tall fescue pasture. However we need data on calf weight after six months when cows are grazing tall fescue pastures treated with P compared to calf weight from untreated control pastures.

4. Procedure: An established tall fescue (endophyte infested) pasture will be selected at the Forage Systems Research Center near Linn. Pastures selection will be based on low to moderately low soil Bray I phosphorus analysis. Treatments will be 0 or 100 lbs P/acre, 100 lbs N/acre/yr and K will be added as recommended by the soil test results. All pastures will be supplied with salt blocks containing only NaCl. There will be four replicated pastures of each treatment and pastures size will be 16-30 acres each depending on pastures selected for the study. Each pasture will be supplied with at least six beef cows (crossbred cows with Red Angus calves) with approximately four-week-old calves. Calving on this herd actually begins around February 15 and ends around March 15. Cows will be preconditioned on the same large stockpiled tall fescue pasture for at least four week prior to the beginning of this experiment. Around (depending on the year, weather and green-up) April 15, 2005, cows and calves will be weighted on the day they are put into the treated pastures, and then they will be weighted monthly for six months. Stocking rates will be adjusted to produce similar grazing pressures that result from the P treatments. Grab samples of forage from each pasture will be collected, dried, and analyzed for quality components and mineral elements monthly, as well. The entire experiment will be repeated on adjacent pastures in 2006. Data from the two year experiment will be combined and means of all data will be separated using Fisher's protected least significant difference, and the 0.10 alpha level will be used to test our hypothesis. The hypothesis is that calves from beef cows grazing P treated tall fescue pastures will gain more weight and be larger at weighing than calves from cows grazing untreated pastures.

5. Current Status/Importance of Research Area: Missouri has 13 million acres of tall fescue pasture and has the second largest herd of beef cows and calves. The feeder calf industry is one of our leading agricultural income sources. Much of this industry is producing feeder calves on tall fescue growing on low P soils. Both the quality and
quantity of the tall fescue produced in Missouri can be improved by increasing soil Bray I P levels to the University recommended levels for pastures (Reinbott and Blevins, 1997).

Very little research has been reported on the effects of improving P fertility of pastures on the growth of beef calves. Improving the P nutrition of forage, increased forage production, increased milk production of cows and increased rate of gain of calves in a Texas study (Minson, 1990). In this study, P fertilization also increased estrus and conception rates of the beef cows and increased the growth rate per animal and the live-weight gain per acre of beef calves. In fact, P fertilization increased the financial returns per unit area more than using a diet supplement containing P (Minson, 1990).

In Missouri, in a study designed to improve forage Mg concentrations and prevent grass tetany in beef cows, calf rate of gain was increased during March and April with P fertilization (Lock et al, 2004). Although calves were in the study for only the first two months of their lives, and were then sent back to North Missouri pastures, their weight records were kept, and when sold as feeder calves, those started on the P treated pastures weighed 50 lbs/head more than those from pastures not treated with P fertilization. At today's prices for feeder calves, this would be an increase of over $60 per calf. In 2003, Missouri had 2,116,000 beef cows (Missouri Farm Facts, 2003), and based on the major counties involved in beef production in the state, and University of Missouri Soil Test records for those counties, one can safely estimate that at least half of these cows were grazing tall fescue growing on low P soils. Based on our previous study, if P fertilization increased weight of each of one million calves by 50lbs/calf, and if the market price of each calf was $1.25/lb, this would add $62,500,000 to the Missouri economy. We predict that in the proposed experiment, with most of their first six months on pastures treated with P fertilization, final weight increase of the calves on P-treated pastures will exceed 50 lbs/calf!

6. Timetable for Proposed Research. This study will begin in March, 2005 when soil samples will be taken from selected tall fescue pastures at the Forage Systems Research Center near Linneus. Beef cows will be selected at this time, weighed and sorted into groups according to weight. All cows will begin the preconditioning faze on the same tall fescue pasture at this time. On March 15, 2005 selected pastures with be treated with the 100 lbs/acre rate of P (applied as 0-46-0) and treated with N and K. Around April 15, the cows with calves that are approximately one week on age will be weighted and placed on appropriate pastures. Both cows and calves will be weighted monthly for six months. Forage grab samples will be collected at these same times and analyzed for quality and mineral elements. The entire experiment will be repeated on similar pastures during 2006. After the two years experiment, late October 2006, all data will be combined for the two year study and analyzed.

7. Strategy for Application and Transfer of Knowledge. The results of this study will be used for presentations at Missouri Cattlemen's Association meetings around the state, at Missouri Forage and Grasslands meetings, at University of Missouri Field Days around the state, and at the North Central Soil Fertility meetings and at the annual meetings of the American Society of Agronomy. The final results will be distributed to the University Forage Extension personnel for distribution to Extension people throughout the state. A referred journal article will be published with data provided from this research.
8. Budget.

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References.


Resume:

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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

