Phosphorus Fertilization Improves Quality of Stockpiled Tall Fescue

By Dale G. Blevins, Matt Massie, and Will McClain

Previous fescue forage nutrition studies have shown that adequate phosphorus (P) improves forage production, enhances forage magnesium (Mg) uptake, and lowers the risk of grass tetany. Continued research showed that stockpiled forage P and Mg levels declined during the winter, but 57 lb of P_2O_5/A kept stockpiled forage P and Mg levels within desirable ranges for beef cow nutrition. This P rate also boosted hay production by the equivalent of two big round bales/A, resulting in an estimated net return of $30/A.

Missouri is second in the U.S., after Texas, in feeder calf production. Beef cattle production in Missouri and in a large portion of the U.S. is based on tall fescue pastures. Half of the feeder calves in Missouri are produced within a 100-mile radius of the University of Missouri Southwest Research Center near Mt. Vernon. Tall fescue in southwest Missouri is typically grown on soils low in plant-available P.

The major expense of beef cattle production is feeding costs, primarily in harvesting, storage, and consumption of hay. Therefore, it is often recommended that cattle producers save some tall fescue pasture for winter grazing, called "stockpiling", to reduce winter feeding costs.

Early studies in Kentucky, Tennessee, and West Virginia indicated that stockpiled tall fescue contained low P and Mg concentrations. In fact, by late winter and early spring, concentrations of these two nutrients were often below levels recommended for lactating beef cows. This poses a problem for beef herds that calve in late winter and early spring.

Our studies in Southwest Missouri have shown that P fertilization of low P soils increased both P and Mg concentrations of tall fescue leaf tissue in early spring and greatly increased total forage production. That work was conducted to try to increase the Mg concentrations of tall fescue leaves, in order to combat grass tetany in beef cattle. Our new studies on the quality of stockpiled tall fescue included P treatments to improve the nutritional quality of stockpiled tall fescue during winter.

A Stockpiled Tall Fescue P Study

An established Kentucky 31 tall fescue pasture was selected at the Southwest Center near Mt. Vernon on a Creldon soil (mesic Oxyaquic Fragiudalf) that contained 7 lb P/A (Bray 1) and 247 lb Mg/A (ammonium acetate). Triple superphosphate (0-46-0) was applied to 10 ft. x 25 ft. plots at 0, 12.5, and 25 lb P/A (0, 28.5 and 57 lb P_2O_5 /A). Each treatment was replicated 18 times in the 2-year experiment. The study was started the third week in August by

Broomsedge encroachment into tall fescue pasture not treated with P fertilizer is shown at left, compared to pasture at right which received P fertilization.

cutting and removing all forage, then applying the P fertilization treatments. Beginning in mid-October and continuing through April, 20 of the most recently collared leaves were harvested each month. Hay was harvested during the third weeks of May and August. Leaf and hay samples were analyzed for macronutrient element concentrations and these concentrations were compared to those required for diets of lactating beef cows.

Leaf P in Stockpiled Tall Fescue

Leaf P concentrations dropped during the fall and winter months, reaching their lowest levels by mid-February (**Figure 1**). By January of the first year, P levels in leaves from all P treatments were below those required by lactating beef cows, and these P levels remained below 0.20% through mid-April. During the second year, leaves from untreated plots remained between 0.10 and 0.15% P, much lower than levels required for lactating beef cows. However, with the 25 lb P/A applied during a second season, leaf P concentrations remained around 0.20% throughout the winter. At the 12.5 lb P/A treatment level, leaves harvested during December, January, and February of the second year remained below the 0.20% P target level. It should be noted that leaf P concentrations dropped during the second year, although not as dramatically as in the first year. Our working hypothesis is that leaves of this perennial grass translocate or move P to roots during late fall and winter. This is called nutrient remobilization, and involves nutrient transport in phloem tissue.

Leaf Mg in Stockpiled Tall Fescue

In earlier work, we found that late winter P treatments increased tall fescue leaf Mg concentrations during March and April. Based on these studies, we think that tall fescue growing on low P soils has a problem with Mg uptake by roots and Mg transport from roots to leaves. So, we were interested in the response of Mg to P treatments in stockpiled tall fescue.

A decline in leaf Mg concentration occurred during late fall and winter, reaching the lowest levels in mid-March (**Figure 2**). This decline was very similar to the decline in leaf P concentrations, except P levels were lowest in mid-February. A sharp decline in Mg concentration also occurred during the second year, but with the 25 lb P/A treatments, leaf Mg concentrations remained about 0.20%. Again, our hypothesis is that this mobile divalent cation, Mg, is re-translocated during late fall and winter months from leaves to roots. Magnesium concentrations in leaves of untreated tall fescue dropped below the 0.20% target in January, February, and March of both years, indicating a nutritional problem for early calving beef cows.

Leaf Potassium (K) and Calcium (Ca) in Stockpiled Tall Fescue

Leaf K concentrations declined each fall and winter. However, leaf K concentrations did respond to the P treatments

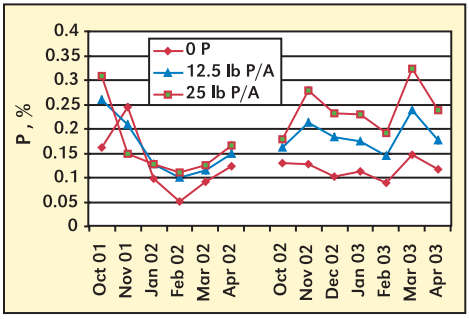

Figure 1. Leaf concentrations of P following P fertilization of stockpiled tall fescue.

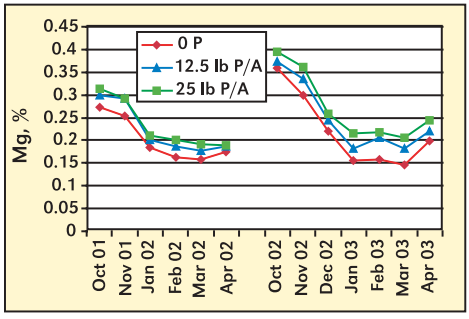

Figure 2. Leaf concentrations of Mg following P fertilization of stockpiled tall fescue.

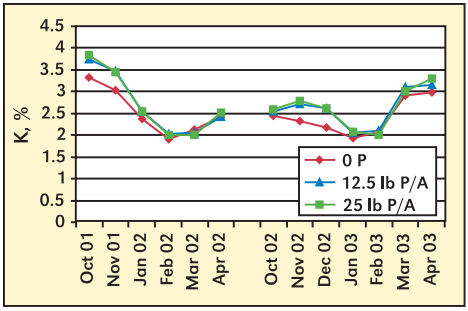

Figure 3. Leaf concentrations of K following P fertilization of stockpiled tall fescue.

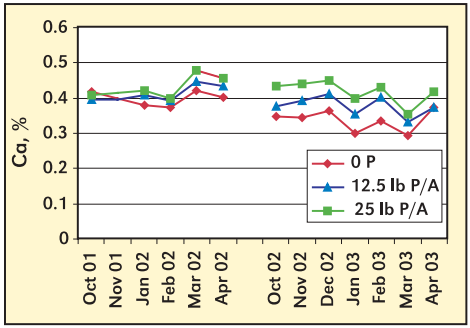

Figure 4. Leaf concentrations of Ca following P fertilization of stockpiled tall fescue.

(**Figure 3**). The K levels of leaves from all treatments exceeded the nutrient requirements for lactating beef cows.

Calcium is not mobile in phloem tissue in plants, and therefore is not remobilized from leaves to roots during winter. Thus it was not surprising to find that Ca concentrations in leaves remained level during late fall and winter (**Figure 4**). During the second year, there was an obvious Ca response to the P treatments, with leaves from the 25 lb P/A treatment being higher than those from the 12.5 lb P/A treatment. Leaves from both P treatments were higher in Ca than from untreated control plots.

Hay Production and P Treatments

As we have reported in the past, P fertilization at this location increased tall fescue hay production by over 1,500 lb/A/year (**Figure 5**). This yield increase is equivalent to about two big round bales of hay. At $25 per bale, this would equal $50/A of increased hay production as a result of P fertilization. Fertilizer for 25 lb P/A (57 lb P_2O_5) would cost around $15.45, so the net (minus application cost) return on investment would be around $30/A. For a forage production system, it is not uncommon to harvest tall fescue yields totaling 4 t/A/year, either by grazing or by hay harvests, and based on our results, this would remove about 16 lb P/A or 37 lb P_2O_5 /A.

Conclusions

The physiological nature of tall fescue may affect the quality of stockpiled tall fescue during the winter months. Leaf P and Mg concentrations declined during late fall and winter, and research is underway to determine if these mobile elements are retranslocated from leaves to roots as winter approaches. By late winter, both P and Mg levels dropped below those required for lactating beef cows, unless plots were treated with 25 lb P/A. This P application rate boosted hay production by the equivalent of two big round bales, or by a net return of about $30/A, at a cost of $15.45 for the P fertilizer. It would also reduce the amount of supplemental Mg required by the grazing beef cows. BC

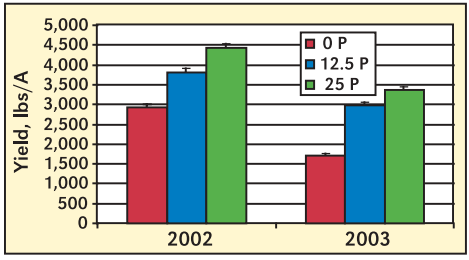

Figure 5. Hay yield of tall fescue treated with P fertilization. Hay was harvested in May and August of each year.

Note: In **Figures 1-5,** 12.5 lb P/A = 28.5 lb P_2O_5; 25 lb P/A = 57 lb P_2O_5

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