K IS THE KEY TO HIGH YIELDS AND GOOD STANDS

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"Look at those bags of fertilizer," I said to my graduate students as we passed by a hayfield on a recent drive to an Extension meeting. Sometimes I say things like that just to get a laugh out of the strange looks they give me.

I also say things like this to them to get them to think about what goes into making hay and how we keep the stand productive. Those bermudagrass bales were roughly the equivalent of a fertilizer bag with an analysis of 2.3-0.75-2.5, which is to say 2.3% nitrogen (N), 0.75% phosphate (P_2O_5), and 2.5% potash (K_2O). So, if a cattleman has a hybrid bermudagrass field producing 6 tons/acre each year, that crop would remove 276 lbs N, 72 lbs of P_2O_5, and 300 lbs of K_2O.

Most cattlemen put on about 50-60 lbs N/acre at green-up and after each cutting on bermudagrass through the season. This total is within the range that is recommended (200-300 lbs N/acre for the year on rainfed fields, 300-400 lbs N/acre for irrigated fields). The problem is that the amount of K_2O added is rarely enough. It is a rare producer who puts on enough potash. I'm certain that those who religiously read my articles put on enough K, but those folks who don't will typically put out whatever they can afford in the spring, often neglecting to put out any more later. The consequence is lower yields, great disease problems, higher weed pressure, and thinning stands.

Potassium is critical to maintaining high yields, greater disease resistance, and thick, persistent stands (Figs. 1 and 2). Deficiency symptoms occur initially in the margins of lower leaves in the form of chlorosis (yellowing) followed by necrosis (death). It affects plant vigor, drought tolerance, forage quality, rhizome and stolon production, and winter survival. In most cases, K deficiency comes about slowly. A bermudagrass stand may be very old before it begins to exhibit severe stand thinning as a result of K deficiency. Additionally, some varieties are more prone to K deficiency problems than others.

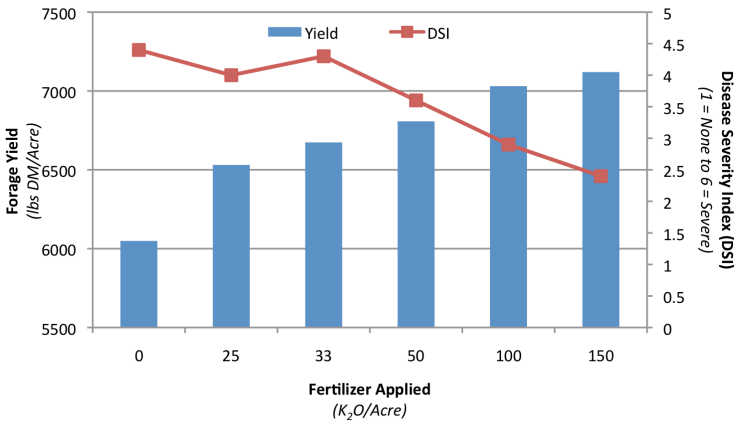

Figure 1. Forage yield (blue bars) and disease severity (red line) of 'Tifton 44' bermudagrass in response to potassium fertilization.

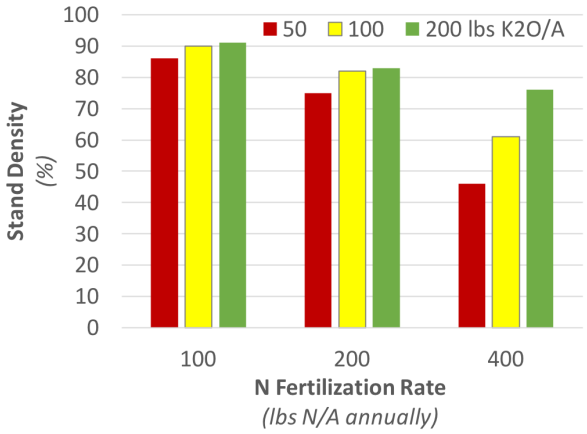

Figure 2. Stand density of hybrid bermudagrass fertilized with potash at 50, 100, and 200 lbs of K2O/acre and with nitrogen at low (100 lbs N/acre), medium (200 lbs N/acre), and high (400 lbs of N/acre)

To determine if K deficiency is causing the problem, take a representative soil sample from the affected areas and another from areas nearby that are unaffected or less affected. Submit these samples for soil testing and compare the results. It is also highly recommended that plant tissue samples (clippings from the top 6 inches of 3 to 4-week-old growth) be collected from the affected and unaffected areas.

When these tests are compared, the affected and unaffected areas will usually be subtly or even substantially different from one another in K availability in the soil and/or concentration in the plant tissue. Soil test K levels should ideally be in the high category. If the soil test levels are low or even on the low side of the medium range, K deficiency may occur during periods of water stress. The plant absorbs K from the soil by drawing in water that contains K from the soil. During drought stress, K absorption may be decreased. Thus, even if the soil test indicates an adequate level of soil test K, a drought effectively reduces the amount of K available to the plant. In a plant tissue analysis, the K concentration should be above 2.2% for optimal production and levels less than 1.8% can result in rapid declines in yield and stands. If these levels are low, then K is likely the cause of the decline.

Research has shown that stands can recover if given adequate K supplementation. One major reason for this is that K fertility is critical for healthy rhizomes, the underground stems that aid the spread of bermudagrass. Figure 3 presents a study from Texas where adequate K nutrition resulted in a nearly 800% increase in rhizome mass compared to when K is deficient.

Even if one has been following soil test-based recommendations, K deficiency can eventually occur in a field. It is important to recall two of the fundamental precepts of soil test-based recommendations: the recommendations are 1) NOT meant to result in a build-up of nutrients in the soil over the long-term and 2) based on average conditions (our conditions lately have been anything but average).

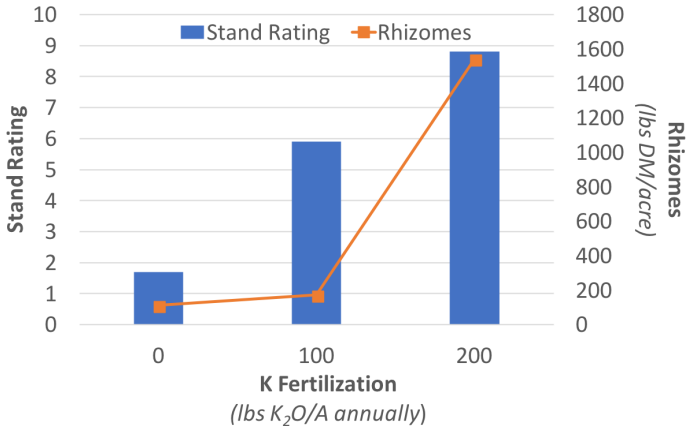

Figure 3. Stand rating (0 = no stand, 10 = 100% stand) of 'Coastal' bermudagrass after 3 successive years of receiving high levels of N and 0, 100, or 200 lbs K_2O/acre in Texas.

Applying Potassium

In contrast to N and P, the environmental risk posed by K is very low. However, K is quite expensive and necessary for optimum forage production. As a result, K applications should be made in a way that maximizes the availability of K over the entire growing season.

Muriate of potash (KCl) is by far the most common K fertilizer, though other K fertilizers are occasionally used. Substantial amounts of K may also be found in animal wastes or biosolids. However, if these products are applied at rates designed to supply recommended N and P levels, additional K may be needed on K-deficient soils.

When K comes in contact with water, it quickly dissolves and enters the soil. Potassium is a cation (has a positive charge) and is attracted to the soil (which carries a negative charge). However, some soils in Georgia have a very low cation exchange capacity (CEC), which means they do not have enough negative charge to have much capacity for attracting cations (K, Ca, Mg, etc.) or making them available to the plant. Consequently, significant amounts of K can be lost to leaching in those soils. This problem is more common in the sandy soils in the Coastal Plain region and can be exacerbated by low soil pH.

Still, the biggest potential for inefficient use of K is a phenomenon called "luxury consumption." Most plants (especially forage crops) will take up more K than is required for optimum growth. Thus, if relatively large rates of K are applied early in the growing season, forage crops will absorb excess K and reduce the amount available for later growth cycles.

Because of this potential for luxury consumption and (in some cases) K loss to leaching, it is recommended that K applications be split across two or more application times. In generally, most hay producers should apply 40-50% of the K_2O recommended by the soil test at green-up with at least the remaining 50-60% applied after their late July or early August harvest. As mentioned previously, adding more potash than the soil test recommendations will be required if one desires to replace the total K removed in the hay or build K levels in the soil. Regardless of the strategy, splitting the K applications will lower the risk of luxury consumption and leaching, allowing K to be used more efficiently and available throughout the growing season. This is particularly important for forage crops that are harvested for hay or silage.

More Information

For more information about nutrients can be managed to ensure high yields and durable stands, check out the publication entitled "Soil and Fertilizer Management Considerations for Forage Systems in Georgia," which is available on our website (www.georgiaforages.com).