



Kick-Off the Fall Season with Fertilization Management / Fall 2005

Phosphorus and Potassium Nutrition of Forages... Consider the "Hidden" Benefits



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Forage production represents a large portion of the agricultural economies of most states. Forages are either annual or perennial, and cool season or warm season. The overall quality, in terms of digestibility, of annual forage grasses is generally higher than perennials. Cool season forage quality is generally higher than warm season. Legumes tend to be of higher quality than grasses (**Figure 1**).

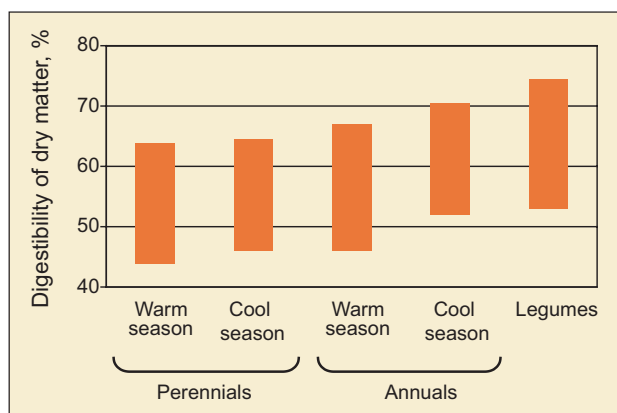


Figure 1. Approximate ranges for digestibility of dry matter (%) for different forage classes. (After J.N. Pratt. Texas A&M University.)

Nutrient input is critical to the profitability of any forage system...whether hay, silage, or pasture. A few of the benefits of a complete and balanced forage fertility program include:

- Increased yield
- Improved quality
- Higher profit potential
- Greater water use efficiency
- More resistance to diseases and insects
- Improved winterhardiness
- Enhanced drought tolerance
- Greater efficiency of other inputs

Most discussions of forage fertilization focus on yield and/or quality. However, there are many other, less obvious or "hidden" benefits that are worth discussing. Following are a few examples.



A shortage of K in bermudagrass production can have serious consequences.

Greater Water Use Efficiency (WUE)

Adequate and balanced nutrition can greatly increase production per unit of available water (WUE) of forage crops. Consider the irrigated annual ryegrass example given in **Figure 2**. Nitrogen (N) and phosphorus (P) inputs increased WUE of ryegrass more than 200% over the no fertilizer control. At the 360 lb N rate the increase in WUE over the zero fertilizer control went from 90 to 200% with the addition of 80 lb P_2O_5/A .

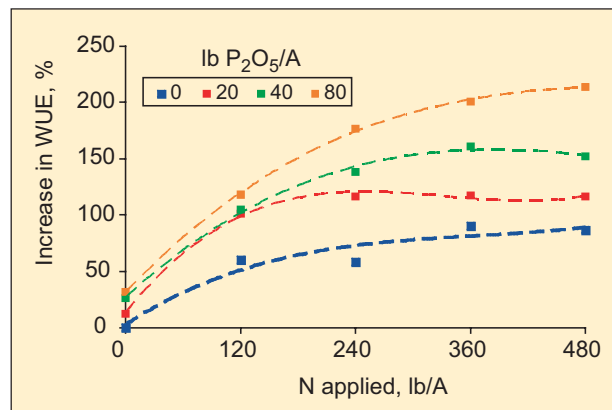


Figure 2. Nitrogen and P fertilizer increase WUE of irrigated annual ryegrass. Baseline for comparison was the zero fertilizer control. Nitrogen was applied in split applications. (H. Lippke. Uvalde, TX. Data from 1996 season. [Click here](#) for link to BC article.)

Increased N Use Efficiency (NUE)

Adequate P and potassium (K) fertilization of forages has the potential to significantly increase N use efficiency... an important consideration in today's N fertilizer price environment. In the previously discussed annual ryegrass study, applying 80 lb P_2O_5/A

increased average (across all N rates) apparent NUE from 31 to 65 lb forage dry matter (DM)/lb N fertilizer applied...a 110% increase in fertilizer NUE over the zero P control.

The NUE effect was seen recently with K in Tifton 85 bermudagrass research. Notice in **Figure 3** that at both N fertilization rates the addition of K fertilizer increased yield, thus increasing apparent NUE by producing more forage with the same amount of N fertilizer. Another important feature of this work is the increased impact of higher rates of K with the high N rate, illustrating the importance of balancing nutrient inputs.

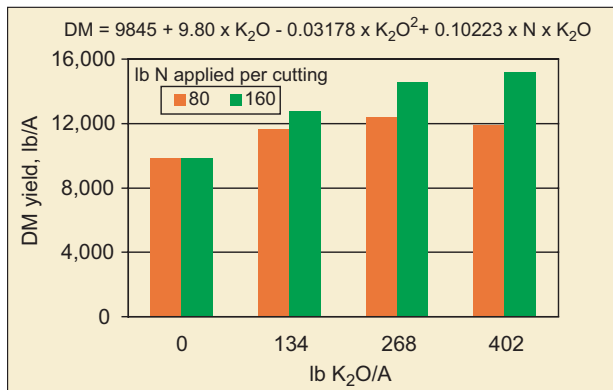


Figure 3. Potassium and N fertilizer interact to improve yield and NUE of Tifton 85 bermudagrass. (V.A. Haby. Overton, TX. Data from 2004 season. [Click here](#) for link to annual report)

Improved Nodulation and N Fixation by Legumes

Good P fertility of legume forage crops can increase their ability to fix N from the atmosphere. **Figure 4** shows that higher soil P concentrations increased the number of nodules on alfalfa roots at three soil moisture contents (dry, moist, and wet). An adequate P supply is essential for proper N fixation and protein production, which both impact the quantity and quality of alfalfa hay.

Fall is an ideal time to address the P and K needs of many forage crops. Consider the following potential benefits of fall forage fertilization.

- Fall applications can help spread-out grower and dealer workload and smooth-out some of the peaks and valleys of yearly activity. Furthermore, it can save valuable time in the spring season and can help clear the way for other spring activities.
- Soils tend to be drier in the fall than in the spring in many areas. Dry soils are much less susceptible to compaction from application equipment. Also, fall affords greater flexibility for scheduling applications to coincide with optimum soil conditions.

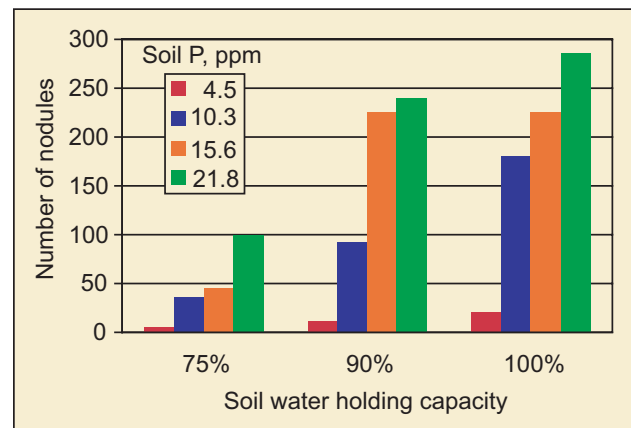


Figure 4. Soil P increases number of nodules and N fixation capacity across three soil moisture levels (dry, moist, and wet). (Source: Azcon, R., F. El-Atrach, and J.M. Barea. 1988. Influence of mycorrhiza vs soluble phosphate on growth, nodulation, and N₂ fixation in alfalfa under different levels of water potential. *Biol. Fertil. Soils.* 7:28-31.)

- Root vigor of perennial forages is boosted from fall fertilization before the onset of winter dormancy.
- Cool-season forages have nutrition in place for prime production in the spring.
- Since P and K are relatively immobile nutrients, there is little concern with winter leaching losses prior to spring growth in all but the sandiest soils.
- The total annual requirement can be applied at this time, or a portion of the annual rate can be added if heavy applications are needed or there are other factors that would favor splitting applications.

Remember...complete and balanced fertility, including P and K, is needed to maximize use efficiency of all inputs and optimize forage production. Don't pass-up the opportunity to make appropriate applications this fall. ■

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