

### Fall Topdressing P and K for More Yield and Longer Stands

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**M**AINTEINING high-yielding, profitable hay production over a period of years requires careful attention to fertilizer management. Few crops can deplete a soil of available phosphorus (P), potassium (K), and other nutrients faster than harvesting high yields of forage crops. Virtually all of the top growth is hauled from the field with each harvest along with the absorbed nutrients. There is little crop residue with its contained nutrients to be recycled as with most annual crops (stalks, stems, leaves, etc.). **Table 1** presents nutrient removal/ton for various forages. An 8-10 ton crop of alfalfa, for example, would annually remove 120-150 lb/A of  $P_2O_5$  and 480-600 lb/A of  $K_2O$  from the soil. Nutrients must be replaced at rates consistent with removal over time, or the soil will decline in fertility and, therefore, productivity. In many cases, maximum yield potential will only be obtained if soil fertility is built up beyond its current level.

**Table 1. Estimated nutrient removal by perennial forages.**

	lb removed/ton forage				
	N	$P_2O_5$	$K_2O$	Mg	S
Alfalfa*	56	15	60	5	5
Bermudagrass	50	12	47	3	6
Bromegrass	36	13	59	4	4
Clover*-grass	50	15	60	5	5
Fescue	40	19	53	4	4
Orchardgrass	50	17	62	4	4
Timothy	38	14	62	3	4

\*Legumes get most of their nitrogen (N) from the air.

Although investment in fertilizer may be substantial, the benefits of balancing fertilizer additions with perennial forage and soil needs are also significant and include:

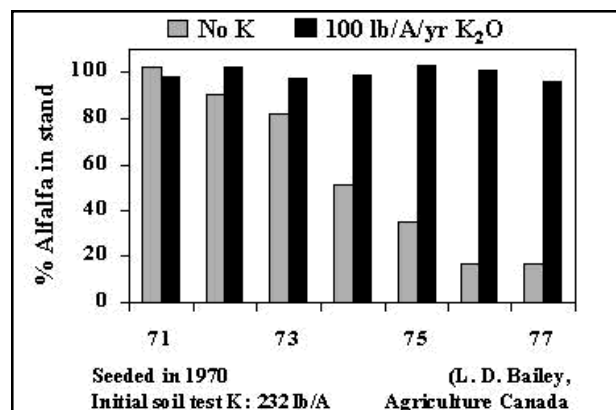
- Avoiding stand decline due to winter injury or weed competition
- Minimizing disease problems accentuated by nutrient shortage or imbalance
- Maintaining crop stress tolerance to drought, temperature extremes, frequent harvests, or injury by pests and diseases
- Prevention of early decline in both forage yield and quality

Many research programs across North America have demonstrated the value of both P and K fertilization in promoting stand persistence leading

to long-term productivity. Researchers from the University of Missouri, for example, demonstrated that plowdown treatments benefited alfalfa yields, especially in the first two years, but it was the annual topdressing applications that maintained economical stands for eight years. They observed that well-managed alfalfa thins from about 20 plants per square foot at the end of the seeding year to about six after three years and gradually declines thereafter, ultimately reaching an economic threshold of two to three plants per square foot. Annual topdressing with both P and K produced more stems per plant. Potassium was especially critical as stands thinned because it encouraged more stems per plant to develop with time for yield compensation as neighboring plants died.

Root health and vigor are essential for stand longevity. It is, therefore, not surprising that both P and K are important in maintaining forage stands, considering their functions in plants. Phosphorus promotes starch export from plastids, enhances photosynthesis, and increases root development. Potassium increases carbohydrate assimilation and transport, is essential for certain starch- and protein-synthesizing enzymes, and is important for proper nodulation and symbiotic N-fixation by legumes.

**Figure 1** presents an example of the benefit of adequate K nutrition in preventing winterkill of alfalfa in Manitoba, Canada. Over a seven-year period, stand density was maintained with annual K applications while the alfalfa in the stand dropped to 15 percent in the unfertilized stand. These data emphasize the importance of maintaining adequate carbohydrate root reserves during the fall to enhance winter hardiness and early spring growth.



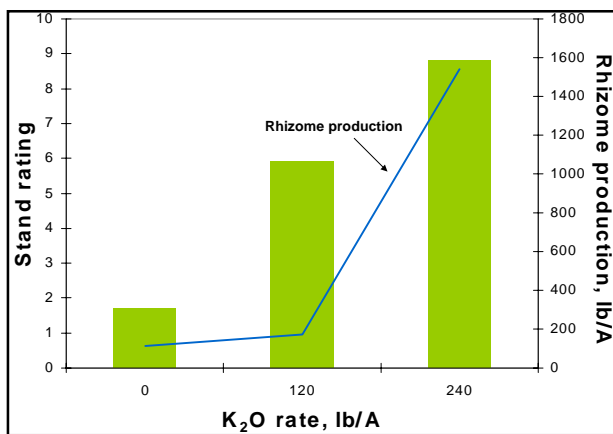
**Figure 1. Alfalfa stand persistence with and without annual K fertilization.**

Such benefits are not limited to just legumes in cold northern climates. Similar benefits can be observed for forages (grasses as well as legumes) in much milder climates as well. Coastal bermudagrass production has been shown to be directly related to stand density. The subterranean stems (rhizomes) of bermudagrass are responsible for stand persistence and spring regrowth. The amount of stored reserves (carbohydrates) available in the rhizomes that may be used to generate new top growth is important in maintaining productivity. Coastal bermudagrass stands and rhizome production were substantially improved following three years of annual K fertilization in a study conducted by Texas A&M researchers. Rhizome production was increased about 14-fold with the highest K rate (**Figure 2**). Over this three-year period, available soil K was drawn down from 160 lb/A to about 50 lb/A. As stated initially in this article, removing total top growth of a crop results in high nutrient removal and rapid drawdown of nutrients. Average three-year yields of Coastal bermudagrass and the resultant K soil tests are presented in **Figure 3**.

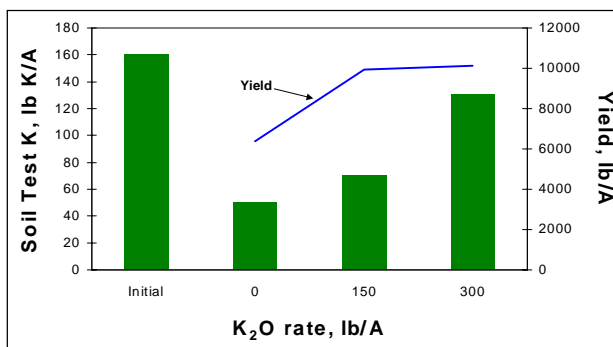
An annual fertilizer program should be part of any forage system aimed at producing high yields over an extended number of years. While preplant application of nutrients is important to establish stands and support production the first few years, nutrient drawdown is rapid, and sufficient rates cannot be effectively applied to optimize yields for the desired duration of the stand. Remember, a 10-ton alfalfa or bermudagrass crop will remove around 120-150 lb/A of  $P_2O_5$  each season and around 500-600 lb/A of  $K_2O$  (see **Table 1**).

Fall is an excellent time to apply annual applications of P and K fertilizers, or at least a part of the total annual rate in the case of heavy applications. Root reserves can benefit immediately from fall application prior to winter dormancy. Fall weather tends to be drier and more reliable to accomplish the topdressing operation compared to spring weather. Also, since both P and K are relatively immobile nutrients, there is little or no concern about leaching losses prior to spring growth in all but the sandiest situations.

Maintaining high yields of forages over several years requires careful attention to nutrient management. Annual fertilizer applications at rates sufficient to replace nutrients removed in harvested forage and to maintain a high soil fertility level are essential to achieving this goal. Fall is a good time to begin. ■



**Figure 2. Coastal bermudagrass stand and rhizome production after three years annual K fertilization (initial soil test K: 160 lb/A). Stand rating: 0 = bare ground; 10 = best.**



**Figure 3. Three-year average yield and K soil test following three years of Coastal bermudagrass.**

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