NEWS & VIEWS

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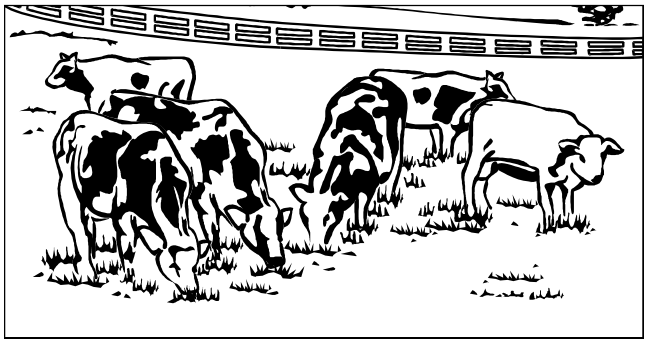
Nutrient Management for Quality Forages

OVER 60 million acres of forage crops are harvested each year in the U.S. with an average annual yield of about 2.5 tons/A. Both research and top farmer yields show this is far below the realistic potential. By adjusting certain production practices, it becomes possible to increase forage yield as well as improve feed quality and lower the cost per ton of forage harvested. Nutrient management is one of those practices which is vital to any quality forage production system.



A forage system should produce a dependable supply of quality feed to achieve a target level of animal performance. For stocker cattle, this might be two pounds of gain per animal per day. For dairy cattle, it might be so many pounds of milk per year. To provide quality feed over an extended period of time, a forage system will likely include a combination of field grazed and stored feed systems. It will also likely involve growing one or more forage species during the year and paying special attention to the detail and timing of certain key forage management practices.

Animal performance and enterprise profitability are affected by a number of conditions, one being a dependable supply of low cost, high quality feed. Consider the following soil and crop management practices. Each contributes best when fit into a forage management system that is developed for specific crop and field conditions.

Select fields with highly productive soils. Forages are not miracle workers. Both legume and grass forages grow best on fertile, well-drained soils.

Soil test to determine soil acidity and fertility levels. Taking a truly representative soil sample from a field is a major challenge and the greatest source of error in soil testing. A poor soil sample can be costly due to improper applications of lime or fertilizer, stand establishment problems and overall poor crop performance. Research shows that about 20 cores of soil are needed to overcome natural variability in the sample area. Cores should be taken at a uniform depth (about four inches for pastures and six inches for crop renovation or establishment) and mixed into a single sample to be sent to the analytical laboratory. Sample each field three or four months prior to crop establishment, at the same time of the year, use the same laboratory, and record the results each year to determine nutrient and soil acidity changes. Good soil test results, along with plant analysis and other plant performance data, will allow growers to monitor the basic fertility levels and develop reliable aglime and fertilizer management programs.

Lime is a long-term investment that pays many ways. Aglime moves very little in the soil so it works best if incorporated into the crop root zone. It takes about three months for aglime to neutralize soil acidity and benefit seedling development. In general, it is desirable to adjust soil pH to about 6.0 for grasses and to at least 6.5 for forage

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legumes and legume/grass mixtures. Legumes need a higher soil pH for optimum availability of molybdenum (Mo) and growth of the nitrogen (N) fixing *Rhizobium* bacteria. At the same time, manganese (Mn) and zinc (Zn) availability declines. Thus, these nutrients might need to be considered in the fertilization program. Finely ground high calcium and dolomitic [contains magnesium (Mg)] limestone are both effective in neutralizing soil acidity.

Build soil fertility levels prior to crop establishment. Phosphorus (P), like aglime, will remain in the soil right where it was applied. Potassium (K) will also move very little in the soil except in very sandy fields and under heavy rainfall conditions Thus, the opportunity exists during soil preparation for crop establishment to build both the soil P and K levels in the crop root zone. The quantity of fertilizer needed to adjust the soil to a medium or high test level will vary from one field to another based upon soil test results and crop nutrient requirements for establishment. After establishment, top dress fertilization is effective if there are no restrictions to surface-soil feeder roots, such as a shortage of moisture.

Fertilize for optimum crop yield and feed quality. Crop nutrient management is one of the few production practices that the grower can control. The challenge develops when other crop management practices, such as harvest frequency, require adjustments in specific nutrients needed, rates, timing, and methods of application. Such practices also include forage species being grown, feed quality requirements, forage harvest methods, crop protection, irrigation, etc.

Forage crops differ in their nutrient requirements. Research provides an indication of the total nutrient content of several important forage grasses and legumes (**Table 1**). Nutrient uptake data can vary with both yield level and plant growth stage at harvest. It is one of the important factors for establishing fertilizer needs.

Table 1. Total nutrient uptake for selected forage crops.

Crop	Yield, tons/A	N	P_2O_5	K_2O	Mg	S
		- - - - - - - Uptake, lb/A - - - - - - -				
Alfalfa	8	480*	110	480	40	40
Ladino Clover	6	380*	90	280	30	30
Bermudagrass	8	370	95	340	25	45
Fescue	3.5	135	65	185	15	20
Pensacola Bahia	7	300	85	240	35	25
Corn Silage	32	265	110	265	40	30

*Legumes get most of their own N from the air.

Nutrient content in harvested forage changes with plant growth stage at harvest and frequency of harvest. For many plants, the optimum time for harvest of high quality forage is just prior to first flower. At that time the plant is approaching peak vegetative growth, leaf to stem ratio is high (**Table 2**) and the concentration of quality components is suitable for optimum animal gains.

Table 2. The influence of plant age on leaf percentage of the harvested forage.

Crop	Harvest schedule, weeks 2	5	9	12
	- - - - - - - - - - - - % Leaves - - - - - - - - - - - -			
Orchardgrass	100	62	36	30
Ryegrass	100	63	32	26
Tall fescue	100	62	40	33

Coastal bermudagrass harvested at 3, 4 and 6 week intervals showed improved feed quality with shorter harvest intervals. As plants aged, dry matter yield increased, Vitamin A content declined, leaf content in the forage declined from 86 to 62 percent, and crude fiber increased from 27 to 33 percent.

Legumes build quality into forage production systems. Many growers know that legumes can prosper along with grasses in the field. They are aware that grasses are very competitive for their space, just like weeds. With the right management practices, legumes can hold their own ...year after year. **Consider these tips for holding legumes in the stand.**

- Select grass and legume crops with compatible growth patterns.
- Use legume plant growth stage as the harvest guide.
- Avoid legume injury from excessive grazing and the inability to replace root carbohydrate reserves needed for regrowth.
- Use aglime to keep the soil pH near 6.5 to favor the legume N fixing bacteria.
- Maintain high soil fertility levels since grasses are more competitive for K than legumes and are capable of starving out the legume at low soil K levels.
- Insure adequate P, sulfur (S) and boron (B)… needed by both grasses and legumes.

Consider the following reasons for including a legume in the forage.

- Grass may contain up to four times more of the low digestibility hemicellulose
- Protein in grass is heavily dependent upon N management
- Legumes are naturally higher in protein, TDN, net energy and digestibility
- Legumes can supply most of the N needed by grass in 50/50 mixture
- Animal health problems, such as grass tetany, are reduced
- Animal daily gains are often higher and more consistent

Fertilize forage crops for both yield and quality. Forage fertilizer programs should fit the specific forage crop, soil characteristics, and harvest practices, yet be flexible in response to unpredictable weather conditions. Research seasoned with experience provides guidelines for the development of site-specific forage fertilization programs.

- **Select highly productive fields**. Follow sound soil testing procedures.
- **Prepare a fertile soil.** Incorporate aglime needs and build-up soil P and K during seedbed preparation.
- **Time nutrient applications** with plant growth stage and/or harvest interval.
- **Maintain soil fertility levels.** High yielding forages contain about 12 to 15 lb of P_2O_5 and 50 to 60 lb of K_2O in each ton of hay removed from the field.
- **Forage harvest by grazing removes less fertility** from the field than hay for off field storage. However, manure causes localized areas of high and low fertility. Also, nutrients such as N, K, S, and Mg are subject to loss by leaching from sandy soils during intense rains. Nutrients removed from the system need to be replaced to prevent any forage yield and quality loss.

- **Frequent harvests, such as every 30 days**, remove high quality, high nutrient content forage from the field. Nutrients can be replaced by fertilizing after each harvest or after the first and next to last harvest each year. Split applications help to assure adequate nutrition throughout the year and minimize the effects of adverse weather conditions.
- **Nitrogen use efficiency** is regulated not only by the N rate applied, but also by adequate soil levels of P, K, S, and B. These nutrients work together in the formation of protein, regulation of photosynthesis, promoting root growth, and other vital functions.
- **Phosphorus promotes root growth** during seedling establishment. Later it functions as a storage unit for energy needed to power all aspects of forage plant growth.
- **Potassium helps plants resist** stress and optimize photosynthesis. It directs more than 60 enzyme systems. Inadequate K is a major cause of loss of legumes from a legume/grass mixture and for the invasion of weeds and loss of desirable grass species. Potassium helps to build root reserves of carbohydrates for rapid plant regrowth after harvest and for improved survival during harsh winters and adverse weather conditions.
- **Sulfur is vital for effective N utilization** and protein formation. Crop response varies from year to year. However, 20 to 30 lb of S per acre per year provides for most forage crop needs.
- **Boron is needed in very small amounts** (2 or 3 lb per acre per year). It plays a vital role in plant cell development and regrowth rate of forage crops.
- **Magnesium is needed for photosynthesis.** Absorption is difficult in cold, wet soils and can result in low Mg levels in early spring growth of grass and hypomagnesemia (grass tetany) in certain animals. Remember, legumes contain a higher Mg content than grasses. Dolomitic aglime and soluble forms of Mg fertilizers are effective in meeting crop needs. Recent research has shown that P also enhances Mg uptake from the soil and improves response to Mg fertilization.

Summary

Nutrient management for any forage crop is very site-specific or field-specific. It must be flexible in response to climatic conditions and it must be fit to individual crop needs and harvest management procedures. Crop nutrient requirements will differ depending upon whether the forage is removed from the field as stored feed or if animals are allowed to graze the crop.

Soil physical and chemical characteristics are also involved in the decisions relating to which nutrients will need to be applied, the rate of application, and even the timing and method(s) of application. **To realize the greatest return from the investment in fertilizer, this input must be fit to the crop being grown, local soil and climatic conditions, harvest management, and feed requirements for desired animal performance.** Fertilizer for forages does not cost...it pays in many ways. ■

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