Manage Nutrition for Profit Advantage

Forage Fertility… Planning for 2007

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Using fertilizer to restore the productivity of established forage crop stands pays major dividends, with the proper balance of all the essential nutrients critical to maximizing yields. Soil testing is key to ensuring that multi-nutrient deficiencies are addressed in fertilizer management programs.

Forage crop fertilization is considered an optional practice by some farmers, but an essential practice for those striving to maximize livestock and land productivity. In some regions, dryland forage yield may be limited by a lack of rainfall. However, where irrigation is available, high forage yields from multiple cutting harvest programs provide an abundance of high-quality hay.

There is a large data base to support fertilization of forages as a means of maintaining yield, quality, and stand longevity. In fact, the true cost of not fertilizing becomes much higher when the impact of declining stand productivity is included. As long as the quality of the forage plant stand has been maintained, the ability to rejuvenate forage production with fertilizer additions has great potential.

Forages are large consumers of nutrients, especially given the whole crop removal of the nutrients taken up. Unlike annual grain crops, where most of the crop residue is left in the field, almost all of the aboveground biomass of forages is removed at harvest. As a result, some nutrients such as phosphorus (P) and potassium (K) are more likely to become deficient faster than with grain crops. The amounts of nutrients removed in forage is shown in **Table 1**.

Table 1. Nutrient uptake by forage crops.

Crop	N	P_2O_5	K_2O
	lb nutrient/ton dry matter forage		
Alfalfa[1]	56	15	60
Bermudagrass	46	12	50
Bromegrass	36	13	59
Fescue	38	18	52
Orchardgrass	50	17	62
Timothy	38	14	62

[1]Alfalfa is a legume, and obtains most of the N used from the atmosphere.

***Either** broadcast or surface dribble banding can be effective methods for forage fertilization.*

Forage fertilization to overcome nutrient deficiencies can pay big returns on the investment. However, timing this fertilizer application varies considerably based on where in North America you are farming. For forage production, early spring fertilizer application is considered the best time in many areas. This early timing provides the forage crop with an adequate supply of nutrients during the initial spring growth period.

If you are growing forages for seed production, fall application has been found to be the best time to apply fertilizer nutrients. As you move to the southern and western states, fall is an excellent time to fertilize forages. Be sure to avoid application to frozen soils and during periods where surface runoff may be expected to occur.

How should fertilizer be applied to forage crops? If you have the resources to apply sufficient rates of P and K for multiple harvests before the crop is seeded, then banding is a good option to consider. The mobility of nitrogen (N) in the soil generally limits its use to annual application on forage crops. Once established, broadcast application is an effective means of applying the nutrients. A healthy forage crop has an abundance of surface roots which can take up surface-broadcast nutrients, which is not the case in newly established stands. Research trials show that a slight improvement in P uptake may occur when it is band-applied into established forage stands, but the added cost of application was often hard to recover with this slight yield improvement.

Table 2. Average yield response to fertilizer N and P additions on established legume-grass forage stands at two locations in Saskatchewan, 2001-2004.

Treatment	Year 1	Year 2	Year 3	Mean
	- - - - - - - - Forage yield, lb/A - - - - - - - -			
Check – no fertilizer	1,193	1,210	997	1,130
Coulter check – no fertilizer year 1, coulter applied UAN and APP in year 2 and 3	1,059	1,682	2,456	1,736
Broadcast ammonium nitrate and MAP	1,771	2,723	3,088	2,528
Dribble UAN[1] and APP	1,825	2,706	2,537	2,359
Dribble UAN with 10% ATS + APP	1,914	2,581	3,035	2,510
Coulter UAN and APP	1,566	2,456	2,830	2,287
Coulter UAN	1,406	1,673	1,362	1,477
Coulter UAN and 3 X APP[2]	1,914	2,786	3,008	2,572
LSD P=0.05	325	291	354	

[1] UAN – urea-ammonium nitrate; APP – ammonium poly-phosphate; ATS – ammonium thiosulfate. N rate was 53 lb N/A in 2002 and 2004, and 27 lb N/A in 2003 at Scott; 75 lb N/A in all years at Indian Head. Annual P rate is 30 lb P_2O_5/A.

[2] 3 X APP – ammonium poly-phosphate applied at three times the annual rate (90 lb P_2O_5/A).

Dribble banding of fluid fertilizers onto the soil surface is also another effective means of supplying nutrients for forage crops. Dribbling is generally preferred over broadcast application since more of the nutrients come into contact with the soil where they can be taken up by the roots. Broadcast applications are generally less efficient since a significant portion of the nutrients may stay unabsorbed on the foliage and because N applications are more susceptible to gaseous loss when applied with this method.

Research trials conducted in the northern Great Plains showed that either broadcast or surface dribble bands of fertilizer were similar in their effectiveness, while little advantage was captured from coulter injection of a fluid fertilizer (**Table 2**).

How does balanced nutrition optimize forage response to fertilizer? Forage productivity often declines as a result of more than one nutrient being deficient. For example, applying N to a forage when there is also a P deficiency will not provide much of a crop response. In the trial shown above, one of the locations had a severe P deficiency. When N was applied alone, there was little response. However, when N was applied with P, forage yields increased by 300% over the period of the study. Be sure to test your soil and the forage since a multi-nutrient deficiency may be limiting the response to any single nutrient.

Phosphorus deficient forage stands generally show a progressive response to fertilizer P over several years. Where a P deficiency is limiting your forage yield, it is common to see a good response to P application in the first year, with further increases following continued application in Years 2 and 3. This cumulative response reflects the nature of fertilizer P availability to crops, as it continues to become plant available in Year 2 and 3 from the previous year's application. In the study shown in **Table 2**, applying 90 lb P_2O_5/A in Year 1 and no P in the next 2 years provided superior yield responses to applying 30 lb P_2O_5/A/year through the 3 years of the project. While the costs of a high rate of P application may limit its use, these results confirm the strong response of the crop to N application when the P needs have been met. Remember that it is best to anticipate forage nutrient needs prior to establishment rather than to try to correct deficiencies and compensate for lost yields.

Where the productivity of established forages has declined over time due to nutrient deficiencies, fertilizer additions can be an effective means of improving yields. Soil testing to evaluate the level of available nutrients is critical to ensure that all deficient nutrients are applied. Correcting P deficiency is essential before achieving a profitable N response in forage crops. ■

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