NEWS & VIEWS

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Mixed Hay Fields Respond to NPK in Fertilizer and Manure

ACROSS Eastern Canada and the northeastern U.S., more than 5 million acres of land produces mixed hay from forage crops other than alfalfa (**Table 1**). Estimates of the economic value of the crop vary across the region, but average about US$60 per ton. The hay crop is often undervalued. Therefore, fertility needs receive little attention on much of this land. The lost opportunities arising from under-fertilizing could be in the neighborhood of $300 million, assuming that yields would improve by 50 percent if nutrient inputs were increased.

Forages such as timothy, orchardgrass and reed canary-grass respond to nitrogen (N), phosphorus (P), and potassium (K). Their productivity can exceed 4 tons/A of hay, but average yields are much lower (**Table 1**). Yields of 4 tons/A or more can quickly deplete available nutrients from the soil. A typical crop of mixed hay removes about 13 lb of P_2O_5 and 50 lb of K_2O per ton of dry matter harvested.

Table 1. Estimated hay production, other than alfalfa, in eastern Canada and northeastern U.S.A. (1995-1996).

	Area, acres	Production, tons	Value, $US	Yield, tons/A
Ontario	1,275,000	2,780,000	129,000,000	2.18
Quebec	1,075,000	2,365,000	110,000,000	2.20
Atlantic	225,000	439,000	22,000,000	1.95
New England	566,000	1,069,000	99,000,000	1.89
New York	870,000	1,740,000	118,000,000	2.00
Pennsylvania	1,130,000	1,674,000	135,000,000	1.48
New Jersey	120,000	200,000	17,000,000	1.66
Total	**5,261,000**	**10,267,000**	**630,000,000**	**1.95**

Recently in Maine, research compared manure and fertilizer sources of NPK for their impact on yield from a mixed hay field. Manure provided 125 lb/A of N, to supply the first and second growth of the sward. It also supplied about 95 lb/A of P_2O_5 and 250 lb/A of K_2O. A normal recommendation for the soil would have been 30 lb/A of P_2O_5 and 100 lb/A of K_2O. Fertilizer was applied matching the available NPK rate of the manure, and, in another treatment, matching only the available N. Applications were split so that 60 percent was applied in mid-May and 40 percent after the first cut in mid-June. Additionally, all treatments received 50 lb/A of N as ammonium nitrate (NH_4NO_3) following the second cut.

The fertilizer source produced the greatest yield response (**Figure 1**). Most of the yield response was due to N alone, but added P and K produced an additional yield increase that was statistically significant when the first two years were considered. While the yield response to added P and K was not large enough to justify the fertilizer cost in these first two years, in the longer term the response would be larger. The crop removed more P and K than would have been supplied in a normal recommendation. The N only treatment caused a sharp reduction in soil test levels for both P and K. For sustainable yield in the longer term, the use of P and K would provide economic returns.

Manure alone also produced a yield response. Hay yield when manured was 88 percent of that when fertilized with NPK, and 91 percent of that fertilized only with N. The fact that manured fields

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yielded less than with N alone suggests that the cause was not limited availability of P and K in the manure. Possibly, losses of N by ammonia volatilization were greater than the expected 20 to 30 percent. Better application techniques, such as surface banding, would possibly produce better results.

All nutrient sources increased the crude protein concentration and total protein yield, important quality considerations for feeding livestock.

We are continuing these experiments to investigate the effects of these nutrient sources in the longer term.

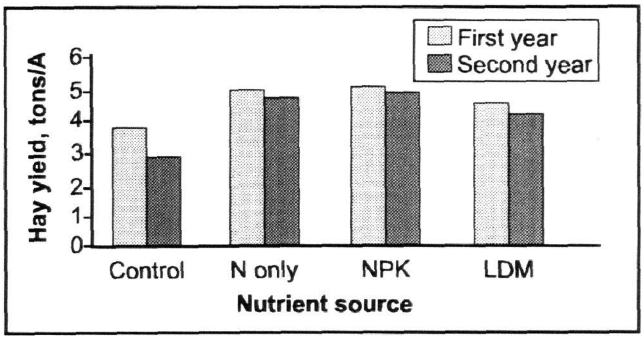

Figure 1. Yield of a mixed hay field in response to added nutrients. NPK supplied by fertilizer, at rates equivalent to nutrient content of liquid dairy manure (LDM). First year yields are means of two separate trials in 1995 and 1996; second year results are from 1996 only.

Need for nutrients in addition to N is reinforced by previous data from Maine, which indicate that K contributes to hay yield (**Table 2**). The response of 0.5 ton/A would more than justify the 150 lb/A rate of K_2O ($30 return to less than $10 worth of K).

Table 2. Response of hay yield to K in Maine averaged over two locations and three years. Hay field was 45 percent timothy, 45 percent quackgrass and 10 percent bluegrass. (Brown, et al.)

Fertilizer rate, lb/A N	Fertilizer rate, lb/A K_2O	Hay yield, tons/A
200	50	3.6
200	150	4.1
200	300	4.2

Similarly in Connecticut, reed canarygrass responded to K whenever N rates exceeded 100 lb/A (**Table 3**).

Table 3. Response of reed canarygrass to annual N and K applications in Connecticut. (Allinson, et al.)

K_2O rate, lb/A	N rate, lb/A: 100	200	300
	Hay yield, tons/A		
0	3.6	5.1	5.5
200	3.6	5.9	6.9
400	3.5	5.7	6.7

In New Brunswick, an appropriate balance of N, P, and K kept a long-term stand of timothy producing yields of 3.8 tons/A or more for 26 years. An annual application of 140-90-120 lb/A of N, P_2O_5 and K_2O was calculated to be the most profitable level of fertilization.

How can you assure that your hay field is producing its optimum yield of quality forage? Nutrient use planning will help. To budget nutrients for your crop, test soils regularly, analyze manures and harvested forages for their complete nutrient content, and apply nutrients to match the needs of the crop. Mixed hay fields respond to all three of the major nutrients (NPK), whether supplied in manure or in fertilizer. Economic comparisons of the two sources will depend on the manure supply situation and on costs for material transportation and application. **If you value your hay, nutrient management will pay.** ■

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