ATLANTIC CANADA

Balanced Fertilizer Ensures Long-Term Timothy Productivity

By Gilles Bélanger and John E. Richards

Timothy is an important forage grass species in eastern Canada, the northeastern U.S., and many other temperate areas. Most studies of the fertilization of timothy have been concerned primarily with N or the interaction between N and K, and were conducted for only a few years.

The fertilizer requirements to ensure long-term productivity were studied over the last 35 years at the Fredericton Research Centre of Agriculture and Agri-Food Canada. All combinations of four rates of fertilizer N (0-240 lb N/A), P (0-90 lb P_2O_5/A), and K (0-150 lb K_2O/A) have been applied annually to timothy grown on an acid sandy loam soil. Two cuts of timothy were taken each year.

Timothy productivity was maintained for 26 years without reseeding when balanced applications of nitrogen (N), phosphorus (P), and potassium (K) were made. Persistence of timothy depended solely upon K fertilization. Long-term applications of N, P, and K also affected soil pH and the movement of P.

Yields

Forage yields approaching 3.8 tons/A were still obtained after 26 years of balanced N, P, and K fertilization. As a comparison, forage yields of newly seeded timothy fields range between 4.3 to 5.5 tons/A. Forage yields were increased by N, P, and K. The response to each applied nutrient was affected by the application of the other nutrients (**Figure 1**). Based on a fixed value for timothy hay and the market cost for the fertilizer, the most profitable rates of fertilization were approximately 140-90-120 lb/A of N, P_2O_5, and K_2O. In the first three years of this experiment (1960-1962), forage yield was limited primarily by N and K. The yield response to applied P, however, increased over 26 years. Timothy productivity was maintained after 26 years of continuous production without reseeding when balanced applications of the nutrients were made.

Botanical Composition

Long-term timothy persistence depended solely upon K fertilization (**Table 1**), a fact not evident in the first three years of the experiment. Over all plots, timothy comprised from 0 to 95 percent of the forage yield. In plots which received balanced applications of N, P, and K over 50 percent of the yield was due to timothy. Bentgrasses and bluegrasses were the major indigenous

TABLE 1. The effect of 26 years of K fertilization on the proportion of some grass species.

K_2O, lb/A	Timothy, %	Bluegrass, %	Bentgrass, %
0	16.2	36.5	22.1
50	41.7	14.9	9.2
100	49.1	11.4	6.9
150	57.8	9.3	5.2

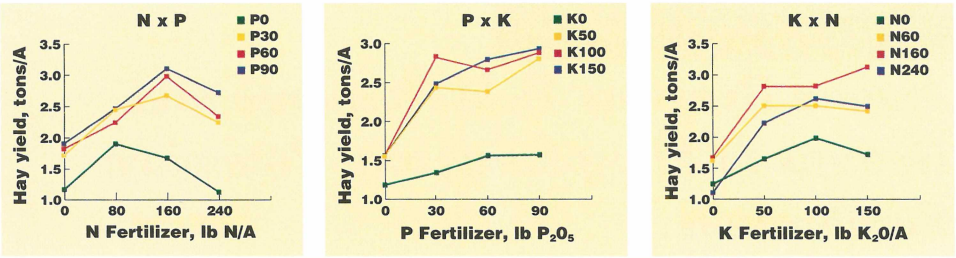

Figure 1. Effect of applied N, P, and K on total forage yield (average of 1985 and 1986). Forage yields expressed as hay at 18 percent moisture content.

species when low levels of K were applied. The proportion of bluegrass increased with increasing levels of applied P.

Soil

Applications of large amounts of N decreased soil pH of the topsoil by more than 1.3 units. This decrease was also observed at a depth of 18 inches. The decrease in pH, however, was less when P fertilizer was also applied because of the presence of calcium (Ca) in the superphosphate. Some fertilizer P was translocated into the 12- to 18-inch depth. The amount of P translocated increased with increasing rates of applied P.

Soil organic carbon (C) in the 0- to 6-inch layer ranged from 2.2 to 3.7 percent after 26 years and from 2.6 to 4.4 percent after 35 years. Organic C was greatest in plots with the lowest biomass production. Conversely, soil in plots with the greatest biomass production had the least amount of soil organic C. The differences were likely related to greater amounts of dry matter partitioned to non-harvested plant parts of the less productive forage species.

Conclusion

Long-term production of timothy is possible with balanced applications of N, P and K. The changes over time in response to P fertilizer, botanical composition, soil pH, and the movement of P would not have been predicted from short-term studies of three years or less. Fertility requirements of perennial forage crops are not well defined by field trials of short duration. BC

Dr. Bélanger and Dr. Richards are Research Scientists with the Research Branch of Agriculture and Agri-Food Canada, located at Ste-Foy, Quebec and St. John's, Newfoundland, respectively.

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considered desirable. While grass and forage crops protect soil from erosion and reduce impacts of sediment loss, corn and grain cultivation may have a more positive environmental impact when total P losses to aquatic systems are considered. BC

Dr. Simard, Dr. Drury and Mr. Lafond are research scientists with Agriculture and Agri-Food Canada in Ste-Foy, Quebec and Harrow, Ontario.