Preplant Manure Applications for Alfalfa Production

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Proper management of manure is critical in regions with large livestock numbers if water quality is to be preserved. Frequently, livestock producers apply manure to alfalfa when corn ground is not available. The following research results evaluate the agronomic and environmental soundness of this practice.

LIVESTOCK PRODUCERS often find themselves in a dilemma when they do not have enough corn acres for spreading their manure at agronomic rates. This leads to the need for additional acres to spread manure, and for dairy farmers, alfalfa is often the only other crop grown.

A long-term project was started in 1989 to examine the effects of preplant manure fertilization on alfalfa. Trials were established at University of Minnesota Agricultural Experiment Stations at Rosemount and Waseca. Ammonium acetate extractable soil potassium (K) was 200 parts per million (ppm) at the Rosemount sites and 94 ppm at Waseca. Soil Bray P-1 phosphorus (P) was 35 ppm and 8.5 ppm at Rosemount and Waseca, respectively.

Three rates of manure . . . 3,000, 6,000, and 12,000 gallons per acre (gpa) . . . were broadcast and incorporated prior to establishment of alfalfa, which was direct seeded. Swine manure was used at Rosemount and dairy manure at Waseca. Three commercial fertilizer treatments, consisting of potassium chloride (KCl) and triple superphosphate (TSP), were also used to give equivalent P and K application rates contained in the three rates of manure. A control treatment was included at all sites.

Various alfalfa yield and nutrient removal values were measured. In addition, inorganic nitrogen (N) was monitored in the soil throughout the study.

Results

At all sites, manure and fertilizer treatments resulted in dramatically higher yields than the control areas (data not shown). At the Rosemount sites, the manure treatments produced significantly higher yields than the corresponding fertilizer treatments.

Weed pressure was visibly increased with the manure application. However this difference was not statistically significant. After the first cutting, weed pressure was not visibly different among the treatments.

Alfalfa producers are vitally interested in production year yields. Expressed as a percent of the control plot yield (**Figure 1**) increasing manure rates resulted in increased yields at all sites. The increase was much more dramatic where soil P and K tests were low or medium. Responses to the fertilizer treatments were similar on the low testing soils–increased fertilizer rate resulted in increased yield.

At approximately comparable P and K rates, manure treatments generally outyielded plots receiving fertilizer only (**Figure 1**). On very high P and K testing

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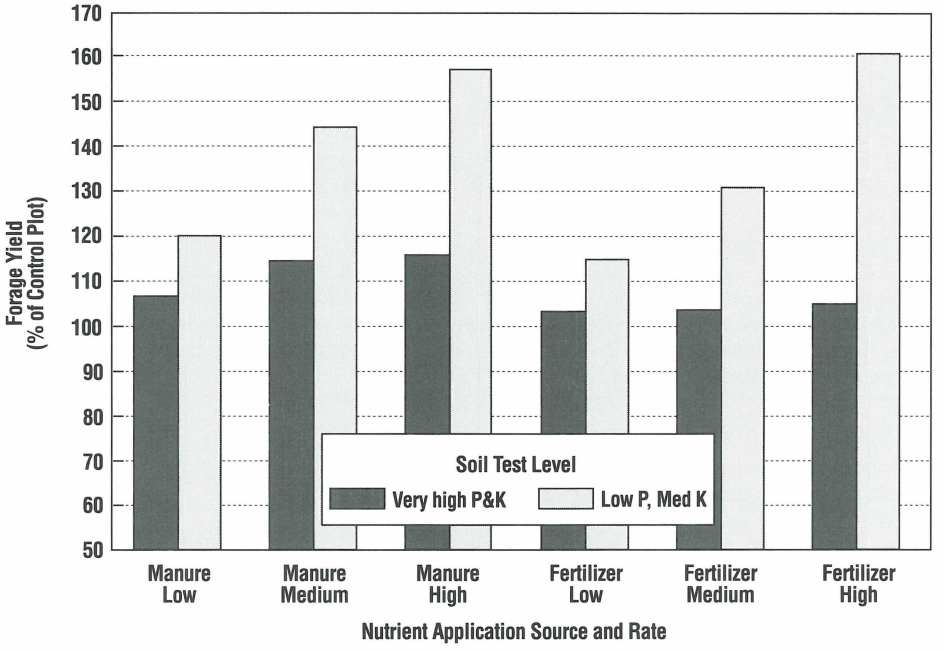

Figure 1. The effect of nutrient application sources and rates on production year forage yields.

soils where P and/or K fertilizer response would not be predicted, manure additions still improved yield. This implies that some other nutrient or property contributed by the manure was beneficial.

Plant N measured at each cutting did not vary with treatment. This is not surprising because alfalfa gets much of its N from the soil or atmosphere. Plant P concentrations from the first cuttings each year were not significantly affected by nutrient treatments (**Table 1**). Plant concentrations of K increased according to the rate of K applied in either nutrient source (**Table 1**).

Table 1. The effect of preplant nutrient applications on P and K concentrations in first cuttings each year for all sites.

Source	Rate	P	K
		----- %	-----
Control	—	0.29	1.70
Manure	Low	0.30	1.90
Manure	Medium	0.31	1.95
Manure	High	0.31	2.11
Fertilizer	Low	0.28	1.81
Fertilizer	Medium	0.28	1.88
Fertilizer	High	0.31	2.24

Nitrate N concentrations in the soil provide an indicator of the amount of N available from the manure. Soon after manure application, soil nitrate N concentrations were relatively high compared to the control plots (**Figure 2**). Five months after application, neither the 3,000 or 6,000 gpa treatments had resulted in significantly higher soil nitrate N than the controls. Soil nitrate N concentrations in the high manure rate treatment area continued to decline and were comparable to those in the control plots by the second year.

Summary

Either manure or inorganic fertilizer can supply the nutrient requirements of alfalfa. Both nutrient sources increased dry matter production, although manure-amended treatments inexplicably produced more dry matter than a comparable amount of P and K fertilizer. There was no difference between the two nutrient sources with regard to the N, P, and K composition of the forage.

Seedbed preparation is important for establishment of alfalfa. With preplant

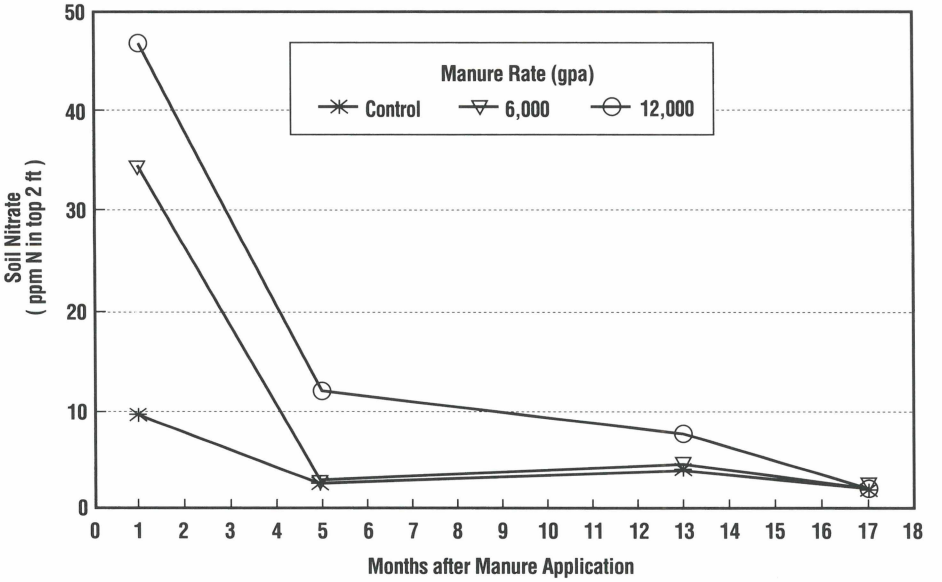

Figure 2. Soil nitrate-N concentrations in the top 2 feet of soil as affected by the rate of manure application and sampling time after application.

manure applications, the potential for having a poor seedbed is higher. Manure must be applied to the soil and thoroughly mixed into the topsoil. Otherwise, alfalfa may be seeded into high concentrations of manure and wheel traffic over the seedbed may cause excessive compaction, both reducing alfalfa stand uniformity. In the final analysis, with proper rate and distribution, alfalfa appears to be an acceptable alternative crop for manure application. ■

LUSH GROWTH of alfalfa in these plots occurred where manure was applied.