Nutrient Management of Perennial Forages on Minnesota Dairy Farms

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Introduction

There is relatively little information available on a state-wide basis regarding fertility management of perennial forages by dairy farmers. Information available on manure and fertilizer use generally relates to corn acres. It is critical to know what fertility practices dairy farmers use on their perennial forages and what influences and constrains them in choosing those practices.

Method

Minnesota dairy farmers were surveyed by mail during August and September 1996. The questionnaire was mailed to 1007 dairies selected randomly by the Minnesota Agricultural Statistics Service from farms that had reported milking 30 or more dairy cows. A total of 354 surveys were found suitable for statistical analysis, representing 3.6% of all farms with less than 200 milking cows and 11.5% of farms with 200 or more milking cows. Because sampling intensity varied between these two categories, distributions of specific farm characteristics do not accurately reflect overall conditions in Minnesota. I divided the state into three areas, based on climate and general soil characteristics (Fig. 1).

Distributions of many individual farm characteristics were skewed, so both the median and mean are presented. Stepwise logistic regression was used to discern relationships among variables.

Results

Milk cow numbers ranged from 20 to 400 (P_{50} = 51, x = 69) and farmers reported having from 0 to 300 (P_{50} = 24, x = 34) replacement heifers. Rolling herd average ranged from 4000 to 11,800 kg milk (P_{50} = 8200 kg, x = 8400 kg) and is more likely to be high in larger herds, on farms where feed is tested for quality frequently, and as the area of permanent grass forages increases. It tends to be lower on farms that spread manure on grass forages. This latter characteristic may be related to other limitations on management (time, land area in corn, etc.), or it may be some direct effect, such as reduced feed intake due to palatability problems.

The percentage of forage land fertilized is greater in the cold Alfisol region, and when soil tests are used for information regarding fertilizer recommendations. In contrast, less forage land is fertilized where manure is topdressed on established alfalfa fields and on farms with permanent grass-legume mixtures.

Reported rates of preplant P and K fertilizer range from 5 to 70 kg P/ha (P_{50} = 18 kg P/ha, x = 23 kg P/ha) and 25 to 225 kg K/ha (P_{50} = 112 kg K/ha, x = 116 kg K/ha). More K is incorporated before seeding when farmers get information from fertilizer dealers and from the Extension Service and as the proportion of fertilized forage

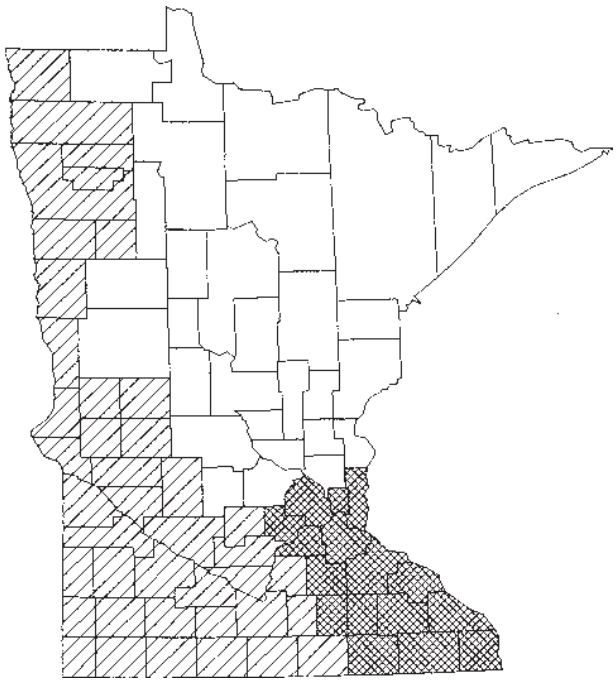


Figure 1. Three generalized soil areas of Minnesota: the cold Alfisol region (no shading); the warm Alfisol region (darkest shading); and the Mollisol region (medium shading).

land increases. The rate is smaller in the Mollisol region, which has high native soil K availability.

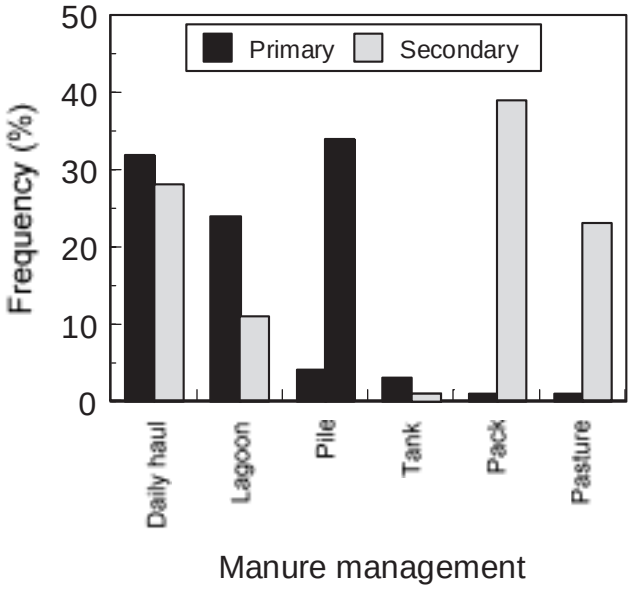
On established alfalfa, farmers reported using from about 5 to 70 kg N/ha (P_{50} = 20 kg N/ha, x = 24 kg N/ha), 5 to 80 kg P/ha (P_{50} = 21 kg P/ha, x = 27 kg P/ha), and 15 to 390 kg K/ha (P_{50} = 128 kg K/ha, x = 139 kg K/ha). Phosphorus rates are higher in the calcareous Mollisol region, on farms where a large percentage of forage land is fertilized, and when information on fertilizer rates is obtained from the Extension Service. Little variation in applied K could be explained by farm characteristics, presumably because nearly one half of all farms use K on established alfalfa. P and K fertilizer is applied almost entirely during the growing season and is spread all at once or in a simple split, mostly in September and October.

Nearly 80% of the reported soil tests exceeded 20 mg P/kg, at which point no additional nutrient is recommended by the University of Minnesota, and several exceeded 120 mg P/kg. Higher soil P levels were associated with manure storage in a pack and with higher percentages of fertilized forage land. Lower soil P is characteristic of farms in the Mollisol region and occurred on farms with daily or frequent haul manure systems. About one-half of the reported soil K tests were greater than 160 mg K/kg, the level at which no fertilizer is recommended. Soil K is related positively to pack and lagoon manure storage systems, with increasing proportion of forage land fertilized, and with increasing acreage of permanent grass forages.

The two manure handling systems ranked as most typical were daily or frequent hauling and lagoon storage of liquid manure (Fig. 2). Dairy farmers apparently rely more on daily or frequent manure hauling in the warm Alfisol area, as more forage land is fertilized, and as fertilizer dealers serve as more important sources of nutrient information. This also might be interpreted that farmers who rely on daily or frequent hauling are less likely to employ independent consultants than the personnel at the fertilizer distributor. Daily hauling is less likely as alfalfa land area increases.

Reliance on lagoon storage of liquid manure is more likely as herd size and rolling herd average increase, and is less likely in the warm Alfisol region and when information is obtained from farming magazine articles. Other manure handling systems rarely were listed as most typical, but were employed on many farms. Overall, manure storage facilities need to be emptied an average of twice a year, with a range of 1 to 26 times per year.

Minnesota dairy farmers are more likely to spread manure before seeding perennial forages when the typical manure source is manure pack in livestock facilities. Manure application both before seeding and as a topdressing on established forage stands is more likely with larger herds and on farms in the cold Alfisol area. Farmers are less likely to apply manure to perennial forages when a larger percentage of their forages received commercial fertilizer. Topdressing manure is less likely the more farmers rely on independent consultants for information on recommended fertilizer rates.



Figurs 2. Primary, or most typical (dark bars), and secondary (gray bars) types of manure management used on Minnesota dairy farms. Results of a survey done in 1996.

Topdressing manure on established grasses is less likely at higher rolling herd averages. About 10% of the respondents indicated that they topdressed at least a portion of their manure on forages during winter, but at least twice as many spread manure only during the growing season. The most frequently given reasons for topdressing manure on established perennial forages included the opportunity to spread manure in summer and to make good use of nutrients. In contrast, at least 20% of the respondents said that lack of time, lack of uniformity in spreading manure, increased weed problems, and lack of manure (due to use on other crops) were reasons for *not* topdressing manure on all perennial forage fields.

Although most dairy farmers reported using soil test results for information on fertilizer rates, the fertilizer dealers most frequently helped interpret that information. Farmers rely more on fertilizer dealers when they have more grass pasture, typically use a daily or frequent haul system for manure, and fertilize a higher proportion of their forage land. However, those who said pasturing their livestock is a typical way of managing manure are less likely to depend on employees of a fertilizer dealership for fertilizer recommendations. Similarly, farmers are more likely to use information from independent crop consultants when they fertilize a larger proportion of their forage land but also when they have larger herds. Those dairy farmers who spread manure on established forage stands are less likely to use an independent crop consultant for fertilizer recommendations. Extension, farm magazines, and experience were listed infrequently as the most important sources of information on forage fertilization.

Conclusion

Better knowledge of on-farm forage fertilization practices is needed to direct our future research and education efforts. As with all research, results of this survey should be verified by follow-up work in Minnesota and other states, and other areas where temperate forages are grown. This survey confirms earlier reports that many dairy farms have high soil test levels for P and K. Very high soil P concentrations may be reason to limit application of manure on these fields in order to preserve or improve surface water quality. Improved awareness of nutrient needs should increase the yield, persistence, and quality of perennial forages and improve the viability of livestock farming. Because fertilizer dealers are the most important source of nutrient recommendations to dairy producers in Minnesota, providing them with the latest information on nutrient management likely will result in the most rapid transfer of this information to farmers.