ALFALFA RESPONSE TO SUMMER MANURE APPLICATIONS

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Livestock manures can be a source of N and other plant nutrients for crop production but must be managed properly to avoid negative impacts on the environment. Manure is usually applied to fields cropped to corn or other annual crops. However, frequently farmers have more manure than what can be appropriately applied to annual crop fields. Annual cropping systems do not allow manure applications during the growing season. A perennial forage like alfalfa which is cut several times during the growing season could provide an alternative land base and time management strategy for manure applications.

Studies on alfalfa that received pre-plant or manure applications on established stands before or during the growing season have produced variable results. In management systems using applications of manure during the growing season on established stands of alfalfa, tolerance to ammonium, salinity, and wheel traffic from application equipment will be factors in stand persistence. Results to date of two different experiments where manure was applied during the growing season will be presented.

Experiment 1. Seven moderately dormant alfalfas adapted to the upper Midwest were established at two locations in Minnesota in 1997. Manure was applied at three rates to all alfalfa entries in July of 1998 and 1999. Zero, 4000, and 10,000 gallons of hog manure per acre were applied within 5 days after the second cutting at each location in both years. Herbage yields were recorded for all plots starting with the third cut in 1998, (first cut after the first manure application) through the first cut in 2000. Plant stand ratings were taken in spring and fall of each year to evaluate the influence of winter injury, if any, on tolerance to summer manure applications.

Experiment 2. This research was divided into two studies because of the differences in dormancy and adaptation of the alfalfa germplasms under investigation. The first study included experimental and commercially available alfalfa populations which had been selected for either increased forage production under constant saline soil conditions or tolerance to grazing. Commercially available hay-type alfalfa cultivars will also be included. All entries were non-dormant and adapted to the southwestern USA (dormancy class 8 to 9) and are expected to winterkill in our Midwestern environment. The second experiment will evaluate dormant alfalfa germplasms adapted to the Upper Midwest. Entries included were five experimental and commercially available alfalfa populations which have undergone several cycles of selection for tolerance to continuous grazing by cattle, five hay-type cultivars, three cultivars advertised as grazing tolerant, and one MN experimental population selected for tolerance to frequent mowing.

The non-dormant alfalfa variety experiment will be planted at two locations in both 2000 and 2001 since these genetic sources are not expected to over-winter in Minnesota. Herbage will be removed in mid-July and manure treatments will be applied 7 to 8 days after cutting. Herbage yields will be recorded in mid-August and manure

treatments will again be applied 7 to 8 days after cutting. Yields will again be recorded in mid-September and possibly in mid-October depending on the timing of a killing frost. Plant stand ratings will be taken in late October of each year. The dormant alfalfa variety experiment will be planted at two locations in 2000. No manure treatments will be applied during the establishment year. All plots will be harvested for herbage yield in June, July, August, and September in 2001 and 2002 and again in June of 2003. Manure treatments will be applied 7 to 8 days after cutting in July and August of both 2001 and 2002. Plant stand ratings will be taken in fall and spring of all years at both locations to evaluate the influence of winter injury on tolerance to summer manure applications.

Five manure treatments were chosen for both the non-dormant and dormant variety studies. Manures are highly variable in the amount of nitrogen (N) and salts depending on the animal species, feeds and supplements fed to the animals, and the management of the manure. We decided to add a consistent amount of sodium chloride and ammonium to the manure at each application in an attempt to minimize the variability over time and locations of the salt and N components of the manure treatments. Greenhouse trials were conducted to estimate the amount of additional sodium chloride and ammonium to add to produce a less than 10 % loss in plant population from one application of the amended manure. The control treatment will have the manure application equipment driven over the plots but no manure will be applied. The second treatment will be 5000 gallons per acre (GPA) of hog manure. The last three treatments will be 5000 GPA of hog manure amended with 750 lb/A of sodium chloride (NaCl), 5000 GPA of hog manure amended with 425 lb/A of ammonium (NH_4) applied as ammonium sulfate ($(NH_4)_2SO_4$), and 5000 GPA of hog manure amended with both 750 lb/A of sodium chloride and 425 lb/A of ammonium.