Fertilizing Grass/Clover Mixtures

Nick Schneider, Winnebago County Agriculture Agent, July 2010

A replicated plot study was performed at the Marshfield (WI) Agriculture Research Station starting in 2006 and continued to the spring of 2010 to better understand the influence of fertility on forage species diversity, yield, and quality. Fertility treatments were based on recommendations from University of Wisconsin Publication A2809 'Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin'. The forage species, meant to mimic pastures, established in the spring of 2006 were red clover, white clover, orchardgrass, and Kentucky bluegrass; however, red clover and orchardgrass dominated the sward throughout the study.

Treatments

1. Untreated
2. Nitrogen (N) = 50 pounds per acre (lbs/a) applied in early spring with 40 lbs/a applied in June and August for a total of 130 pounds lbs/a.
3. A2809 Managed Grass Pasture (N+P+K) = N at 50 lbs/a applied in early spring with 40 lbs/a applied in June and August for a total of 130 pounds lbs/a + 30 lbs/a P_2O_5 + 225 lbs/a K_2O applied in spring.
4. Phosphorus (P) = 30 lbs/a P_2O_5 applied in spring.
5. Potassium (K) = 210 lbs/a K_2O applied in spring.
6. A2809 Managed Legume/Grass Pasture + micronutrients (K+B+Ca+S) = 210 lbs/a K_2O + 28 lbs/a calcium + 25 lbs/a sulfur, and 1 lb/a boron applied in spring.
7. Two tons per acre of dairy heifer manure applied after each cutting to mimic grazing.

Soil Fertility

The pH, organic matter percentage, potassium, and phosphorus were determined for all research plots at the beginning of the spring in 2006 and four years later at the conclusion of the study in the spring of 2010 (Table 1). Soil pH consistently declined for all treatments accept one, from 6.5 to 6.9 in 2006 down to 6.0 to 6.3 in 2010. Since no lime was added during this study and the soils in northcentral Wisconsin have a tendency to have a low pH without lime applications, this result indicates it is essential to monitor pH in this region to prevent acidity from reaching levels that hinder plant performance. A pH of 6.3 is currently recommended for pastures and hay stands when clover is desired. Since pH declined consistently among treatments, there was no evidence that adding gypsum (the calcium and sulfur source) at the rates used in this study help improve pH as sometimes hypothesized.

Table 1. Beginning and Ending Soil Analysis

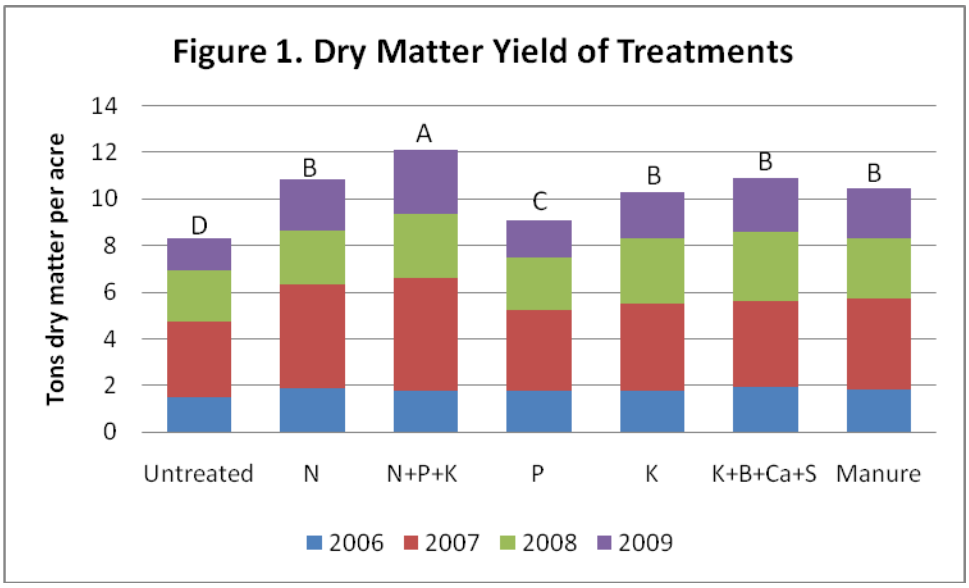
	pH		Organic Matter %		Potassium		Phosphorus	
	2006	2010	2006	2010	2006	2010	2006	2010
Untreated	6.7	6.2	2.8	2.6	56	45 *	31	19
N	6.5	6.2 *	2.9	2.8	54	39 *	33	19
N+P+K	6.9	6.0	2.9	3.0 *	52	71	30	23
P	6.8	6.2	2.9	2.7 *	60	49 *	31	28 *
K	6.8	6.3	2.9	2.6	53	160	30	19
K+B+Ca+S	6.9	6.3	3.0	2.8 *	50	114	31	19
Manure	6.8	6.2	2.9	2.9 *	55	62 *	31	19

* = unchanged from 2006 to 2010 at P=0.10

Generally soil organic matter remained relatively constant between, 2.5% to 3.0% for the duration of the study. There were some small amounts of organic matter change in three of the treatments. Nutrient applications changed the sward content with potassium based treatments containing 40% to 50% clover while nitrogen based treatments had less than 15% clover. These sward composition differences may have led to small changes in organic matter. There was no evidence adding two tons of manure after harvesting, as would be excreted by grazing animals, was enough to increase the soil organic matter content.

The location of this study was selected because of a history of low soil fertility, in particular potassium. Adding potassium in the form of commercial fertilizer was necessary to increase soil potassium from low levels. Treatments K, N+P+K, and K+B+Ca+S all significantly increased soil test potassium levels and yield above the untreated. The fertilizer rate used for potassium and phosphorus was for a yield goal of three to four tons of forage per acre; however actual yields averaged 2.5 tons dry matter per acre. This means potassium inputs exceeded crop removal thereby sharply increasing soil test potassium in treatments K and K+B+Ca+S.

All treatments except for the phosphorus treatment had a soil test phosphorus decline. Phosphorus inputs generated the smallest yield increase over the duration of this study because soil test phosphorus was at excessive levels at the start of the study and dropped to optimum levels over the four years. Phosphorus should be monitored to prevent further declines.



Treatments with the same letter are statistically similar.

This research supports using nutrient recommendations when growing clover/grass mixes for pasture or harvesting. Using an appropriate yield goal is important for determining the correct potassium and phosphorus rates. Relying on manure alone to maintain fertility may not be enough and pastures should be monitored for soil fertility changes as is recommend with other crops. However, the manure treatment still resulted in a significant yield improvement over the untreated check equal to three other treatments, even with less potassium and phosphorus than commercial fertilizer treatments.