Forage Focus - Research Updates- March 2010

North Dakota - Phosphorus Fertilization Doubles Alfalfa Yield on Low-P Soil

by Dwain Meyer, Robert Nudell, and Marisol Berti, North Dakota State University

In North Dakota, phosphorus (P) is alfalfa-limiting more often than potassium (K). An experiment was conducted to determine yield loss associated with P deficiency on a soil testing only 4 lb/ac P (2 ppm).

Seven replicated P-fertilization treatments were applied annually to a 4-year-old alfalfa stand at Buffalo, ND in fall 2005. Treatments included 0, 20, 40, 60, or 80 lb P/ac as ammonium sulfate (11-52-0, AMP); 60 lb P/ac as AMP plus 30 lb S/ac as zinc sulfate; and 60 lb P/ac as AMP plus 30 lb S/ac as zinc sulfate plus a micronutrient mixture ('Max-In'). Forage was flail-harvested three times in 2006 (drought) and four times each in 2007 and 2008.

Table 1. *Alfalfa yield on a low P-testing site at Buffalo, ND, as influenced by P fertilization.*

P Treatment	2006	2007	2008	2006-08 Total
lb P/ac	----------*Ton DM/ac*----------			
0	1.9	2.2	1.9	6.0
20	2.6	4.6	3.1	10.4
40	3.0	5.6	4.0	12.6
60	3.4	6.2	4.1	13.7
80	3.4	6.7	4.5	14.7
60+S+micro	3.6	6.3	4.4	14.4
60+S	3.4	6.0	4.3	13.7
LSD (0.05)	0.4	0.5	0.6	1.0

In 2006, forage yield increased with increasing P up to 60 lb P/ac. Adding S or a foliar micronutrient fertilizer did not affect yield. Forage yields in 2006 were reduced by drought, so the full potential was likely not reached for P fertilization.

In 2007, forage yield increased with increasing P up to 80 lb P/ac. Non-fertilized plots yielded only 2.2 ton DM/ac with no 4th harvest, while all fertilized plots provided four harvests. Rainfall was adequate in 2007, so P fertilization's yield advantage was evident. As in 2006, S fertilization did not affect yield.

In 2008, forage yields again increased with P fertilization; but as in 2006, yields were relatively low due to drought. However, only 40 lb P/ac doubled 2008 yields. If alfalfa hay sells for $80/ton, the increased forage yield in 2008 generated an additional $170 gross return. Assuming 11-52-0 sells for $650/ton, 40 lb P/ac cost $59/ac, resulting in a $112/ac profit. This study indicated that P fertilization is very economical on a low-P-testing site, even in this high fertilizer cost environment.