Fertilizer Options for Reducing Production Costs in Alfalfa

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Introduction

Volatility in fertilizer prices and environmental concerns have raised questions among alfalfa producers and advisors about the impact of reduced fertilizer rates on alfalfa. Information is lacking on alfalfa production and economic returns under reduced fertilization rates.

If fertilization rates are reduced, producers must be careful to avoid an imbalance in nutrients. Berg et al. (2007) concluded that careful monitoring of soil and herbage P and K concentrations, and application of nutrients to avoid imbalanced fertility is key to sustained high alfalfa yields.

Questions have also been raised concerning the need for S application to alfalfa, due to use of S-free fertilizers and removal of S from industrial emissions. Alfalfa has been shown to respond to addition of sulfur (O'Leary and Rehm, 1989) and gypsum (Chen et al., 2005) where soil S is low.

Objective

Compare alfalfa yield under standard fertilizer recommendations and alternative treatment programs, including reduced rates of P and K and a systems approach of pre-plant and foliar fertilization along with annual applications of gypsum and proprietary soil applied products.

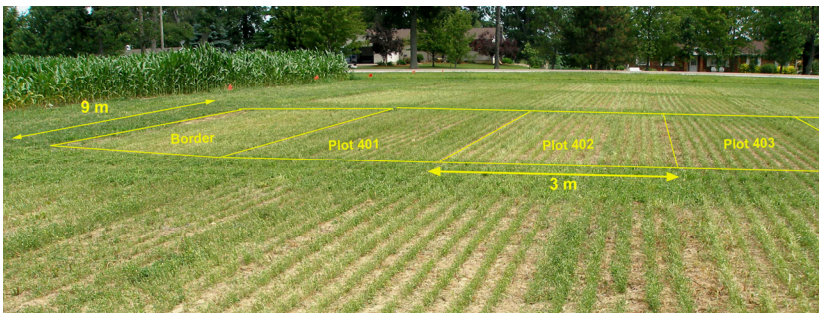
Materials & Methods

- Alfalfa field study established April 2009.
- Seven treatments imposed (Table 1) in 6 reps.
- Tri-state program is standard OH-IN-MI recommendations for alfalfa (Vitosh et al., 1995), which are based on initial soil test values and yield goal (see next bullet).
- Annual crop removal was the calculated nutrient replacement for yields of 5.6 and 18.0 Mg/ha in the seeding and subsequent years, respectively.
- .Initial soil test values (0 -15 cm depth):
  pH 6.7; Bray P1 7.5 µg/g;
  neutral ammonium acetate extracted K 83 µg/g,
  Ca 1479 µg/g, Mg 388 µg/g, S 8.3 µg/g;
  CEC at 11.2 cmol(+)/kg
  organic matter 14 g/kg (wt loss on ignition)
- Initial soil P and K levels were below the critical level for alfalfa on this soil (P=25 µg/g and K=103 µg/g) as defined by Vitosh et al. (1995).
- Two harvests in 2009 and four in 2010.

Table 1. Fertilizer application for seven treatments.

	Treatments	2009 / 2010 application P_2O_5	K_2O	Sulfur	Gypsum
		kg/ha			
1	No fertilizer control	0	0	0	0
2	Tri-state program	140 / 218	213 / 336	144	1646 / 1646
3	Tri-State+Gypsum	140 / 218	213 / 336	0	1646 / 1646
4	Tri-State + Sulfur	140 / 218	213 / 336	0	0
5	Annual crop removal	37 / 116	140 / 448	0	0
6	½ crop removal	18 / 58	70 / 224	0	0
7	Ag Spectrum*	140 / 28	213	84	0

*Ag Spectrum Program: 0-26-299 kg/ha applied pre-plant incorporated in 2009; foliar applied CleanStart (3-7-1 kg/ha), Kick-Off (micronutrients), and GroZyme in two growth cycles in 2009 and four in 2010; Blitz and GroZyme applied to soil surface pre-plant in 2009 and after third cutting in 2010 (should have been pre-season dormant application).



Over-view of the field study at Western Agricultural Research Station near South Charleston, OH following the first harvest in the seeding year (July 2009).

Results

- Yield differences ($P < 0.0001$) were found among treatments in both years and for total cumulative yield (Fig. 1). All plots have excellent alfalfa stand density (data not shown).
- Based on results over the first two years, only the Ag Spectrum treatment did not show a positive marginal return over the no fertilizer control treatment (Fig. 2).
- The study will be continued for two additional years to determine longer term responses on alfalfa productivity, alfalfa stand persistence, soil nutrient levels, soil nutrient removal, and economic implications of the fertilization treatments.

Fig. 1. Forage yield as influenced by fertilization treatments.

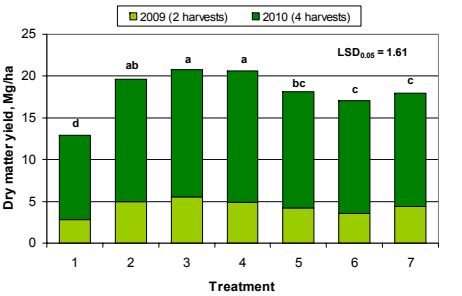
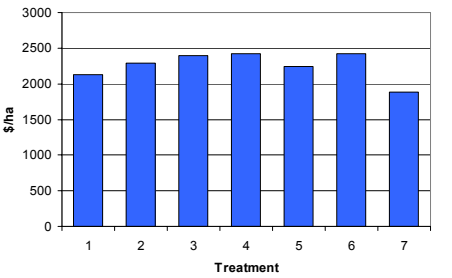


Fig. 2. Marginal return over fertilization cost.



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