ANNUAL RYEGRASS RESPONSE TO RESIDUAL AND APPLIED PHOSPHORUS

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Background. Phosphorus (P) application to soils as commercial fertilizer or as animal manures for a number of years causes increased soil levels of P that are referred to as soil test P or residual soil P. The level of residual P can be sufficiently high in some soils that it will supply all the P needs of crops for one or more years without application of additional P. This study was established to evaluate the effect of residual soil P on continued production of ryegrass.

Six different soils were selected from eight that had been limed, then fertilized in 1992, 1993, and 1994 with increasing rates of P for alfalfa production in 1993, 1994, and 1995. Annual applied rates of P as P_2O_5 were 0, 50, 100, and 150 lb/acre for the three years. Soil pH ranged from 6.4 to 7.1 on these six soils. Ryegrass was grown on these soils in 1995-1996 with no additional P applied. In fall of 1996, the original 10 by 20-ft plots were split. One-half of each original plot was fertilized with 80 lb of P_2O_5/acre. The other half of the main plot was not fertilized so that the ryegrass was grown on the residual P level from the 1992-1994 fertilizer treatments. All plots were drill-seeded to TAM 90 annual ryegrass at 30 lb of seed/acre. All plots were fertilized with 80 lb of N/acre on 2 Dec. 1998. On 25 Jan. 1999, the experimental site was fertilized with the per-acre equivalent of 597 lb of 14-0-20.7 plus magnesium and sulfur. An additional 80-lb of N/acre equivalent was applied on 5 Mar. 1999 and again on 7 Apr. 1999 for ryegrass production. Yield data were collected in three harvests from these 10 by 10-ft plots in 1999. Harvests were made in late Feb. to early Mar., early April, and mid-May. For this report, the weight per area harvested from the small plots was projected to yield per acre. Residual soil P levels for 1999 were not available for this report.

Research findings. Four years after the last P was applied for alfalfa in 1994, the combination of P fixation and ryegrass use of P for growth had apparently used most of the residual P from early applications. Five of the six soils failed to product significant increases in ryegrass yield based on earlier applied P rates. Only the Keithville-Sawtown soil produced ryegrass yields that were significantly different due to apparent residual P differences.

The need for additional P for ryegrass production is evident from plots treated with zero or 80 lb of P_2O_5/acre. Significant yield responses to the additional 80 lb of P_2O_5/acre occurred on four of the six soils. An additional 1000 lb of ryegrass dry matter was produced by the 80 lb additional P_2O_5/acre on the Darco, Lilbert, and the Bowie soils. About 1300 lb of additional ryegrass dry matter was produced on the Keithville-Sawtown soil association.

Application. Without having analyzed residual levels of soil P for the 1999-growing season, it is difficult to make other than generalizations concerning the ryegrass yield differences obtained. It is apparent that even the 150-lb/acre P_2O_5 rate applied on five of the soils for three years did not provide sufficient residual soil P to increase yields beyond three additional years when no additional P was applied. The Keithville-Sawtown soil had the lowest initial soil test P level and was most responsive to applied P initially and over the seven years of this study. It is important to continue to monitor soil P levels by testing at least every other year. Previous soil analysis for P indicated that ryegrass will respond to fertilizer P when the soil P level drops below 10 ppm. Between 10 and 20 ppm, ryegrass response to applied P is difficult to predict. When the soil test P level is above 20 ppm, ryegrass response to applied P is not likely to occur at levels of dry matter production reported here.

Table 1. Response of annual ryegrass to residual soil phosphorus from previous applications for alfalfa for three years followed by four more years of zero or 80 lb of P_2O_5 applied to split plots.

Previous P_2O_5	Cuthbert	Darco	Lilbert	Red Springs	Bowie	Keith./Swtn
rates, lb/acre	----------D. M., lb/acre----------					
0	5085 ns	1988 ns	4118 ns	7018 ns	5809 ns	4963 b
50	5474 ns	3058 ns	4668 ns	7260 ns	5713 ns	5516 ab
100	5532 ns	2417 ns	4815 ns	7501 ns	7219 ns	5792 a
150	6298 ns	3024 ns	4643 ns	6533 ns	6667 ns	6025 a
Reapplied P_2O_5 rates, lb/acre						
0	5313 ns	2187 b	4003 b	7009 ns	5899 b	4752 b
80	5911 ns	3146 a	5099 a	7148 ns	6806 a	6396 a
R^2	0.80	0.88	0.76	0.64	0.86	0.94
C.V.	15.2	19.6	21.2	17.7	12.0	8.8