

The Effect Of Phosphorus On Alfalfa Yield

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Introduction

Phosphorus plays a key role in the growth and development of alfalfa and is normally the only nutrient application that is recommended. Deficiency symptoms are not always definite and normally occur only during the cool periods of the year. Stunting is the most common symptom and will vary with the degree of deficiency and the soil conditions. Leaves sometimes appear dark and bluish-green in color. A survey was conducted in Yuma County in 1991 to evaluate the soil phosphorus levels in a cross-section of established alfalfa fields. The levels of extractable phosphorus (P) in the 30 fields sampled varied from 3 to 43 parts per million. 50% of these fields were in what is considered the high range of above 15 ppm. 17% of the fields were in the medium range containing 11 to 15 ppm. 10% of the fields were in the low range containing 6 to 10 ppm and 20% of the sampled fields were in the very low range containing below 6 ppm. A test was conducted to evaluate the effect of phosphorus on alfalfa yield for the first two years of production on a soil containing low-medium levels of phosphorus of 11 ppm extractable P.

Material and Methods

This test was conducted at the University of Arizona Yuma Mesa Agriculture Center on Superstition sand soil containing residual phosphorus levels of 11 ppm extractable P. The test was established on 4-8-91 and contained 4 treatments: 0, 50, 100 and 150 lbs. per acre of P₂O₅ applied pre plant incorporated in the form of triple superphosphate. Plot size was 40 ft. x 3 ft. replicated 3 times. Irrigation water was applied with an overhead lateral move sprinkler system. Irrigations were scheduled to maintain 1.5 to 2.0 inches of water in the top foot of soil as measured by a neutron probe. Twelve harvests were made between 4-18-91 and 7-1-92 using a self-propelled small plot forage harvester. Fresh weights were measured, corrected to 20% dry matter, and hay yields reported at 12% moisture.

Table 1.

Alfalfa hay yield (12% moisture) as influenced by phosphorus fertilizer rate.

Phosphorus Fertilizer Rate	Hay Yield												
	Apr 18 1991	May 16 1991	Jun 6 1991	Jun 27 1991	Jul 22 1991	Sept 5 1991	Oct 29 1991	Feb 25 1992	Mar 23 1992	May 1 1992	Jun 1 1992	Jul 1 1992	Total
lbs. P ₂ O ₅ /acre	-----Tons Per Acre-----												
0	0.61	0.53	0.45	0.52	0.48	1.70	0.89	0.72	1.60	1.75	1.57	1.98	12.8
50	0.50	0.53	0.41	0.46	0.46	1.63	0.88	0.51	1.58	1.63	1.66	2.13	12.4
100	0.52	0.52	0.46	0.51	0.46	1.90	0.92	1.20	1.86	1.98	1.79	1.90	14.0
150	0.58	0.52	0.45	0.48	0.46	1.91	0.86	1.01	1.91	1.91	1.77	1.83	13.7
LSD (10%)	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.42	N.S.	N.S.	N.S.	N.S.	N.S.

Results and Discussion

We were not able to measure any yield increases due to phosphorus fertilizer except at the cutting on February 25, 1992. This cutting was the first harvest of the second year and phosphorus fertilizer was responsible for a yield increase of approximately 1/2 ton per acre (see table below). The increase in yield paid for the cost of the fertilizer application assuming the following: 1) 100 pounds phosphate applied per acre, 2) fertilizer cost equals 30 cents per pound of phosphate, 3) yield increased by 1/2 ton per acre, and 4) hay price is greater than \$60 per ton.

The results of this study demonstrate that response to phosphorus is most likely during cool weather. Furthermore, soil testing for phosphorus appears to be a reliable tool for predicting response to phosphorus fertilizer.