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LOW FERTILITY ROBS ALFALFA PROFITS

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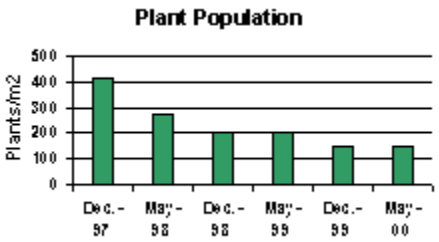
According to our research with each dry ton of alfalfa removed, about 70 lbs. of potassium (K) and 7.4 lbs. of phosphorus (P) or 150 lbs. 0-0-60 and 36 lbs. of 0-46-0 are also removed. To replace this removal of essential nutrients will cost about $17.50 for each ton of forage removed. Although the cost appears large, the loss of an established stand because of malnutrition and then the subsequent cost of replanting are much higher. To insure high yield and stand longevity, these nutrients must be replenished. If not, alfalfa plant health and soil nutrient concentration are subject to harm. This will effect today's crop and could effect crops grown for years to come.

Phosphorus and Potassium Effects on Yield and Persistence of Alfalfa

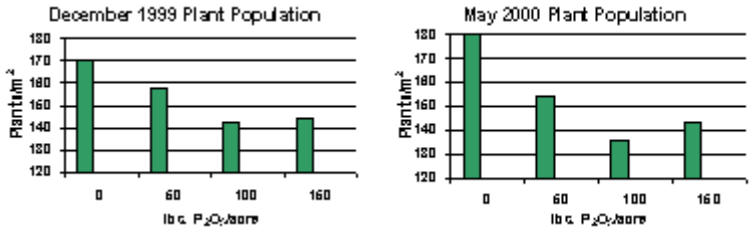
Phosphorus and potassium nutrition has been intensively studied with respect to alfalfa yield and persistence. Increased nutrient fertilization has produced a positive response in these two traits when alfalfa is grown on infertile soils. Despite numerous trials however, little is known of the mechanisms by which P and K enhance forage yield and persistence. In this study, we will document what characteristics of the alfalfa plant that P and K are improving that lead to greater yield and increased stand longevity.

The experiment consists of 20 fertilizer treatments including five K (0, 107, 215, 322, 430 lbs. K_20/acre/yr) and four P (0, 50, 100, and 150 lbs. P_2O_5/acre/yr) treatments in all possible combinations replicated four times. Plots are fertilized after the initial harvest in spring (late May) and after the last forage harvest in mid-September, with one half the specified amount per year in each application. During each of the forage harvests, herbage is harvested with a flail-type chopper and forage yield determined. Shoots are removed at random from the plot area to determine yield per shoot and shoots per area; two key yield components of alfalfa. Roots are dug and plants counted in May and December in order to determine the influence of P and K nutrition on plant persistence, and whether plants die during summer and fall (May to December) or during winter and early spring (December to May).



Population analysis over the past three years have produced surprising results. Plant populations declined from 400 to 200 plants per square meter (approximately 1.2 square yard) between December 1997 and December 1998 but remained unchanged over winter 1998- 1999. From May 1999 to December 1999, plant populations decreased from 200 to 154 plants/meter^2, and again over winter 1999-2000 populations remained unchanged. This decrease in plant populations suggest that plants die during the summer months due to competition between plants for light, water, and nutrients.

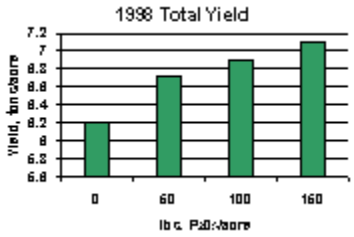
Potassium fertility did not influence plant persistence in this study, and plant populations were not effected by fertilization until December of 1999 where populations **decreased** with the addition of P. Stand counts ranged from 169 to 144 plants per squared meter when receiving no P and 150 lbs. P_2O_5/acre respectively. May 2000 stand count produced similar results with populations of 180 and 143 plants per meter squared with 0 and 150 lbs. P_2O_5/acre respectively.

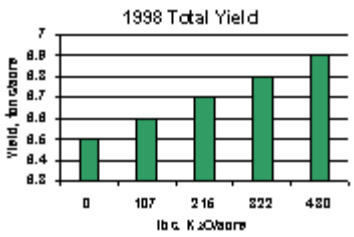


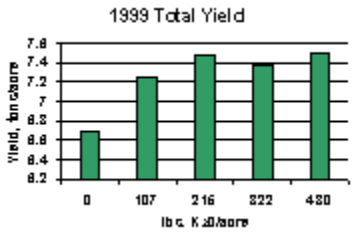
As expected, yield increased with addition of P and K fertilizer. In 1998, forage yield increased from 6.2 to 7.1 tons/acre with added P, and from 6.5 to 6.9 tons/acre with the addition of K. In 1999, results were similar. Forage yield increased from 6.5 with no P added to 7.8 tons/acre with 150 lbs. P_2O_5/acre and from 6.7 to 7.5 tons/acre with the addition of 430 lbs. K_2O/acre. Additional P fertilizer increased first harvest yields in May of 2000 from 1.8 to 2.6 tons/acre with 150 lbs. P_2O_5/acre, and K increased yields from 2.2 to 2.3 tons/acre with 430 lbs. K_2O/acre.

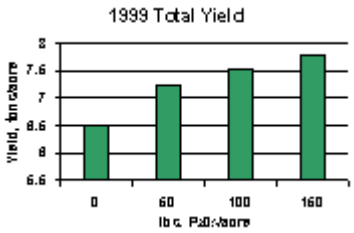
Yield per shoot is the yield component that responds to P and K application. Shoots per plant and plants per area have not been altered by P and K fertility. The increased yield per shoot with additional P and K is due to more rapid

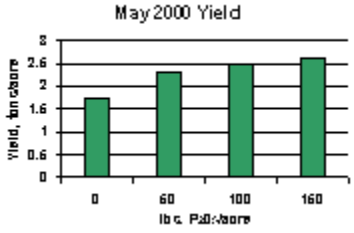
initiation of new shoots after cutting and increased stem elongation rate between harvests.



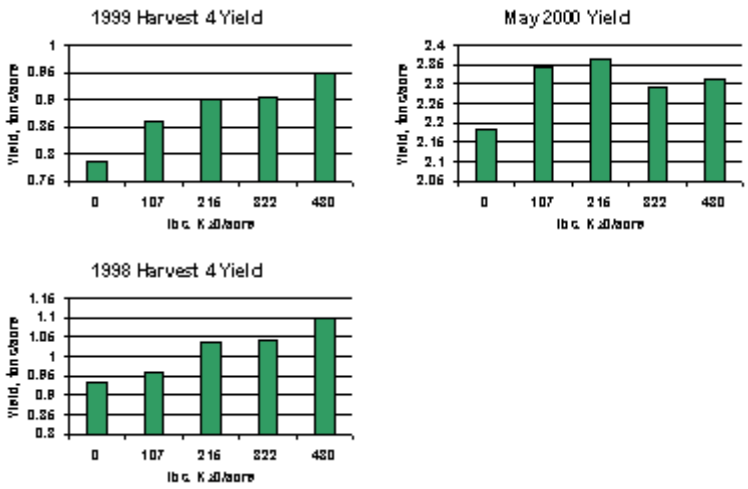








Even though there was a slight increase in first harvest forage yield in 1998, 1999, and 2000 with added K, the effect was not significant statistically. In contrast, forage harvests in Aug. and Sept. of 1998 and June, Aug., and Sept. 1999 exhibit K deficiency symptoms and have significantly lower yields. We think the lack of K fertilizer response at first harvest is due to release of K from clay particles in the soil due to the freeze-thaw action that occurs over winter.



The yield improvement shown is quite dramatic with additional P and K. At the moderate fertilizer rates, the cost per acre of replacing the removed nutrients is more than offset by the extra forage produced. Although this study has not shown increased plant population with increased fertilization, yield has yet to be compromised by the lower stand counts produced by increased P fertilization. This is the third growing season of this study. As time progresses we hope to define how fertilization improves the plant physiologically as to be the most economical for the producer.

Key Points for Alfalfa Fertility Management

- Each ton of hay removes 150 lbs. of 0-0-60 and 36 lbs. of 0-46-0.
- Apply half the recommended rate of fertilizer specified by your yield goal after the first cutting in May/June and the remaining half after your last cutting in September
- Yield increases in response to application of P and K are due to more rapid shoot initiation and faster shoot regrowth which leads to production of larger shoots.
- In this study, more plants have died due to summer stresses than have winterkilled.