

Potassium and Phosphorus Nutrition of Alfalfa: Preliminary Look at Impact on Yield Components and Root Physiology

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In this study, roots are being analyzed for numerous physiological and biochemical attributes (including starch, sugars and proteins) thought to be critical for rapid growth after harvest and winter hardiness. In April 1997, a 3-acre site at the Throckmorton Purdue Agricultural Center was seeded to Pioneer Brand 5454 alfalfa. This site was selected for study because soil tests indicated low levels of soil P...5 to 15 parts per million (ppm)...and low to moderate soil K levels...50 to 120 ppm.

Following establishment, a factorial combination of P (0, 50, 100, and 150 lb P₂O₅/A) and K (0, 107, 214, 321, and 429 lb K₂O/A) fertilizer treatments was applied in split applications; one-half after the first forage harvest in May and the remainder after the last forage harvest in September. (First year applications were made in October of 1997 and again after the first cutting in May of 1998.) In 1998, four forage harvests were obtained when buds appeared on shoots, using a flail-type chopper. A sub-sample of shoots was obtained from each plot in order to determine mass per shoot, and shoots per unit area were calculated using the data for mass per shoot and forage yield per unit area. The relatively large 15 x 30 ft. plot size allows periodic root sampling to obtain information on plant population per unit area (persistence), and to acquire root samples for laboratory analysis.

A new Purdue University study is providing insight into the physiological and environmental factors interacting with phosphorus (P) and potassium (K) soil tests and fertilizer application on alfalfa yield and persistence.

Initial soil K levels were slightly above the critical level required for alfalfa growth, but by Harvest 3 there was a K response. At the end of summer 1998, K deficiency symptoms were visible in some of the control plots where soil K levels were initially lowest. There was also a significant response of forage yield to P application. These findings represent only the first year of the study. It is anticipated that the differences will become more pronounced in succeeding seasons.

Increases in forage yield in response to P and K were generally associated with greater mass per shoot. However, control plots receiving no P or K fertilizer had more shoots per unit area than did plots provided P or K. The reduced competition for light, water, and other resources under P and K stress may allow plants to produce more shoots per unit area than is possible when P and K stimulate shoot growth.



In a new study, Purdue researchers are looking at physiological effects of P and K fertilization as related to alfalfa yield and persistence.

Summary of Findings in 1998

Alfalfa forage yield increased significantly with increasing K applications (**Figure 1**).

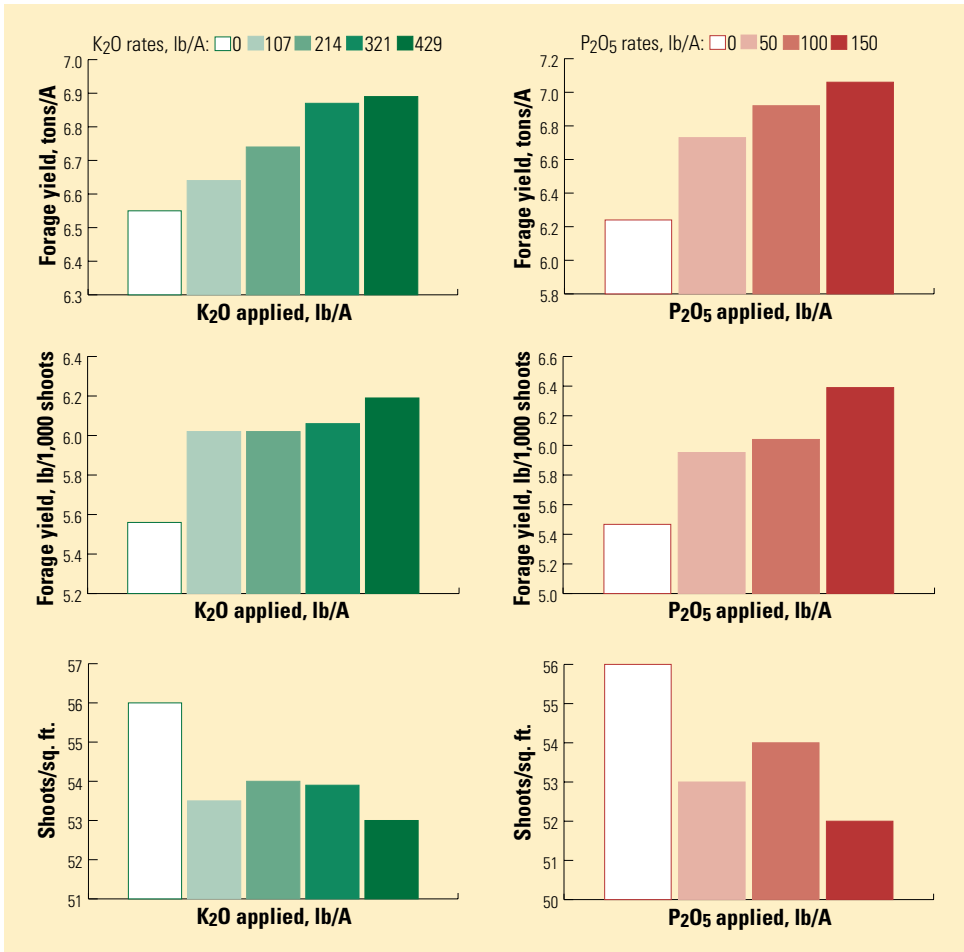


Figure 1. Forage dry matter yield, production per shoot, and stand density as influenced by P and K application for alfalfa. (Throckmorton Purdue Agricultural Center, 1998).

Despite having more shoots per unit area, the control plots generally yielded less forage than did the P and K fertilized plots because of the much larger shoots found on the latter.

Root analyses throughout this study will track effects of P and K levels on root sugar, starch, and protein contents. Stand counts will also be used to monitor effects on stand persistence and winter survival. This study is focusing not only on observations and yield, but also on the physiological basis for observed effects and how P and K influence the physiological processes. These findings

represent only the first year of the study, and with continued nutrient removal in succeeding seasons, differences due to P and K application are expected to become more pronounced. We also expect to learn how P and K interact in determining agronomic performance of alfalfa.

Watch for further developments in this unique field study during coming years. [BC](#)

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