Effects of AVAIL on Phosphorus Utilization in the Production of Bermudagrass

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Story in Brief

This study was conducted to determine the effects of phosphorus source (diammonium phosphate (DAP) vs AVAIL) on bermudagrass yields. AVAIL is a polymer that is added to DAP that inhibits phosphate fertilizer soil fixation. Test plots were applied with DAP or AVAIL to provide 50 lb/P. O./acre plus the addition of urea or urea with polymer (NSN) to bring N rates to 50 lb/N/acre. Companion plots containing urea or urea + NSN (50 lb/N/acre) were used to distinguish phosphorus effects. There was a phosphorus source by harvest interaction \( (P < 0.05) \) for DM yield, so data were sorted by harvest and reanalyzed. At the time of the first harvest, there were no differences \( (P = 0.48) \) between P and N treatments (average 1,642 lb/acre). At the second harvest, DAP treatments produced more \( (P = 0.03) \) yield than AVAIL treatments (3,655 vs. 3,298 lb/acre). Urea + DAP produced more forage \( (P < 0.05) \) than urea + AVAIL and urea alone (3,752 vs. 3,284, and 3,254 lb/acre, respectively). Combination of NSN + DAP and NSN + AVAIL produced more forage \( (P < 0.05) \) than NSN (3,557, 3,312, vs. 3,055 lb/acre, respectively). At the time of the third harvest, NSN + AVAIL, AVAIL, and NSN + DAP produced more forage \( (P = 0.02) \) than urea, NSN, and DAP (1,715, 1,673, and 1,669 vs. 1,537, 1,428, and 1,399, respectively). At the final harvest, all P and N treatments produced more forage than the control \( (P < 0.0001) \); however, there was no difference seen \( (P = 0.96) \) between P and N treatments (average 1,284 lb/acre).

Introduction

Bermudagrass is an important source of forage to producers in the southeastern U.S. It is grown on an estimated 25 to 30 million acres in the U.S. for livestock purposes. Bermudagrass requires high soil nutrient levels to maintain good production. It is highly responsive to nitrogen fertilization. Phosphorus is important for proper root growth. It is also an essential part of metabolic processes that occur within the plant, such as photosynthesis, the synthesis and breakdown of carbohydrates, and energy transfer.

Phosphate is not normally leached from the soil; however, it can be fixed in the soil. Some factors influencing phosphorus fixation include soil type and soil pH. In general, high clay content soils fix more phosphorus than sandy soils. Soils with a low pH usually contain iron and aluminum which readily react to produce iron or aluminum phosphate. Alkaline soils usually contain calcium for fixation as calcium phosphate. Fixed phosphate is not readily available to plants.

Polymer additives are currently being studied to determine their effects on phosphate availability. The development of AVAIL (Specialty Fertilizer Products, Manhattan, Kan.) was used to inhibit phosphate fertilizer soil fixation. This project was conducted to determine the effects of AVAIL on yield of bermudagrass.

Materials and Methods

Plots were established in a Tifton 85 bermudagrass hay meadow located in Hempstead County northwest of Prescott (33°49’42.79”N and 93°27’42.88”W). Soils were Sawyer loam, which are deep, moderately drained, slowly permeable, nearly level to gently sloping soils that formed in thick beds of loamy and clayey, marine sediment (Hoelscher and Laurent, 1979). Lime (2 ton/acre) and potassium (380 lb/acre) were applied according to soil test taken on May 8, 2007. On May 18, 4 replications, each containing 7 (5 ft × 20 ft) plots were cleared to a 2 in stubble using a sickle bar mower (Jari ‘Monarch’ model “C”, Mankato, Minn.). Each plot initially received 1 of 7 treatments: control (none), 50 lb/N/acre/harvest from urea, 50 lb/N/acre/harvest from Nutrisphere Nitrogen (NSN) (Specialty Fertilizer Products, Manhattan, Kan.), urea treatment with diammonium phosphate (DAP), NSN + DAP, urea + AVAIL, or NSN + AVAIL. Nutrisphere Nitrogen is a polymer added to urea that inhibits nitrogen volatilization. Subsequent applications (nitrogen source only) were applied after each harvest (28-d interval).

Plots were harvested on June 18, July 16, August 13, and September 10 to a 2-in stubble height using a 3-ft sickle bar mower. All (wet) clipped forage was weighed, and a sub-sample was collected and dried at 120°C to determine dry matter content, which was used to determine dry forage yield (lb/acre).

Statistical Analysis: Field data were analyzed as a randomized complete block design with 4 replications using the PROC GLM procedure of SAS (SAS Inst. Inc., Cary, N.C.). The response variable was yield. When significant interactions occurred \( (P < 0.05) \), data were sorted by date and reanalyzed.

Results and Discussion

Due to a phosphorus source by harvest date interaction \( (P < 0.0001) \) for dry matter yield, effects of phosphorus source on DM yield of bermudagrass forage and least-squares means by harvest date are presented in Table 1. At the time of the first harvest (June 18), phosphorus treatments and companion N treatments produced more forage than the control \( (P < 0.05) \); however, there were no differences \( (P = 0.48) \) between P and companion N treatments (average 1,642 lb/acre). At the second harvest (July 16), DAP treatments produced more \( (P < 0.05) \) yield than AVAIL treatments (3,655 vs. 3,298 lb/acre). Plots containing DAP produced more forage \( (P < 0.05) \) than AVAIL and urea alone (3,752 vs. 3,284, and 3,254 lb/acre, respectively). Combinations of NSN + DAP and NSN + AVAIL produced more forage \( (P < 0.05) \) than NSN alone (3,557, 3,312, vs. 3,055 lb/acre, respectively). At the final harvest (August 13), NSN + AVAIL, AVAIL, and NSN + DAP produced more forage \( (P = 0.02) \) than

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urea, NSN, and DAP (1,715, 1,673, and 1,669 vs. 1,537, 1,428, and 1,399 lb, respectively). At the final harvest (September 10), all P and companion N treatments produced more forage than the control ($P < 0.05$); however, there were no differences ($P > 0.05$) between P and companion N treatments (average 1,285 lb/acre).

**Implications**

The polymer addition of AVAIL did not consistently improve bermudagrass dry matter yields when compared to DAP alone. The addition of DAP increased yield when compared to AVAIL and companion N treatments while the addition of AVAIL produced as much forage as the companion N treatments.

**Acknowledgements**

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**References**


**Table 1.** Dry matter yields in lb/acre across harvests and by harvest date.

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</table>

*NSN is urea with polymer; DAP is diammonium phosphate; and AVAIL is a polymer that is added to DAP that inhibits phosphate fertilizer soil fixation.

a,b,c,d Means within columns with different superscripts differ at ($P< 0.05$) level.