EVALUATION OF NITROGEN GAS LOSS FROM POLYMER COATED AND POLYMER SULFUR COATED UREA

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INTRODUCTION

Broadcast topdressing fertilizer N application for turfgrass is a common practice. These applications result in loss of N to the atmosphere via nitrous oxide (N\textsubscript{2}O) emissions and ammonia (NH\textsubscript{3}) volatilization. Control release fertilizers potentially increase N efficiency and decrease atmospheric N loss.

Objectives:
- Quantify nitrous oxide (N\textsubscript{2}O) and ammonia (NH\textsubscript{3}) emissions for conventional and control release fertilizers.
- Evaluate the effectiveness of Polymer Coated (PCU) and Polymer Sulfur Coated (PSCU) Urea in reducing N\textsubscript{2}O and NH\textsubscript{3} emissions compared to conventional uncoated urea.

METHODS

- Treatments: 1) untreated control, each treatment received an application of twenty fertilizer prills 2) 146 g N m\textsuperscript{-2} uncoated urea, 3) 104 g N m\textsuperscript{-2} PCU (Duramen 45\textsuperscript{th} and) and 4) 111 g N m\textsuperscript{-2} PSCU (PCU and PSCU from Agrium Advanced Technologies, Loveland, CO, USA); replicated four times in Random Design
- Treatments surfaced applied to 65% water filled pore space Timpanogos Loam
- Soil and fertilizer incubated in a semi enclosed system under constant temperature environment. Soil was placed inside a 4 cm diameter \times 12.7 cm long PVC cylinder nested inside a 7.75 cm diameter \times 15.3 cm PVC cylinder. The area in-between cylinders was filled with dry, medium sized quartz sand. The top of outer cylinder was sealed with a rubber cap. The bottom of the cylinders were left open to the atmosphere so that when the gas sampler evacuated the headspace air for analysis, air could be replaced via flow upward through the sand (refer to figure 2)
- The entire headspace air was collected every 20 minutes using Innova 1309 multiplexer and analyzed for N\textsubscript{2}O and NH\textsubscript{3} using an Innova 1412 Photoacoustic, Field Gas analyzer (Lumasense Technologies, Santa Clara, CA, USA).
- Significance between treatment daily means done with ANOVA, with a Tukey-Kramer means separation.

RESULTS AND DISCUSSION

\textbf{PCU}
- NH\textsubscript{3} volatilization equal to control and 4.9 times less than uncoated urea (figure 4)
- N\textsubscript{2}O emissions 1.9 times greater than control but 1.2 times less than urea (figure 4)
- Urea > PCU 15 days
- PCU > Control 32 days (figure 5)

\textbf{PSCU}
- NH\textsubscript{3} volatilization 1.6 times greater than control but 3 times less than urea (figure 4)
- PSCU > control 15 days (figure 3)
- N\textsubscript{2}O 2.3 times greater than both control and PCU, 1.1 times less than urea (figure 4)
- Urea > PSCU 3 days (figure 5)

\textbf{Soil NH\textsubscript{4} and NO\textsubscript{3}}
- PSCU and PCU both contain 5.9 times less soil NH\textsubscript{4} than uncoated urea (figure 6)
- Possible explanation for significant decrease in PCU and PSCU volatilization

\textbf{CONCLUSIONS}

Polymer coated and polymer sulfur coated urea were found to emit significantly less N\textsubscript{2}O and NH\textsubscript{3} than uncoated urea. PCU reduced volatilization equal to the control, eliminating loss of fertilizer applied N through this mechanism. PSCU reduced NH\textsubscript{3} volatilization, though not as great as PCU. Quantification of N\textsubscript{2}O and NH\textsubscript{3} emissions supports previous research that polymer and sulfur coatings reduce N gas loss. In this study PCU was more effective at reducing N gas loss; this may be due to a shorter shelf life of PSCU, or quicker degradation of the polymer coating due to sulfuric acid build up.