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Comparison of Ammonia Volatilization from Surface Applied Fertilizers on High, Neutral, and Low pH Soils

Principal Investigators: Dr. Jared Williams and Brad Davis

Introduction:

Laboratory research is an essential part of agronomy, and greatly contributes to growers' forward motion in finding and implementing the most effective practices that lead to high yields and thriving plants. This study seeks to determine the effects of two industry-leading approaches to nitrogen loss.

Challenge:

The increased use of urea fertilizers has led to strong interest in reducing nitrogen loss due to ammonia volatilization. Volatilization is affected by the form of nitrogen used, the soil temperature and texture, tilling, and environmental factors. Finding ways to reduce ammonia volatilization are essential for growers, especially in no-till or pasture areas, where protecting nitrogen by incorporating it into the soil isn't possible.

Research:

Researchers Dr. Jared D. Williams and Brad Davis of BYU-Idaho designed a randomized block set study in a laboratory to control variables more precisely than is possible in real-world growing conditions. Their goal was to assess the results of two commercially available volatilization-inhibiting products: FŪSN™, an ammonium sulfate-nitrate fused fertilizer, and NutriSphere-N® (N-N), a urease and nitrification inhibitor.

Methodology:

Temperature (23–25° C), soil type (Eginbench Sandy Loam), moisture levels (field capacity), and fertilizer rates (112 kg ha^{-1}) were kept constant among all samples. The pH levels tested were 5.9, 7.0, and 7.8.

The study was designed as a randomized block set with four replications. Treatments tested included a control, ammonium sulfate (AMS), ammonium sulfate NutriSphere-N (AMS N-N), ammonium sulfate-nitrate fused fertilizer (FŪSN), urea ammonium nitrate (UAN), urea, and urea NutriSphere-N (urea N-N). Ammonia volatilization was measured by titration of boric acid traps. Traps were replaced every 24 hours for seven consecutive days.

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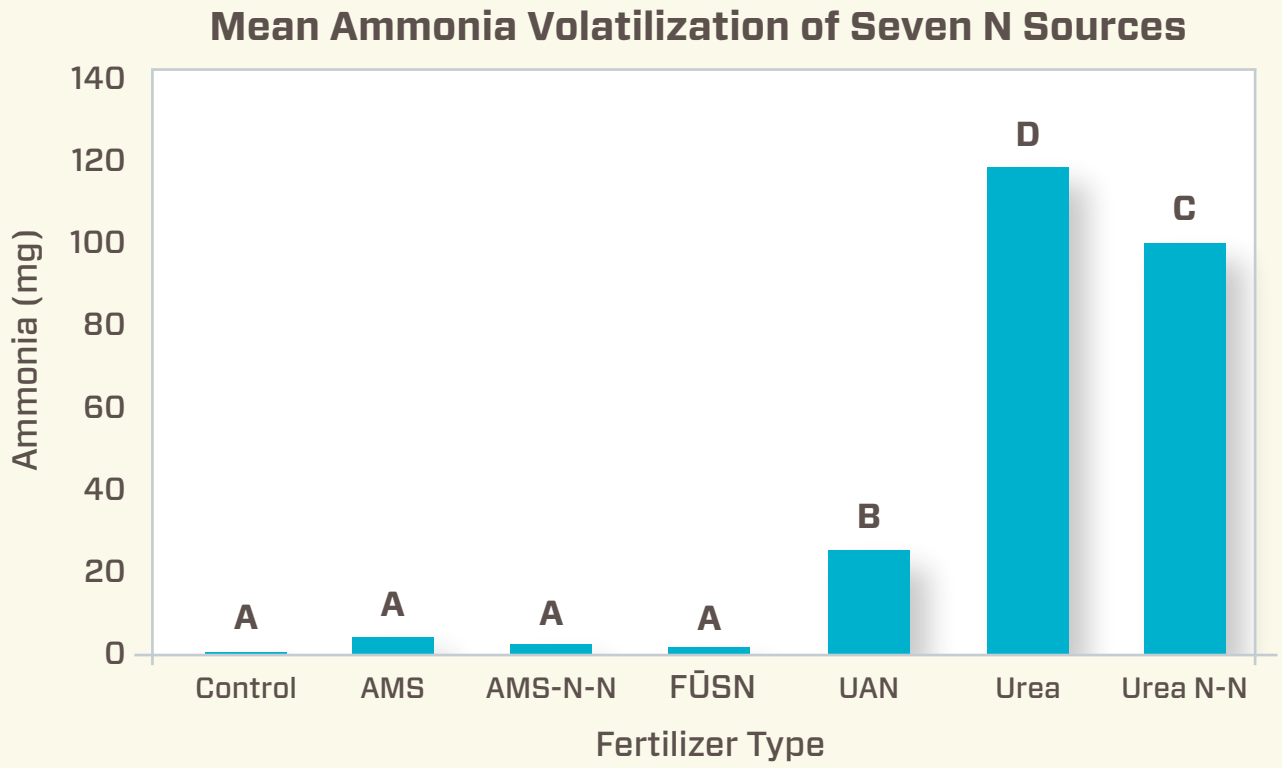
Results:

All urea fertilizers had higher rates of volatilization than non-urea fertilizers. UAN had more volatilization than AMS, AMS N-N, and FŪSN. Ammonia volatilization peaked the second or third day of the study, likely due to the time required by microbes to produce the needed enzymes for processing. Lower pH levels in the soil corresponded with lower levels of ammonia volatilization.

Practical Applications:

The research team found that urea N-N reduced ammonia volatilization in urea fertilizers. FŪSN had lower NH_3^+ volatilization than UAN or urea. Both products have applications in increasing the amount of nitrogen in the soil that is available to plants after application.



Comparison of total ammonia volatilization over a one-week incubation period. Letters denote differences among means at an alpha = 0.05.