

Assessment of atmospheric deposition of nutrients in Minnesota

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1. Goals and Objectives

The primary goal of this research to monitor atmospheric deposition of N and S in selected sites where current N and S rate studies are being conducted. Over the last few years many of the studies being conducted to evaluate crop response to added N fertilizer are showing a decrease in the amount of N required to reach the economic optimum nitrogen rate, in certain parts of the state. One possible explanation is that more N is coming down with rainwater and snow during the winter and being stored in the soil. During the growing season, the plant can then utilize this N in addition to any other N that was applied in the fertilizer form. It is therefore, important to assess the distribution of N being deposited from atmospheric rain and snow fall throughout the state so that better N management practices can developed and implemented. Atmospheric S deposition has also played a key role in plant nutrient for many decades. However, due to advanced technology, the amount of S emitted to the atmospheric has significantly been decreasing over the decades. Today many sites are starting to show increased grain yield when S is applied, however inconsistent results are observed, and we cannot predict which site will and or will not respond to S application. Being able to monitor N and S deposition throughout the state can help shine some light on this issue and help us improve N and S recommendation for Minnesota growers.

Therefore, this proposal aims at addressing both questions.

Our objectives are to: i) monitor atmospheric deposition of N; and ii) monitor the atmospheric deposition of S.

2. Results

We have installed rainwater/snow collection stations at five of the University of Minnesota Research and Outreach Centers in Crookston, Becker, Lamberton, Cloquet forest center (CFC), and Waseca. Water sampling started in the Spring between April and May and has been collected continuously since the start of the study. However, not all data has been submitted for analysis yet. Samples are collected and stored refrigerated, and once a certain number of samples are collected, they are shipped to Lamberton for analysis. We have received samples and data up to September and have been able to analyze the water for nitrate and ammonium up to August for Crookston, Waseca, and Lamberton. We are waiting for samples from Becker and the CFC.

Crookston

Rainfall total reported at Crookston was 14.9" from March to August. Rainfall water pH was also highly variable; however, the pH was much higher than what was observed at Becker. At Crookston rainwater pH was always above 5.59 (ranging between 5.59 and 7.99) when rainfall was below 1". For events above 1" rainwater pH ranged between 5.59 and 7.23. The amount of rainfall in each event was evenly distributed throughout the year with very several events higher than 1", 2.78" being the highest. The majority ranged between 0.14 and 1".

Nitrate concentration in the rainwater was very low and ranged between 0.01 ppm to 1.19 ppm. Ammonium had higher concentrations than nitrate and ranged between 0.01 and 16.5 ppm. As observed in the 2029 data, ammonium concentration tended to be higher in rainfall events that were below 1".

Lamberton

Rainfall total reported at Lamberton was 18.2" from April to September. Rainfall water pH was also highly variable. At Lamberton rainwater pH was never below 6.4 (ranging between 6.4 and 8.6) regardless of rainfall amount. The amount of rainfall in each event was evenly distributed throughout the year with very several events higher than 1", 2.25" being the highest. Nitrate concentration in the rainwater was very low and ranged between 0.02 ppm to 1.97 ppm. Ammonium concentrations were higher than nitrate and ranged between 0.02 and 3.53 ppm. Ammonium concentration tended to be higher in the spring and early summer and during rainfall events that were below 0.5".

Waseca

Rainfall total reported at Waseca was 19.2" from April to August. Rainfall water pH was also highly variable. At Waseca rainwater pH was mostly above 6.0 (ranging between 4.4 and 8.0). The amount of rainfall in each event was evenly distributed throughout the year with several events higher than 1", 4.4" being the highest. Nitrate concentration in the rainwater was very low and ranged between 0.04 ppm to 0.80 ppm. Ammonium had higher concentrations than nitrate and ranged between 0.13 and 1.20 ppm. Ammonium concentration tended to be higher in the spring and early summer and during rainfall events that were below 1.0".

A request for continuation have been submitted through the new MDA portal. We are requesting **\$38,500** to continue this study during April 2021 to March 2022.