

**Minnesota Department of Agriculture  
Agricultural Fertilizer Research and Education Council  
Written Project Update**

PROJECT DESCRIPTION: Updating nitrogen and phosphorus credits from manure to maximize fertilizer use efficiency in row crops  
REPORT DUE DATE: September 30, 2021  
PRINCIPAL INVESTIGATOR: Melissa L. Wilson

**Objectives:**

Our goal is to verify and/or update N and P credit recommendations from manure so that farmers are able to make better decisions when purchasing and applying commercial fertilizers in following years.

The objectives of this study are to use laboratory and field studies to: 1) estimate N and P mineralization from a variety of manures and soil types and 2) determine the best calculation for plant available N (PAN) and plant available P (PAP).

**Current Research Findings:**

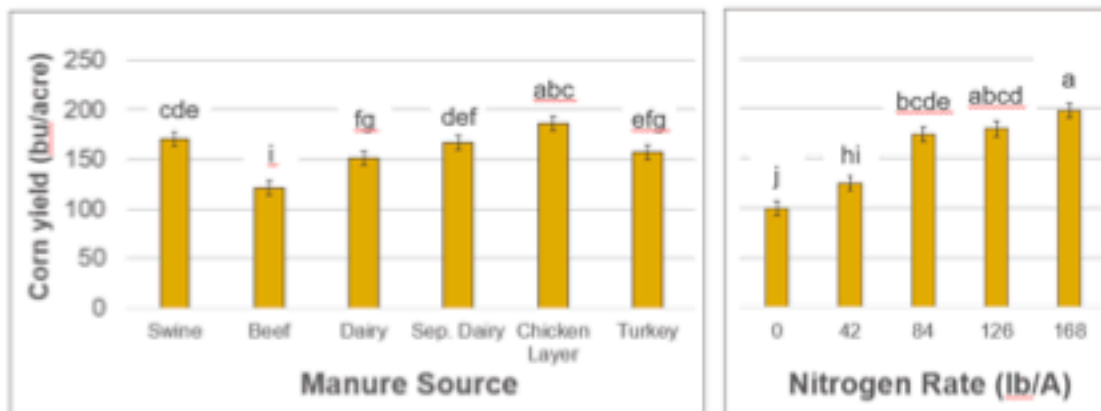
The field studies are being conducted at the Southern Research and Outreach Center (SROC) in Waseca, MN and the Southwestern Research and Outreach Center (SWROC) in Lamberton, MN. Site 1 at each location began in 2018 and Site 2 began in 2019. We have completed three years of the site 1 field study at both locations, and two years of the site 2 field study at both locations. The treatments were as follows in the first year of each site (all manures were applied to supply 140 lbs N):

- |                                      |  |
|--------------------------------------|--|
| 1. Swine finishing manure            | 9. Fertilizer: 84 lb/A N (full P, K)   |
| 2. Bedded beef pack manure           | 10. Fertilizer: 126 lb/A N (full P, K) |
| 3. Dairy manure (raw, untreated)     | 11. Fertilizer: 168 lb/A N (full P, K) |
| 4. Dairy manure, liquid-separated    | 12. Fertilizer: 0 lb/A P (full N, K)   |
| 5. Composted chicken manure pellets  | 13. Fertilizer: 30 lb/A P (full N, K)  |
| 6. Turkey litter                     | 14. Fertilizer: 60 lb/A P (full N, K)  |
| 7. Fertilizer: 0 lb/A N (full P, K)  | 15. Fertilizer: 90 lb/A P (full N, K)  |
| 8. Fertilizer: 42 lb/A N (full P, K) | 16. Fertilizer: 120 lb/A P (full N, K) |

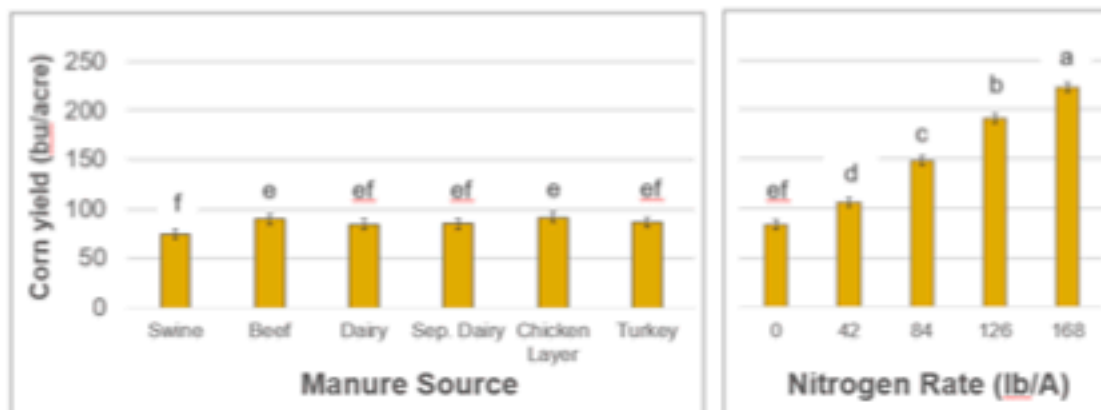
The manure treatments were only applied in year 1 of the study at each site. After that, potassium and sulfur fertilizers were applied to all plots (including fertilizer or manure plots) in following years to ensure they were not deficient. Nitrogen and phosphorus fertilizers were applied at the appropriate rates to the fertilizer only plots in all years, however. This allowed us to compare the nitrogen and phosphorus supplied by the manure in years 1, 2, and 3 after application to a nitrogen-rate and phosphorus-rate curve.

Grain yields over the years at each site are shown below. Though we aimed to apply the manure at the same available N rate in the first year, the dairy and beef manure resulted in

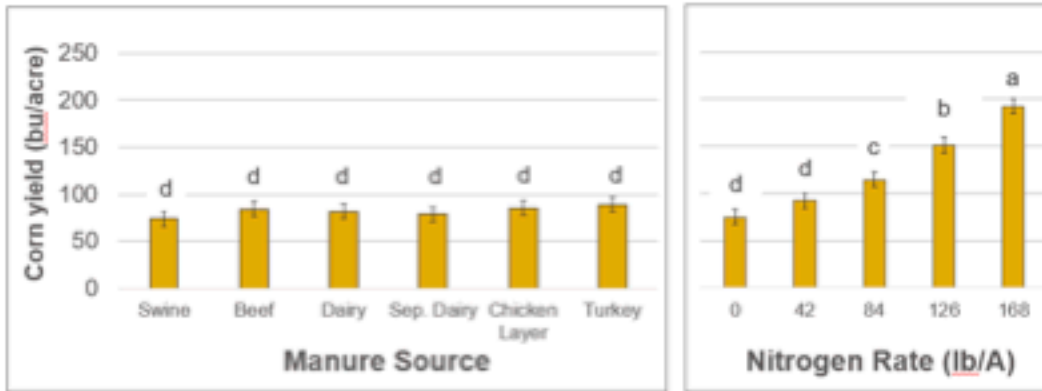
lower yields than expected at both sites. In the second and third year after application, the manured plots did not receive additional N or P and the yields were significantly decreased, though tended to be slightly better than the no N control plots. Based on this, we do not expect to see a nutrient credit in the fourth year after application. We will look further into these trends with the plant nutrient uptake and soil nutrient data that was collected each year of the study.



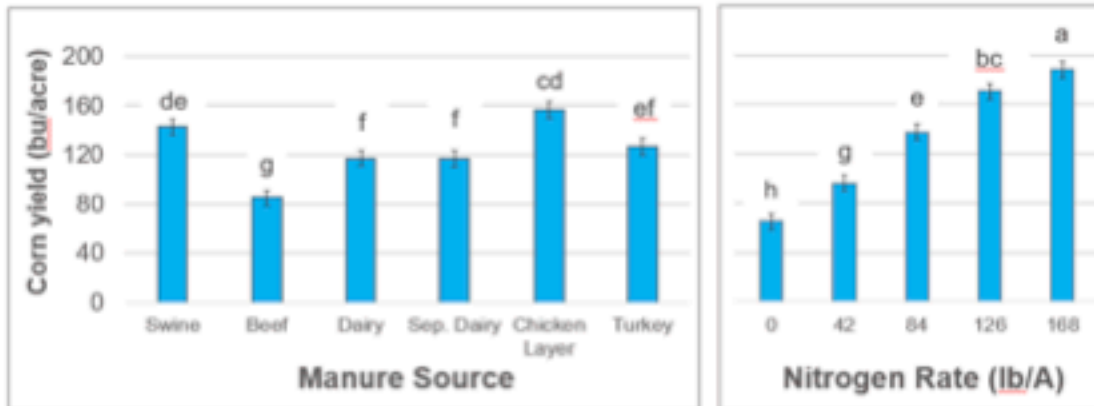
**Figure 1.** Average corn yield at SROC (Waseca, MN) over 2 years when 140 lbs of plant available N was applied in spring via manure versus commercial nitrogen applied at several rates. Bars with the same letter above them are not significantly different ( $P>0.05$ ).



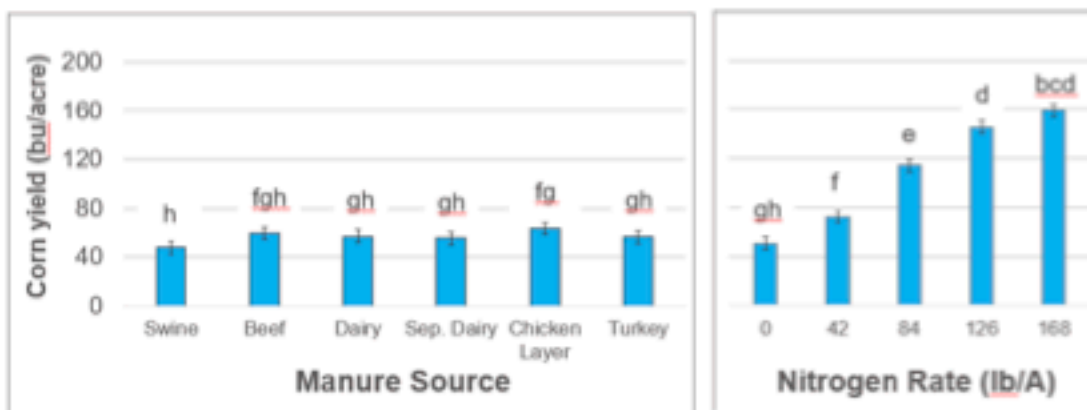
**Figure 2.** Average corn yields at SROC (Waseca, MN) the second year after manure was applied compared with commercial nitrogen applied at several rates. Bars with the same letter above them are not significantly different ( $P>0.05$ ).



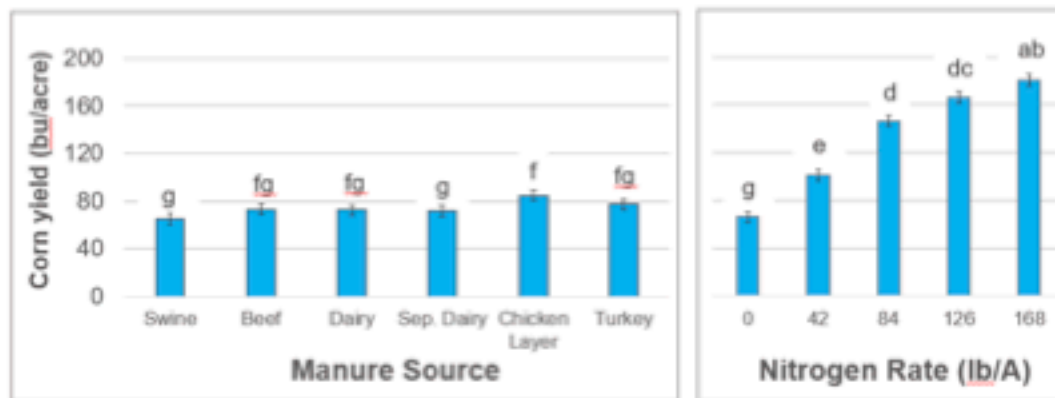
**Figure 3.** Corn yield at SROC (Waseca, MN) the third year after manure was applied compared with commercial nitrogen applied at several rates. Only one year of data has been collected at this time. Bars with the same letter above them are not significantly different ( $P>0.05$ ).



**Figure 4.** Average corn yield at SWROC (Lamberton, MN) over 2 years when 140 lbs of plant available N was applied in spring via manure versus commercial nitrogen applied at several rates. Bars with the same letter above them are not significantly different ( $P>0.05$ ).



**Figure 5.** Average corn yields at SWROC (Lamberton, MN) the second year after manure was applied compared with commercial nitrogen applied at several rates. Bars with the same letter above them are not significantly different ( $P>0.05$ ).



**Figure 6.** Corn yield at SWROC (Lamberton, MN) the third year after manure was applied compared with commercial nitrogen applied at several rates. Only one year of data has been collected at this time. Bars with the same letter above them are not significantly different ( $P>0.05$ ).

#### **Project Schedule and Budget:**

The field study portion of the project is on track. We decided to end each site after three years following manure application due to the lack of the likelihood of a nitrogen or phosphorus credit in the fourth year after manure application. The lab study was delayed, but we are finalizing analysis of the data and preparing a manuscript that we plan to submit to a peer-reviewed journal. The budget is currently on track as well, though we occasionally have had to shift funds from one area to another. Due to the COVID-19 pandemic, our lab analyses were delayed in the past year and we asked for a no-cost extension.

#### **Potential Project Results:**

The main goal of this project is to determine if the University of Minnesota's current recommendations for manure N and P credits are still applicable. Our data showed that we may need to make adjustments to beef bedded pack and possibly dairy manure, but the last year of the experiment is needed to round out our dataset. In the end, if we are able to provide better recommendations for manure use, then farmers will be able to better maximize their commercial fertilizer purchases, increasing profitability.