

## PREPARED FOR THE NITROGEN FERTILIZER EDUCATION AND PROMOTION TEAM:

# What do we know about nitrogen crediting from manure in (southeast) Minnesota?

Greg Klinger, Extension Educator, Agricultural Water Quality Protection

## BACKGROUND

At their meeting held on March 1, 2019, the Nitrogen Fertilizer Promotion and Education Team (NFEPT) discussed manure crediting. The Team identified a need to survey manure applicators, farmers, agriculture professionals and other stakeholders on how nitrogen from manure is credited, and whether/how crediting can be improved. To meet that need, a series of interviews were conducted during the fall and winter of 2019, and past survey data from USDA and the MDA was reviewed. This document provides an overview of the primary findings from these activities as presented at the NFEPT meeting held on February 12, 2020.

## NASS SURVEY HIGHLIGHTS

A primary source of information used to understand manure crediting in corn-based crop rotations were the 2012 and 2014 nitrogen/manure application rate surveys commissioned by the Department of Agriculture<sup>1,2</sup>. These are the most recent surveys available for this specific information. Key findings related to manure crediting in Minnesota *as a whole* are summarized below.

### Information of interest from the NASS surveys

- Fields where manure was applied averaged 10-30 lbs/acre higher N rates than where only commercial N was applied. *However*, University recommendations would generally recommend 20-30 lbs/acre more N when manure is a main fertilizer source than where commercial N is the sole source of N. This is not because the demand for nitrogen is greater from manure than commercial N, or because the risk of nitrate losses are lower, but because the cost of nutrients contained in manure are generally different than commercial N sources.
- Average N rates were 30-50 lbs higher when commercial N was used *in combination with* manure as a nitrogen source than when manure was the *only* N source.
- About half of the farmers surveyed used only manure as an N source on the fields they discussed with the surveyors, the other half supplemented with commercial N.

- Crop rotation did not greatly affect overall N rate when manure was an N source.
- Farmers frequently (>50%) were unsure of the N content of their applied manure. This was most prominent in alfalfa-corn rotations.
- Total N rates of surveyed farmers were similar between different manure sources (hog, dairy, beef, poultry). Hog manure generally provided the greatest *proportion* of N applied to any specific corn field.

### SOUTHEAST MINNESOTA-SPECIFIC INFORMATION

Southeast Minnesota has several considerations that are fairly unique in Minnesota in terms of manure management. One is that average field size, especially close to the Mississippi River, is much smaller than other regions of the state. The number of fields an individual farming operation manages is often quite large. This means that manure management plans and manure management records are often much larger, more unwieldy, and complex than in other regions of Minnesota. Additionally, according to survey data<sup>1,2</sup>, there are more daily or regular manure applications here than any other region of the state, and winter applications are also more common.

Several projects specific to southeast Minnesota provide some insight into nitrogen management and manure management in the region. These projects (Nutrient Management Initiative and Root River Field-to-Stream Partnership) shed some light on manure management trends in southeast Minnesota.

### Information of interest from southeast Minnesota

- Depending on crop rotation, overall N rates when manure was used as a fertilizer source averaged 18-77 lbs higher than where only commercial N fertilizer was used.
- Roughly 60% of acres received manure from sources that were tested annually for nutrient contents.
- Second-year corn after alfalfa often did not account for alfalfa credits in N rates.

### INTERVIEW FINDINGS

This fall and winter, open-ended interviews were conducted (ranging from 15 minutes to 3 hours in length) with 17 farmers, agronomists, researchers, state/local government employees, and custom applicators. All but 6 of those interviewed worked locally in southeast Minnesota. A breakdown of what line of work these interviewees represented can be seen in Figure 1. **Please note that these themes represent peoples' opinions and observations**, but that they collectively have hundreds of years of experience in agronomy and manure management.

### Trust is critical

- Trust (of people, of manure credits) was an idea that came up in every single interview.
- The #1 trust issue expressed towards manure crediting was concern over the evenness of manure application.

*"Trust is the #1 tool that we can utilize, but it is also maybe the hardest thing to get."*  
-Farmer, agronomist, local government employee

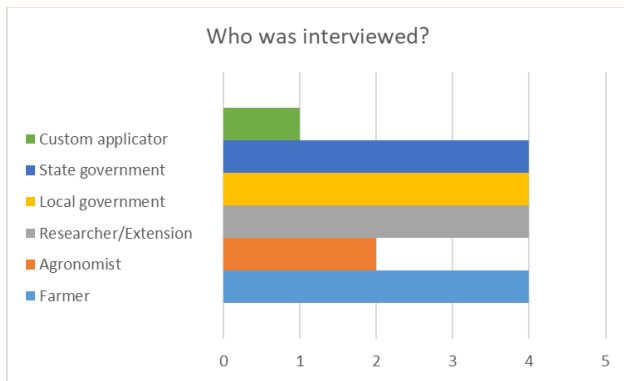


Figure 1. The 17 people I interviewed came from a diverse set of roles within manure management. Several people were interviewed in a few different capacities (for example, a farmer who also worked for the local Soil and Water District).

- The #2 trust issue is how weather (particularly extreme weather) can impact nitrogen release or loss from applied manure.
- The messenger is often more critical than the message itself.

*"[Farmers] would [refer to manure management plans] more often if they believed in it...Their main exposure to University [rate] recommendations is through a regulator..."*  
 -State government employee

**Communication and recordkeeping are vital, and can always be improved**

- The main reason for higher-than-desired N rates were from not keeping track of applications or having pits ready to overflow.

*"The best examples I've seen [of farmers' manure management] are where there's a simple map: here are the fields that should get manure, here's your manure application rate, here's the difference you need to make up with commercial fertilizer, and those two numbers are just color-coded in a simple one-page map. The farmer gets it and the crop retailer gets it so that everyone knows, and that's your plan, and then when you're done with the growing season, you visit again with the grower, and you say, 'Okay, [farmer], did you actually do this?' And [the farmer] will probably say, 'Well, our plan was to put manure here, but it didn't work, and we put it on this field instead,' and then that's your as-applied, and you keep that as your records, and put it in a book, and then you're done."*

-State government employee

- Another reason frequently expressed for higher-than-desired N rates were miscommunications/lack of communication between farming partners/agronomists/custom applicators.

*"You can't bring the whole picture together if nobody talks to each other."*

-Local government employee

- Commercial N applications to fields with full N rates from manure did occasionally happen because of miscommunication (<2% of fields/years), but fairly infrequently.
- Recordkeeping sometimes intersected with crop rotation to affect N rates. For example, sometimes farmers could not remember whether a particular field had been in alfalfa or not two years previous.

**Consistent contact is important for manure planning**

- A frequent comment was that one of the most effective ways to make whole-farm manure management plans a "living document" was to have consistent

engagement with the farmer.

*"You and I having this conversation today doesn't mean that tomorrow you're going to go forward with [an idea we discussed/a management change]... We're a magnet on the [compass] needle."  
-Farmer, agronomist, local government employee*

*"That's the challenge. People do [manure management plans] in the fall, set them up for next year, and you know how long it takes to forget something. You're not going to revisit this before you go out in the field for spring applications, you know, and so- I try to advocate this as being a part of your routine... That was a strategy we had to work on as County Feedlot Officers- when do we reach out to people..."  
-Local government employee*

- The more conversations farmers have about manure management/manure plans, the more inclined they are to value the nutrients applied, rather than think of it as a waste to be disposed of.

*"People would be in this kind of groove where, 'Oh, this field always gets 5,000 gallons/acre'- they just have it in their minds that is what happens- and so, sometimes, they wouldn't need that much, or- they could put way more on and you kind of carry off that stress of having to distribute the manure."  
-Local government employee*

#### Every situation is unique (and local)

- Farmers have different application equipment capabilities, have different manure storage situations, different relationships with farming partners and agricultural professionals, use different manure analysis laboratories...

*"There was never the capability to put manure on corn after corn [in this local area] because the amount of down-pressure needed- the toolbar itself- you needed a pretty aggressive toolbar to cut through that residue, but now [the local custom applicator] has a toolbar than can do corn on corn. That opens up a whole new door for farmers..."  
-State government employee*

**Technology will likely continue to improve some aspects of manure management, and make other aspects more critical**

- Technology (like on-the-fly nutrient content sensing, the ability to reliably variable-rate apply manure, as-applied maps, different manure injection equipment) is likely to improve our confidence in creditable nutrient contents in manure.
- The ability to use these technologies to fine-tune manure applications makes communication and recordkeeping that much more vital.

#### Future research needs and desires

- #1 desired area of research was N uptake and removal from cover crops/double cropping systems.

*"Whenever there's a new way of thinking, that's when we need new research to update the [manure management planning] tool."  
-State government employee*

- How does weather impact N credits from manure?
- How much sulfur is mineralized from different manure sources?

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<sup>1</sup>Minnesota Department of Agriculture, 2017. Commercial nitrogen and manure fertilizer selection and management practices associated with Minnesota's 2014 corn crop. St. Paul, MN.

<sup>2</sup>Minnesota Department of Agriculture, 2016. Commercial nitrogen and manure fertilizer selection and management practices associated with Minnesota's 2012 corn crop. St. Paul, MN.

#### For more information:

<https://extension.umn.edu/animals-and-livestock#manure-management>