Manure Happens: Take credit and cover it up

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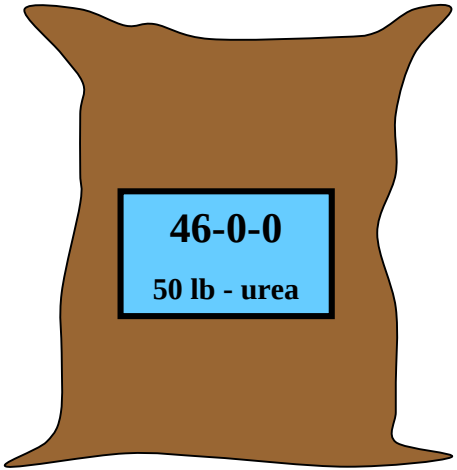
Agenda

- Manure: It’s complicated
- On-going research projects
  - Taking credit for nutrients in manure
  - Covering it up – cover crops for fall manure application

Taking credit for manure application: It's complicated

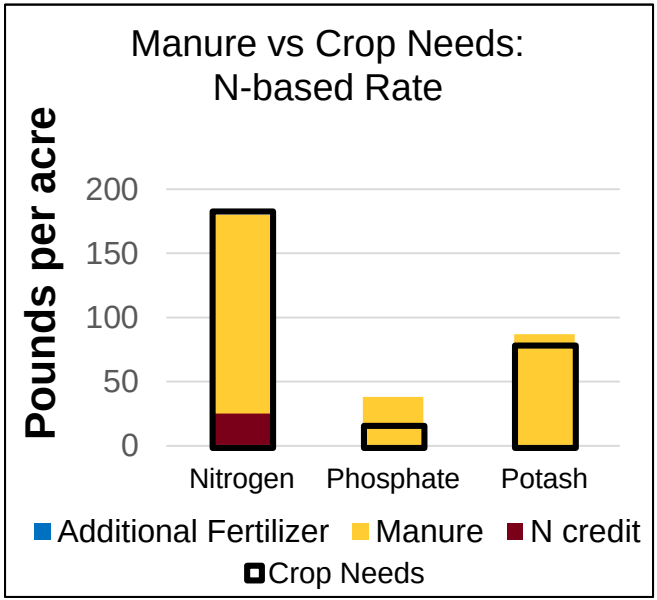
Picture courtesy MN Pollution Control Agency

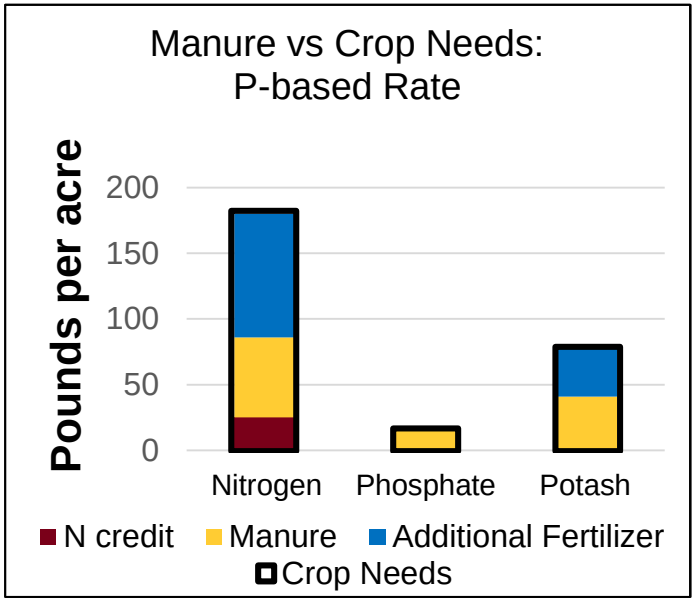
What kind of nutrient value can we expect from manure?



Manure application is complicated

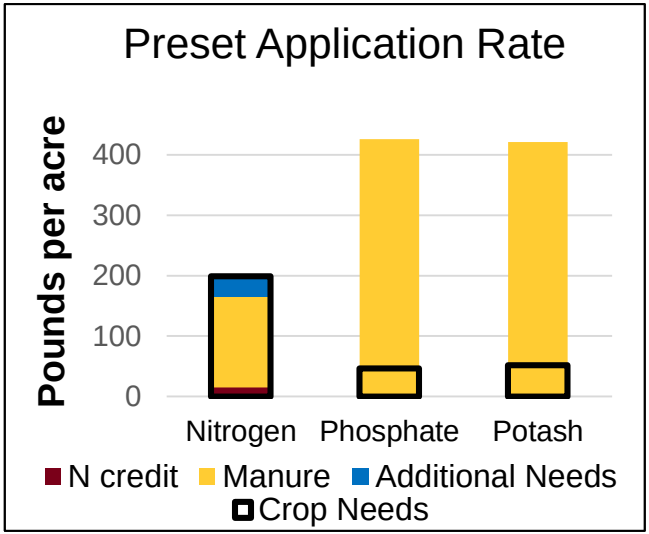
1. Nutrient ratio is fixed



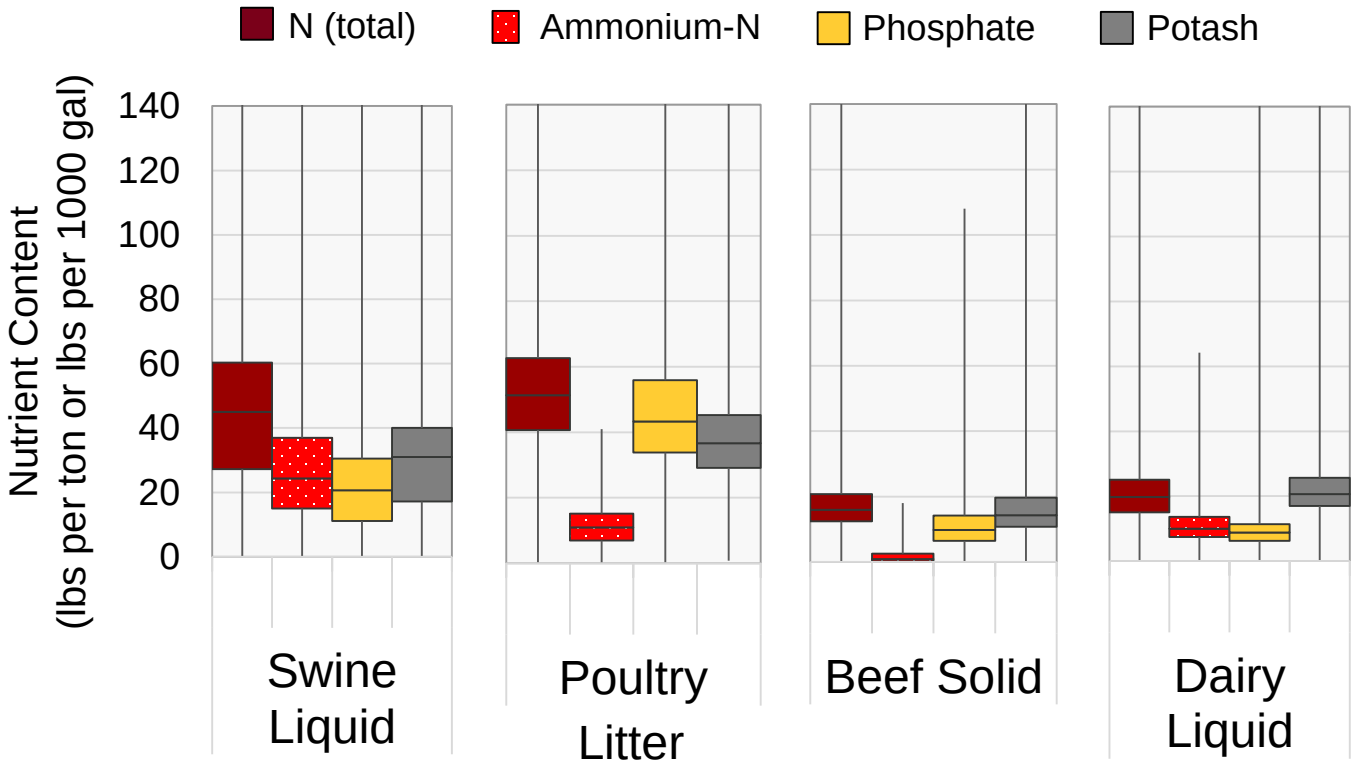


Nutrient ratio is fixed in manure

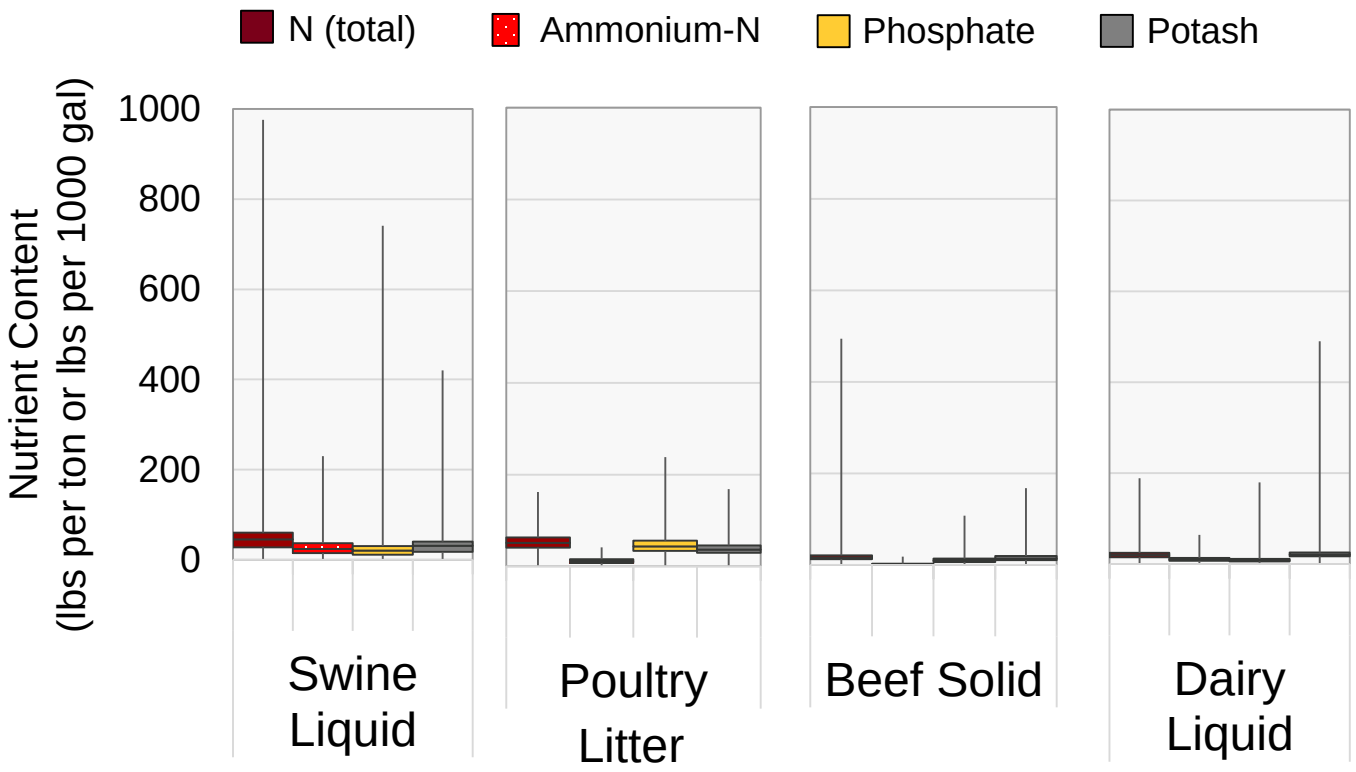
- Scenario:
  - Corn grain
    - Goal: 200 Bu/acre
  - Nutrient needs: 200-47-52
  - Poultry litter at 5 tons/acre into no-till
    - Nutrient content:
      - 151-426-421



2. Nutrient Content Varies by Animal Type



Nutrient Content Varies by Animal Type



Manure application is complicated

3. Nutrient availability is difficult to estimate

Why aren't all nutrients available?

- Inorganic forms are immediately plant available
  - Examples of inorganic N = nitrate and ammonium
- Organic forms (nutrients bound to carbon) are not plant available
  - Must be broken down and released by microbes

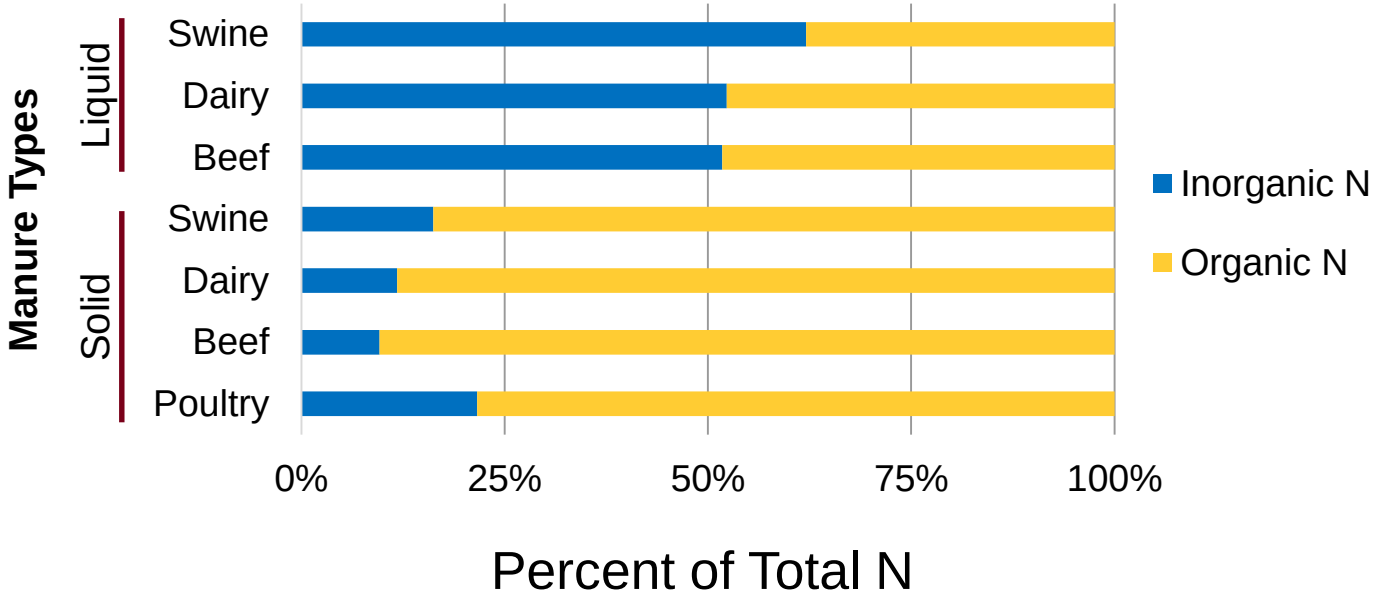
Manure application is complicated

3. Nutrient availability is difficult to estimate

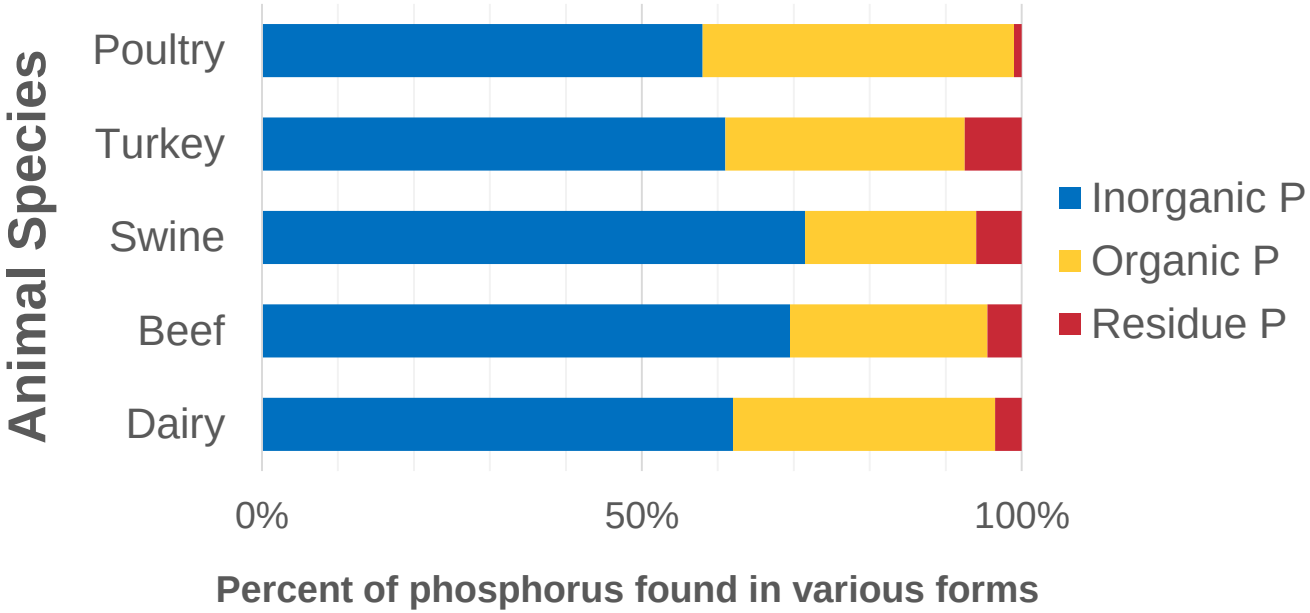
University of Minnesota Guidelines for Manure

Livestock Type	% Total N Available
Dairy year 1	55
Dairy year 2	25
Swine year 1	80
Swine year 2	15

Manure N Distribution

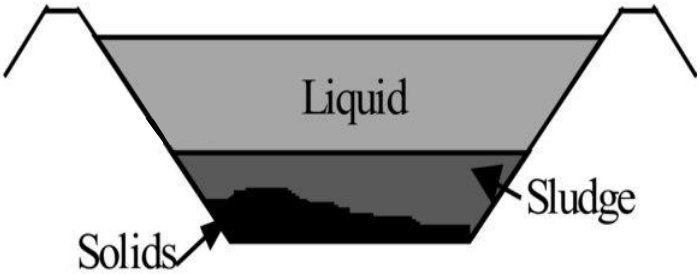


Manure P Distribution

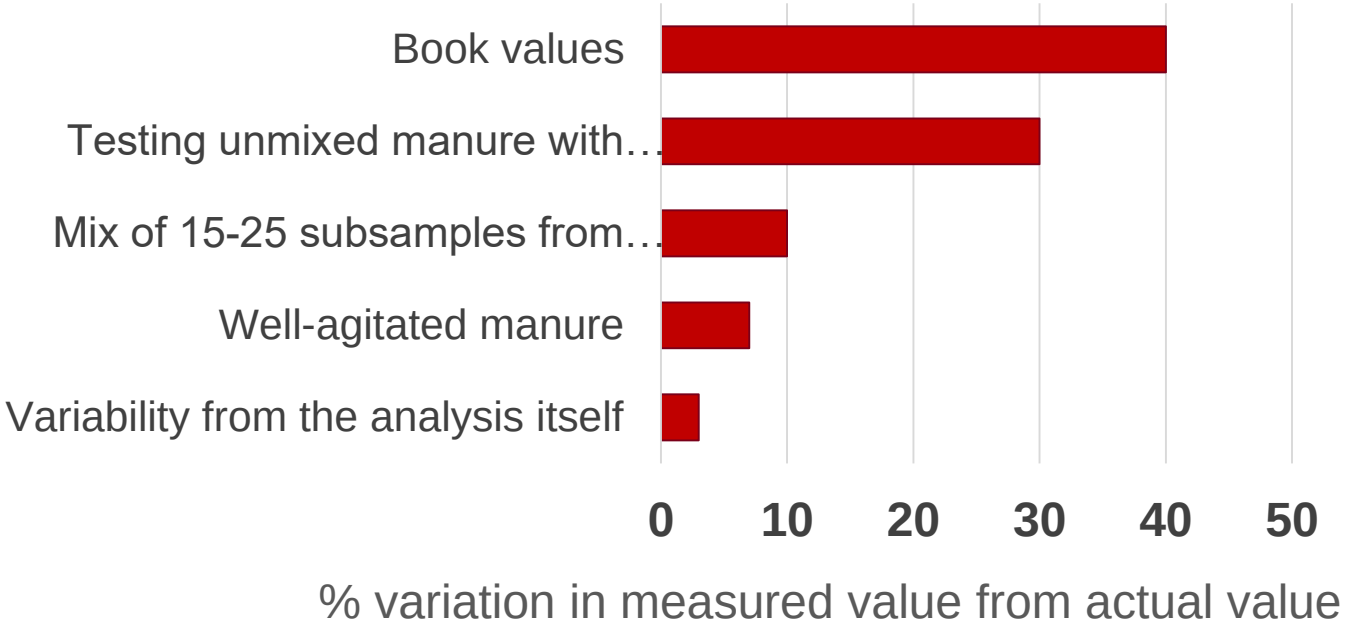


Manure application is complicated

4. Nutrient content is not uniform



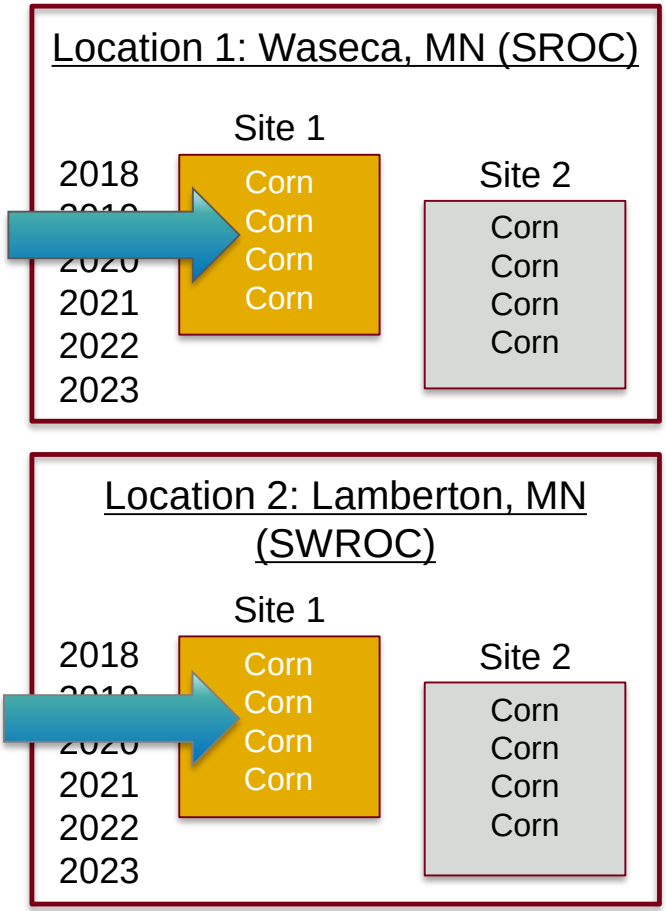
Variability declines when manure is tested and agitated



Taking credit for manure application:
On-going research

Field Experiments

- 2 locations with two sites each
- 6 types of manure
  - Applied all at N-based rate of 140 pounds of plant available N per acre
- Fertilizers (to develop response curve)
- Total treatments: 16



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Nutrient Rate Details

Year 1 Full N rate: 140 lbs N/acre	Years 2 – 4 Full N rate: 195 lbs N/acre
Manures applied at full available N rate per acre (6 plots)	Only K and S fertilizers applied (6 plots)
N fertilizers applied: N rate curve + full P and K (5 plots)	N fertilizers applied: N rate curve + full P and K (5 plots)
P fertilizers applied - P rate curve + full N and K (5 plots)	P fertilizers applied: P rate curve + full N and K (5 plots)

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Manure nutrient availability

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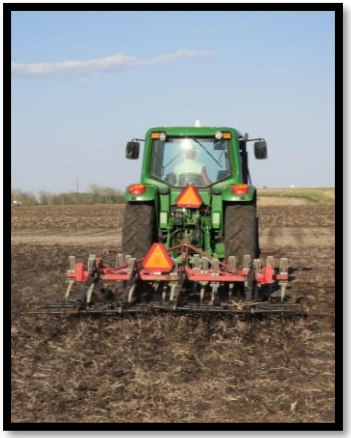
Manure nutrient availability



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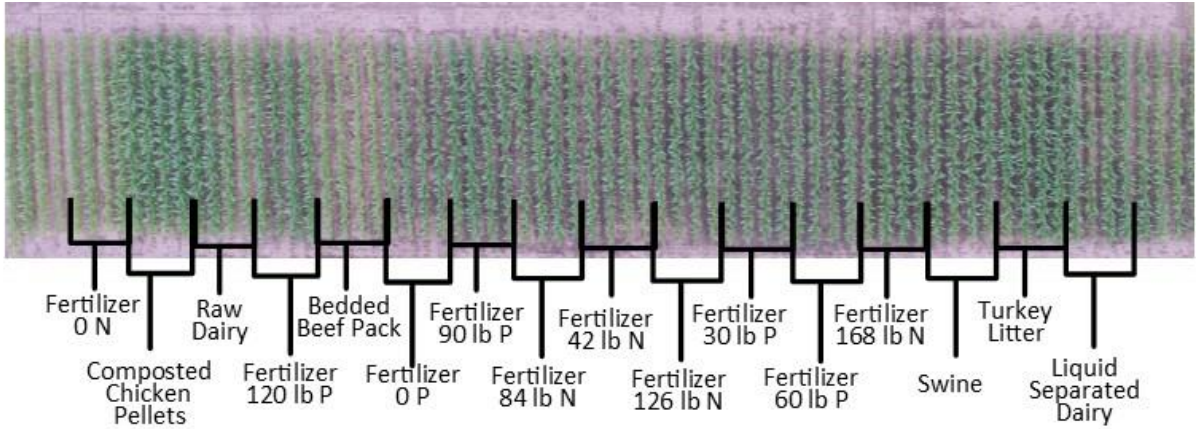
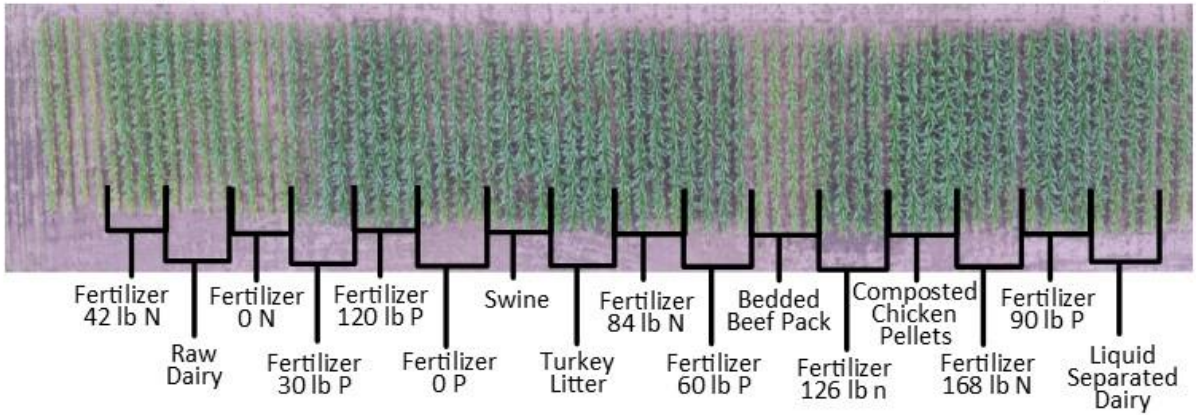
Manure nutrient availability

Picture taken June 18, 2018 at SROC

Funded by MN Ag Fertilizer Research and Education Council

June 28, 2018 at SWROC





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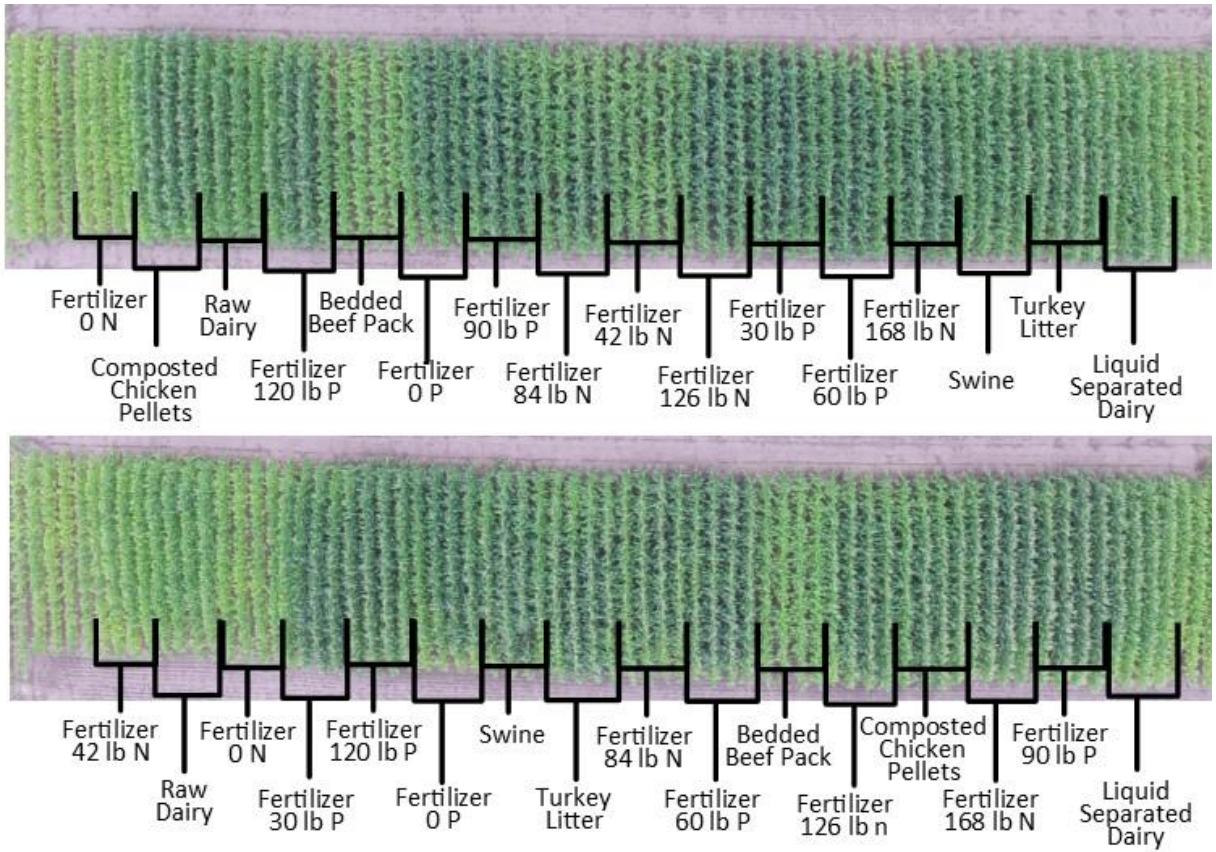
July 26, 2018 at SWROC



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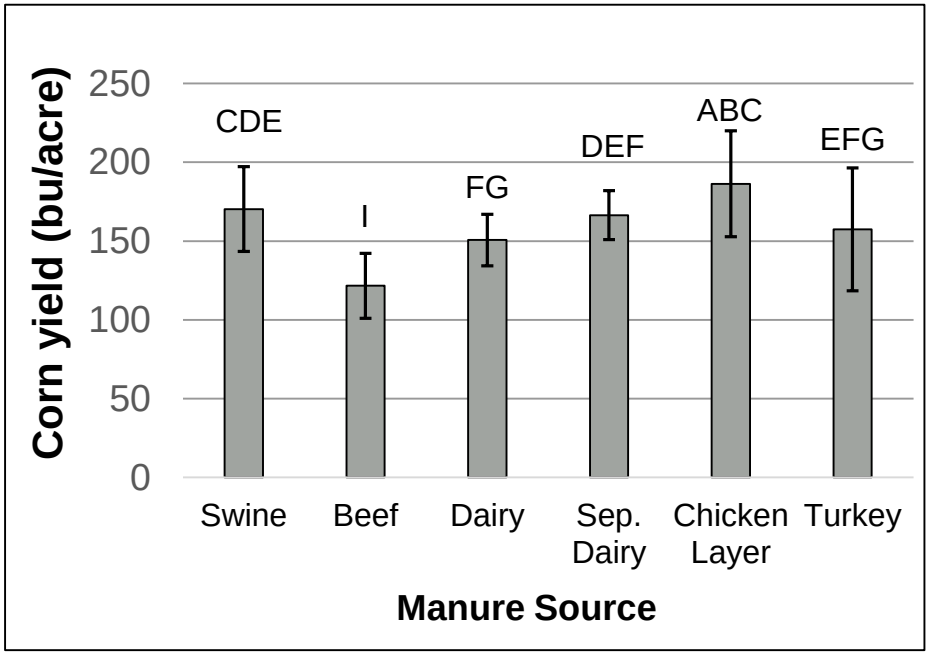
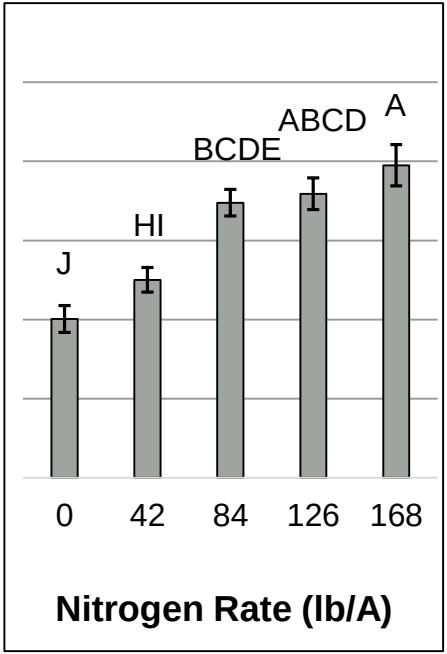
SROC CORN YIELDS 2018 – 2019

- Average yields for 1st year of rotation (2 sites)





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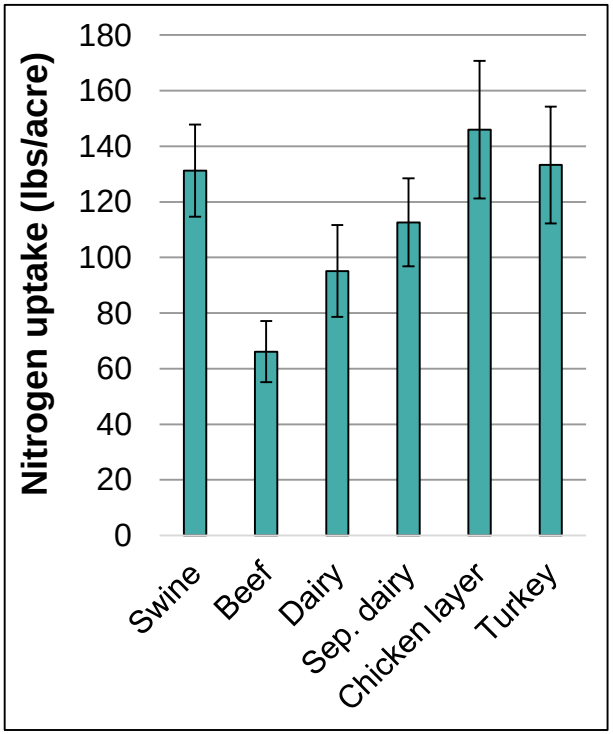
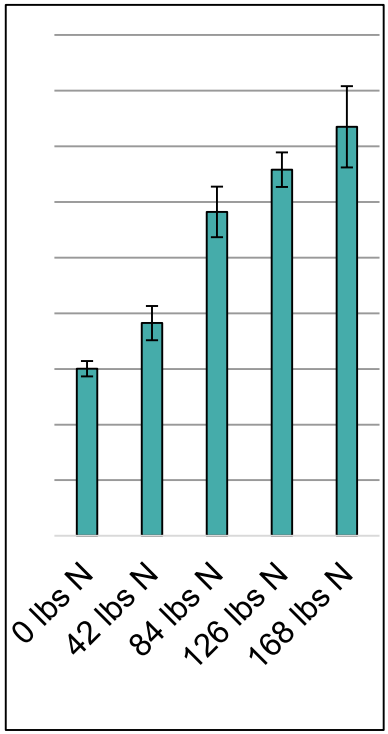
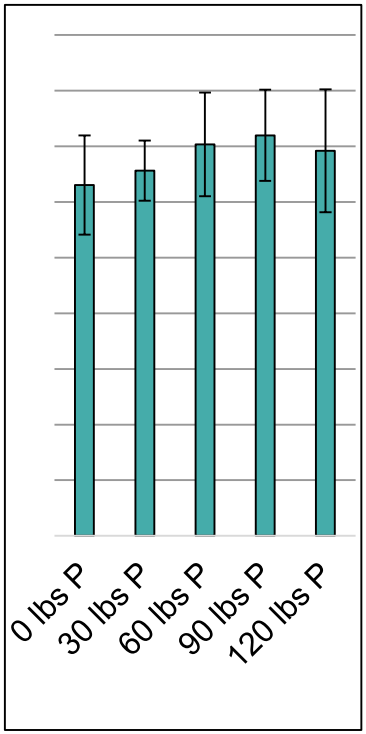
Total N Uptake – SROC 2018







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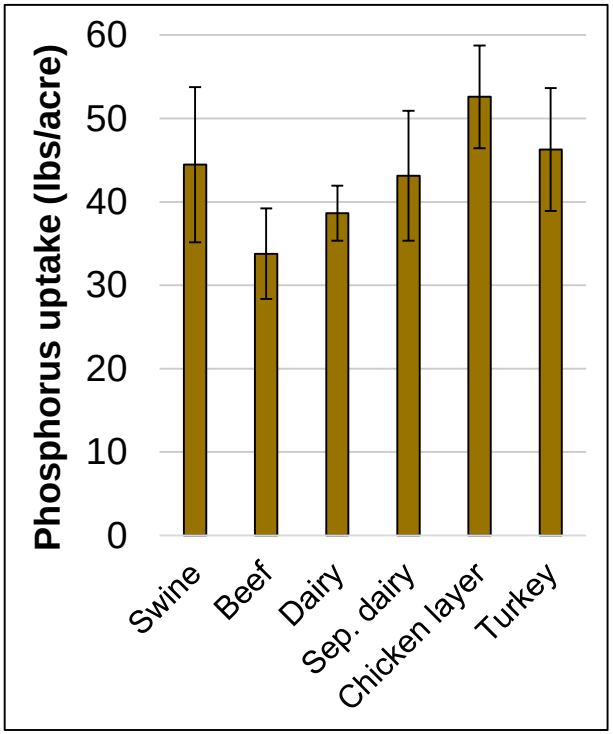
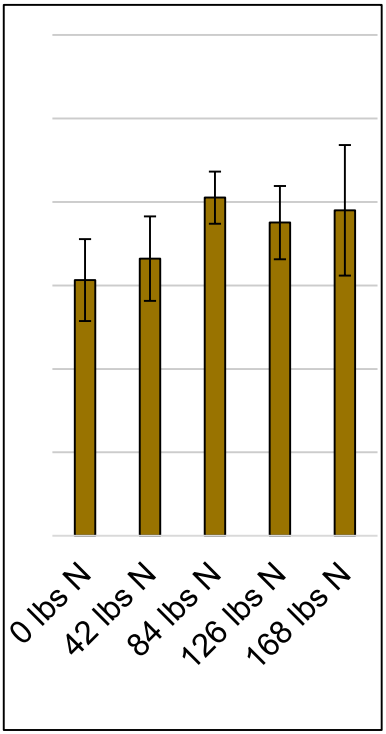
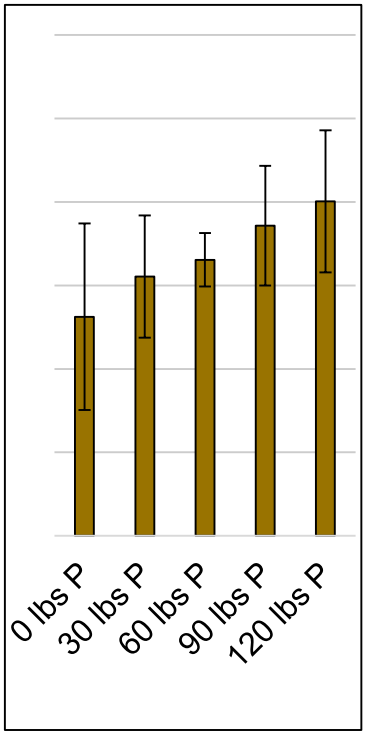
Total P Uptake – SROC 2018







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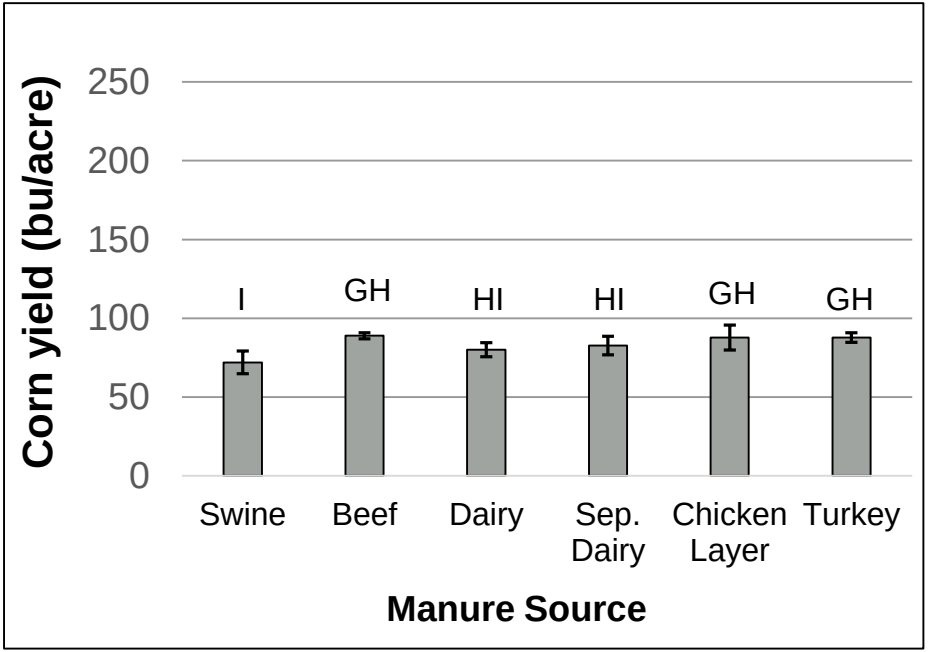
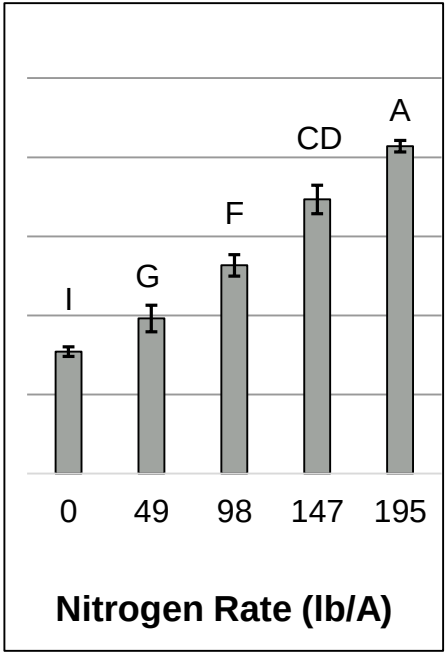
SROC Corn Yields 2019 – Site 1

- 2nd year of rotation (no manure applied)





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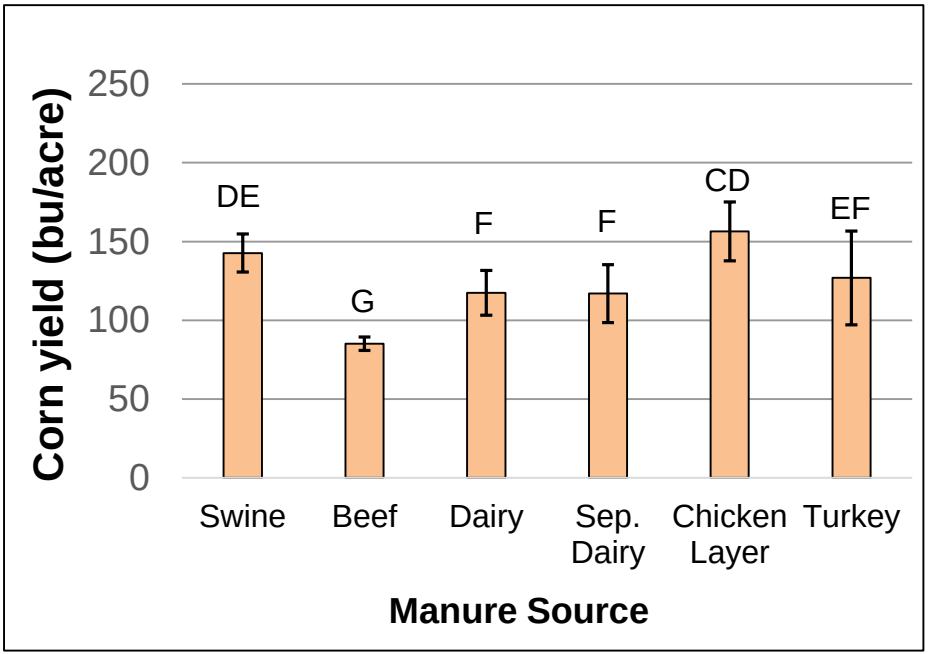
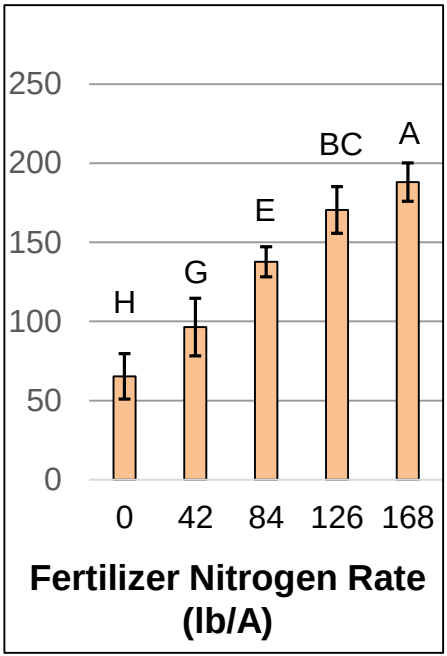
SWROC Corn Yields 2018 – 2019

- Average yields for 1st year of rotation (2 sites)





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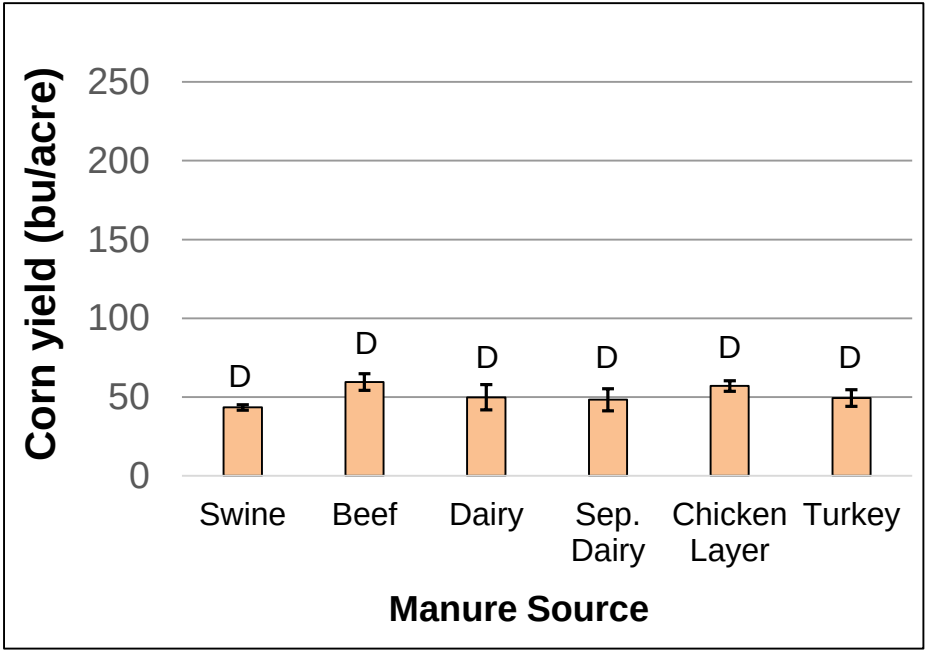

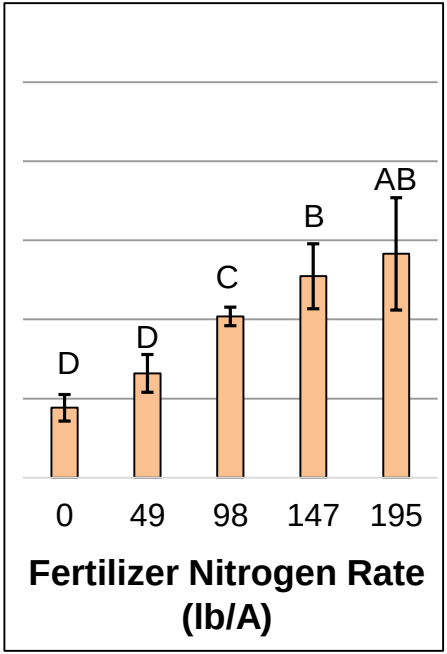

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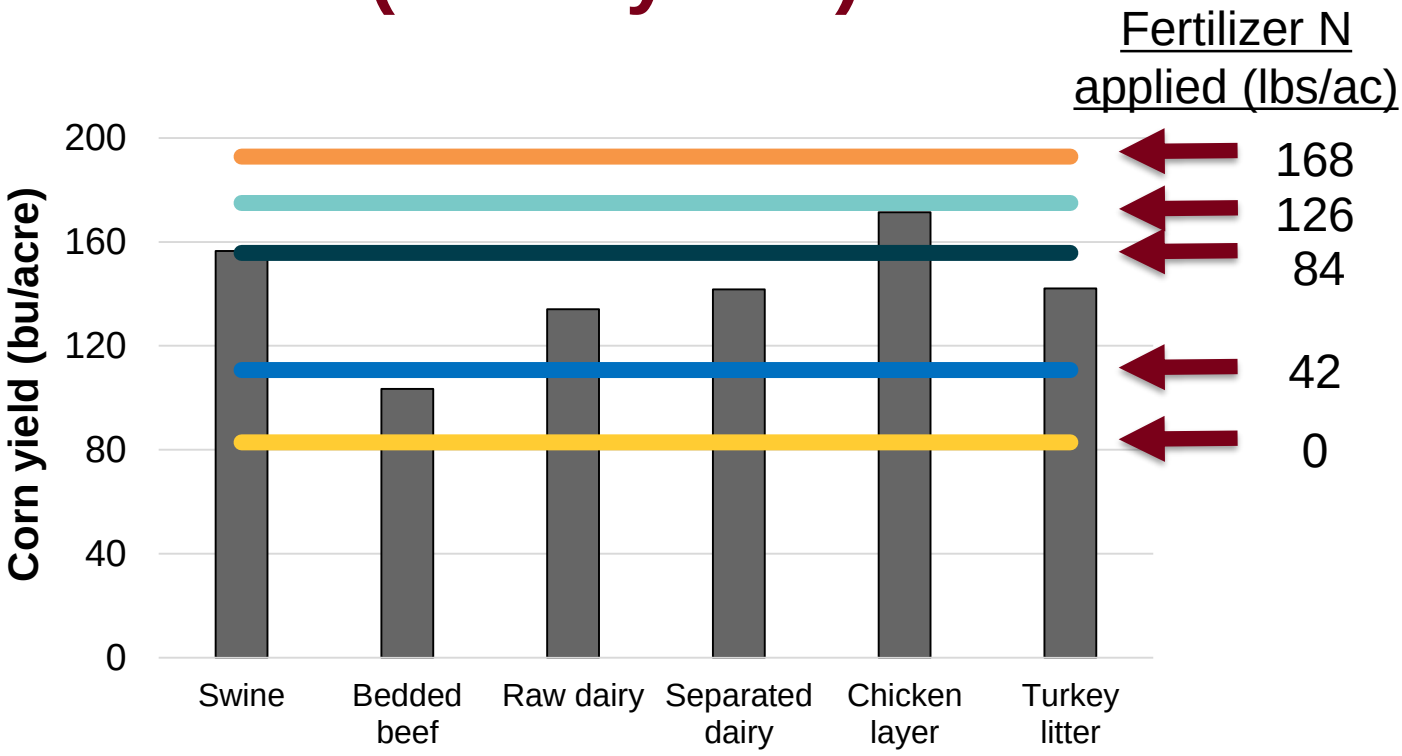
Average Yields For First-Year Manure (4 site-years)



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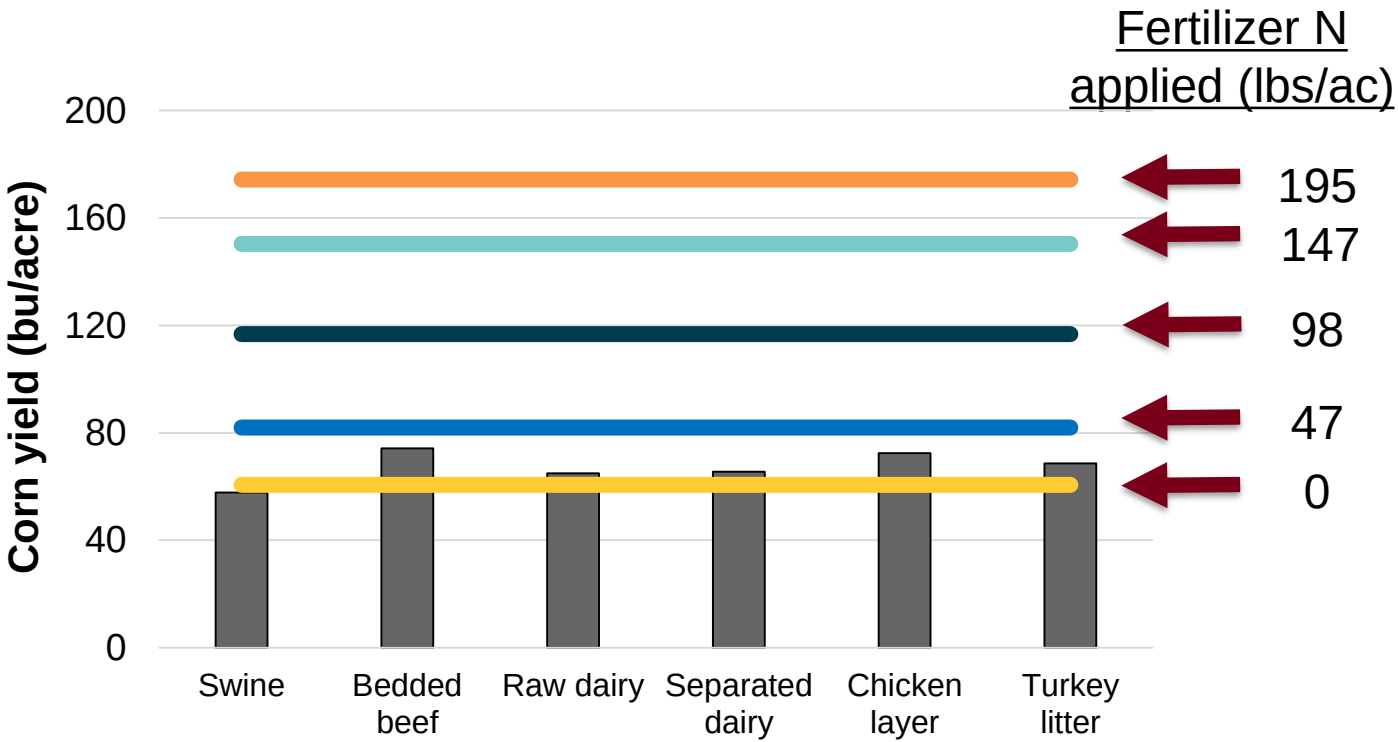
Average Yields For Second-Year Manure (2 site-years)



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Take Home Messages

- After two **VERY WET** years:
  - First-year yields with manure were lower than expected
    - Lower mineralization than expected?
  - Second-year yields with manure were higher than no-N fertilizer controls, except with swine manure

- Where did the N and P go?
  - Still need to evaluate N and P plant uptake as well as in-season soil samples

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Covering it up: Cover crops with fall manure application

Slurry Seeding in Michigan

Photo credit: No-till Farmer

Slurry Seeding in Michigan

- Combine these things in one pass:
  - Tillage
  - Manure application
  - Cover crop seeding

Slurry Seeding

- Findings:
  - Manure decreases germination

Forage Rape

Orchard Grass

Slurry Seeding

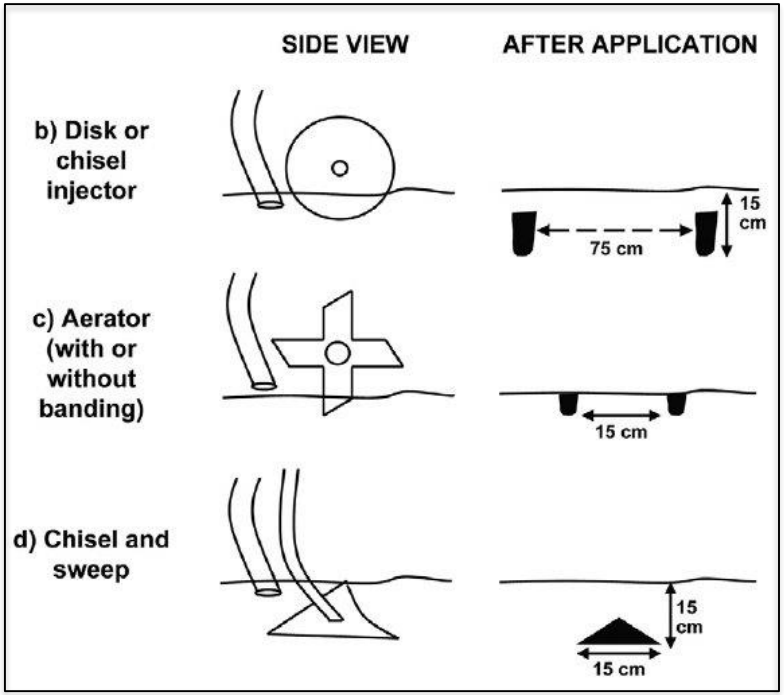
"What doesn't kill you…"

- Findings:
  - Overall biomass of manure slurry seeded crops was often higher than drilled covers

- Seeded: Sep 1
- Harvested: Dec 5

Slurry Seeding in Michigan

- Need to use low disturbance applicator
  - Some form of in-tank agitation
- What crops?
  - Haven't had luck with red clover

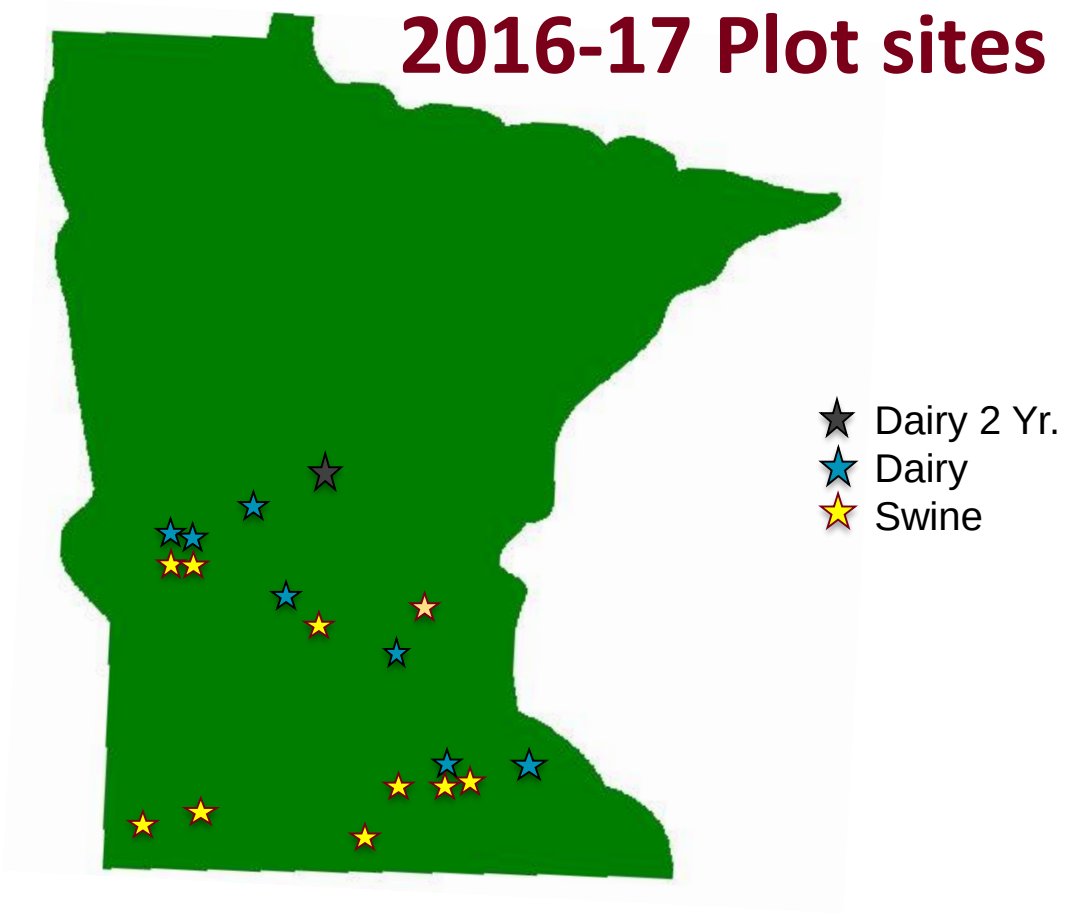


Liquid Manure + Cover Crops

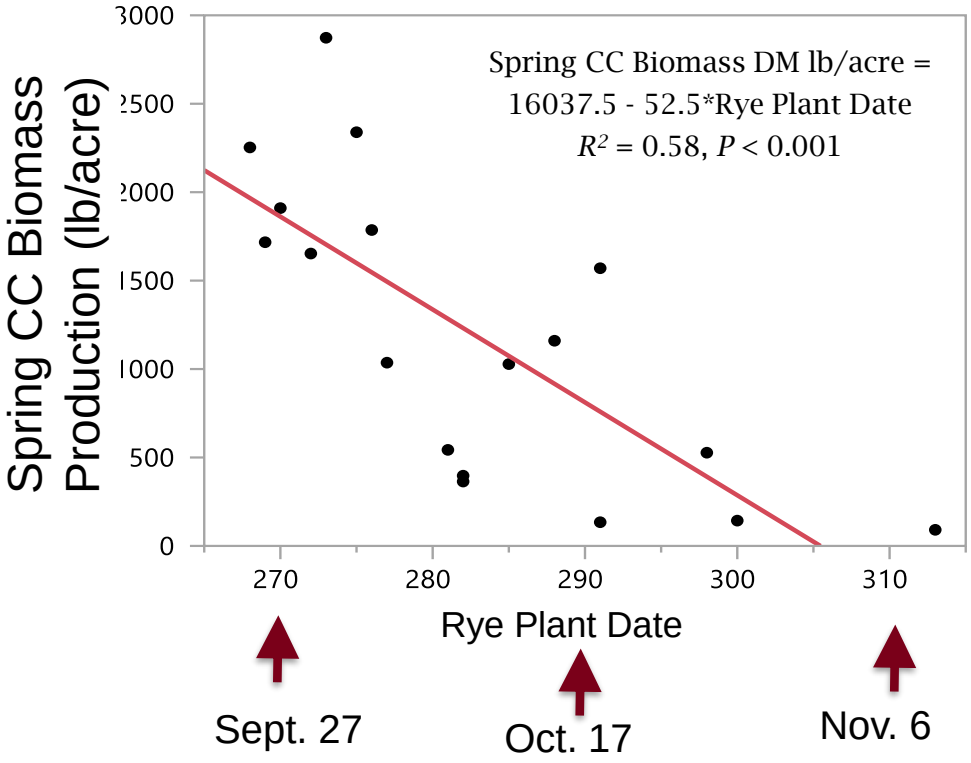
Liquid manure + Cover Crops Project

- Details:
  - Planted rye CC after harvest then injected liquid manure
  - Terminated rye in spring
    - Measured soil nitrate in top 24” of soil and in rye
  - Harvested following corn grain or silage next fall
    - Measured corn yield and nitrogen uptake
  - 2 crop years

2016-17 Plot sites



Rye biomass production



- About 330 pounds of biomass was lost for each week of seeding delay

Deep Shanks

After injection in the fall

Following spring

Double Disks

After injection in the fall

Following spring

Knife Injection

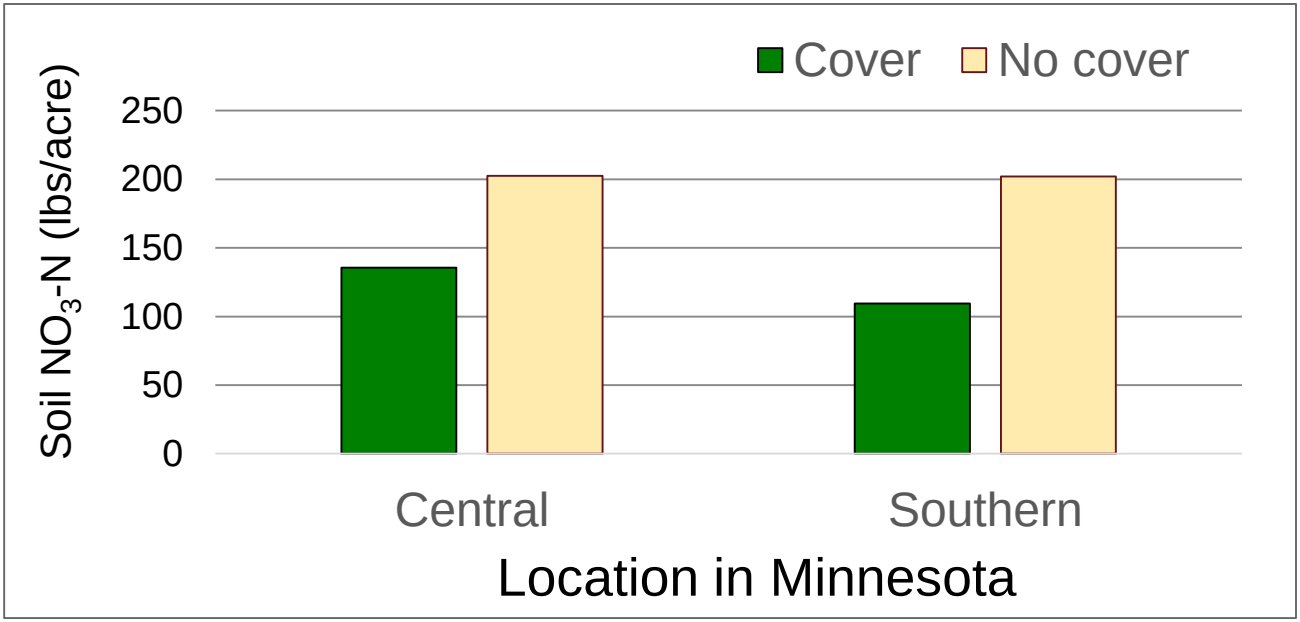
Two weeks after injection

Following spring

Sweep Injection

- Narrow sweeps minimized disturbance of surface soil but allowed manure infiltration

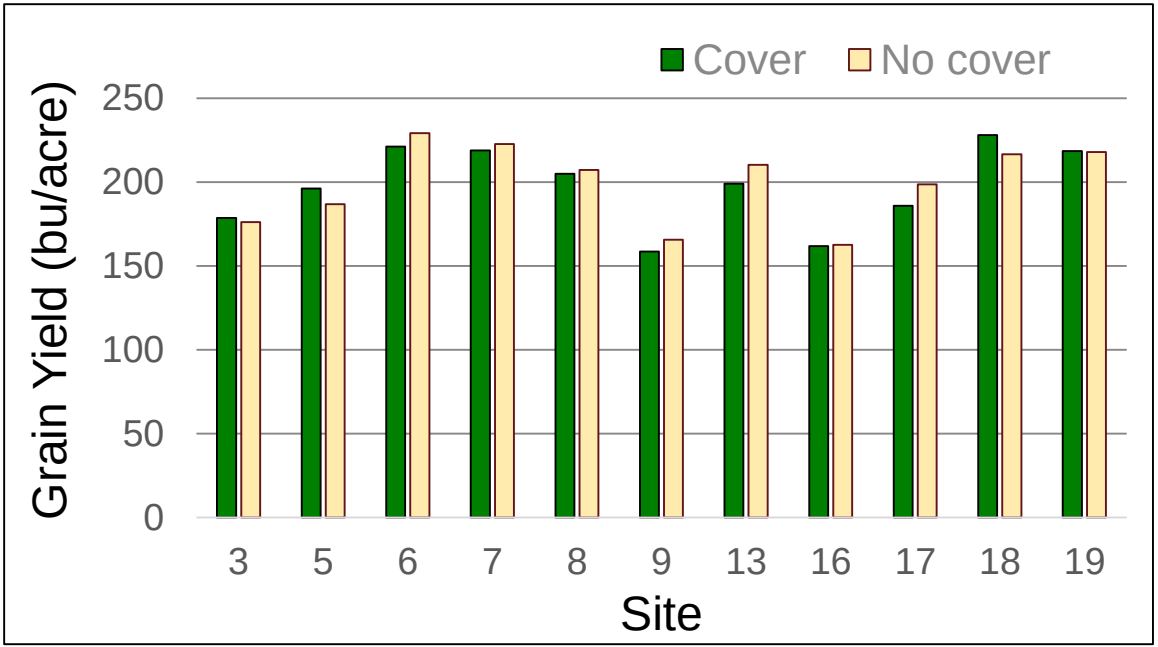
Spring soil 24” Nitrate (NO_3-N)

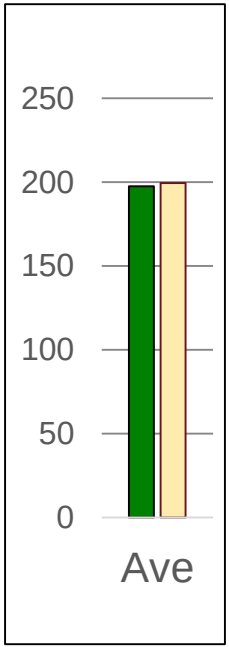


Cover Crop: 123 lbs. NO_3-N/Acre
No Cover: 202 lbs. NO_3-N/Acre

Difference: 79 lbs. NO_3-N/Acre

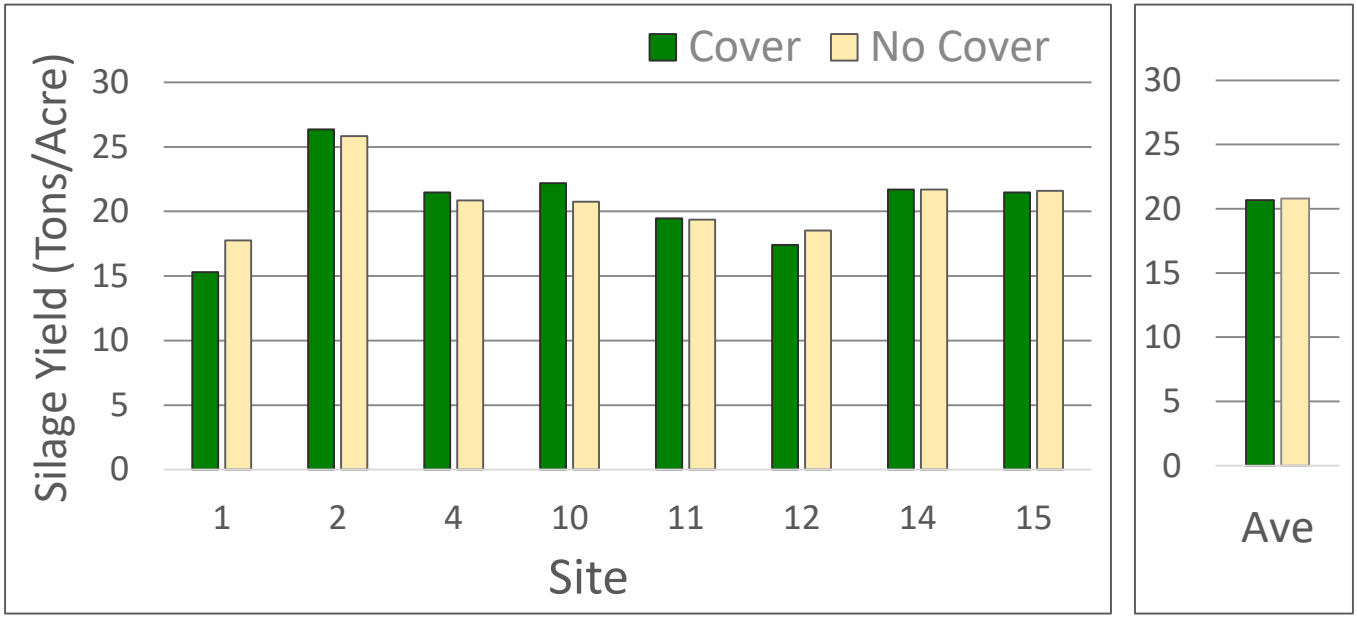
Grain Yield at 15% Moisture





Cover Crop: 197.5 bu/acre
No Cover: 199.4 bu/acre

Silage Yield at 65% Moisture



Cover Crop: 20.7 Tons/acre
No Cover: 20.8 Tons/acre

Take Home Messages

- Injection equipment matters!
  - Knives and sweeps seemed to minimize surface disturbance
- Winter rye conserves manure nitrogen and can potentially reduce N losses
- On average, corn yields were not impacted following cover crops and manure
  - Any given field in a year could see a yield increase or decrease, however

New Research

- Cover crop seeding methods + 2 manure application timings
  - Interseeding vs drilling after harvest
  - Early vs late applied manure

NRCS MinnesotaCorn RESEARCH & PROMOTION COUNCIL

Thanks! Questions?

Contact Info: mlw@umn.edu | Follow me on twitter: @ManureProf

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