



UNIVERSITY OF MINNESOTA EXTENSION

Driven to DiscoverSM

Manure nutrient availability research and testing methods update

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MAKING A DIFFERENCE IN MINNESOTA: ENVIRONMENT + FOOD & AGRICULTURE + COMMUNITIES + FAMILIES + YOUTH

History of Manure Availability Factors

Generated
in the 1990s



Based on total
N and P content
of manure



Averaged over manure
types and handling
systems (liquid vs solid)

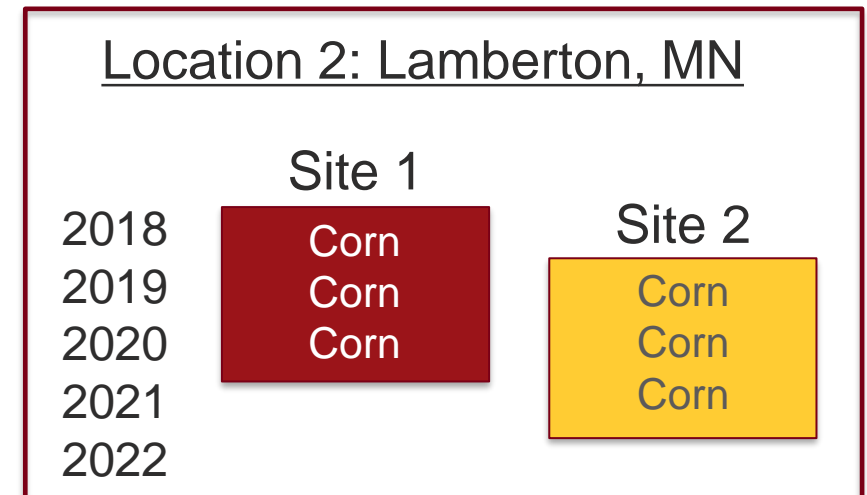
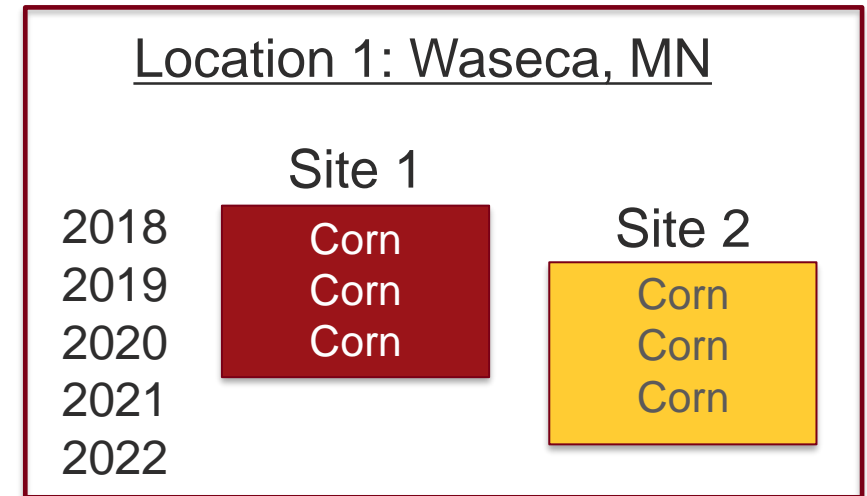


Percent of total nitrogen available per year

Year Available	<u>Broadcast + Timing of Incorporation</u>			<u>Injection</u>	
	> 96 hours	12-96 hours	< 12 hours (includes double disks)	Sweep	Knife/Disk
Beef					
1	25	45	60	60	50
2	25	25	25	25	25
Dairy					
1	20	40	55	55	50
2	25	25	25	25	25
Swine					
1	35	55	75	80	70
2	15	15	15	15	15
Poultry					
1	45	55	70	n/a	n/a
2	25	25	25	n/a	n/a

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



Nutrient Rate Details

Year 1 Full N rate: 140 lbs N/acre	Years 2 – 3 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)

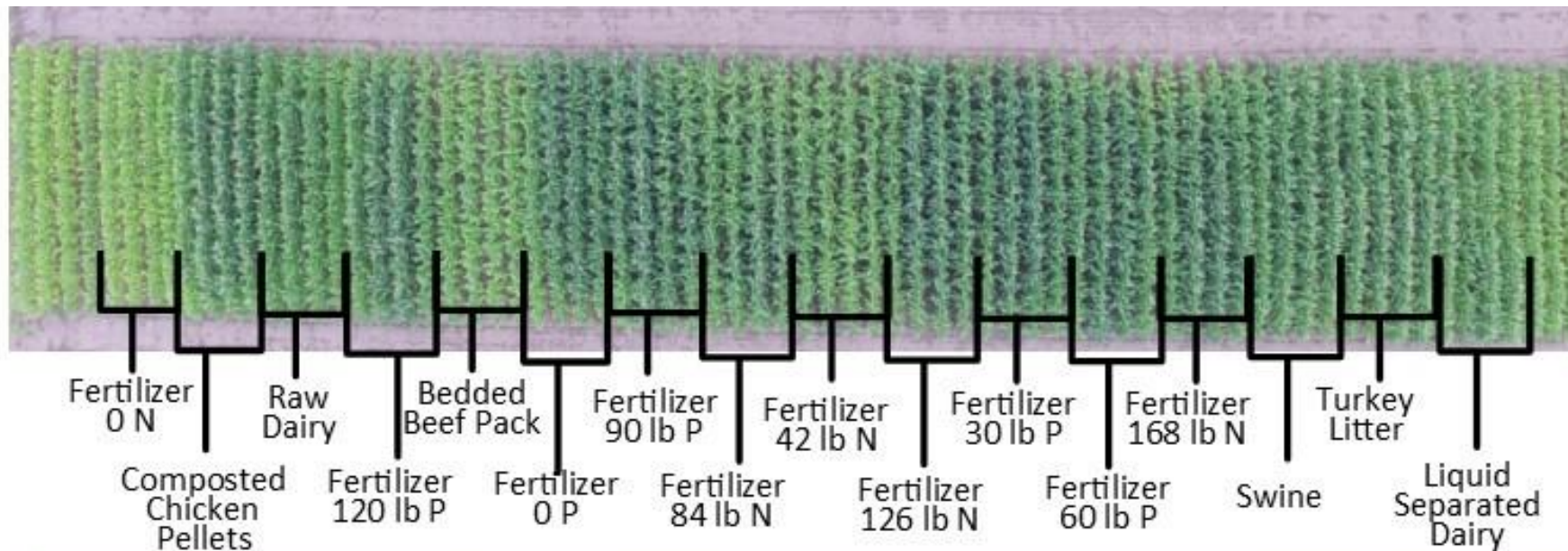
Manure nutrient availability



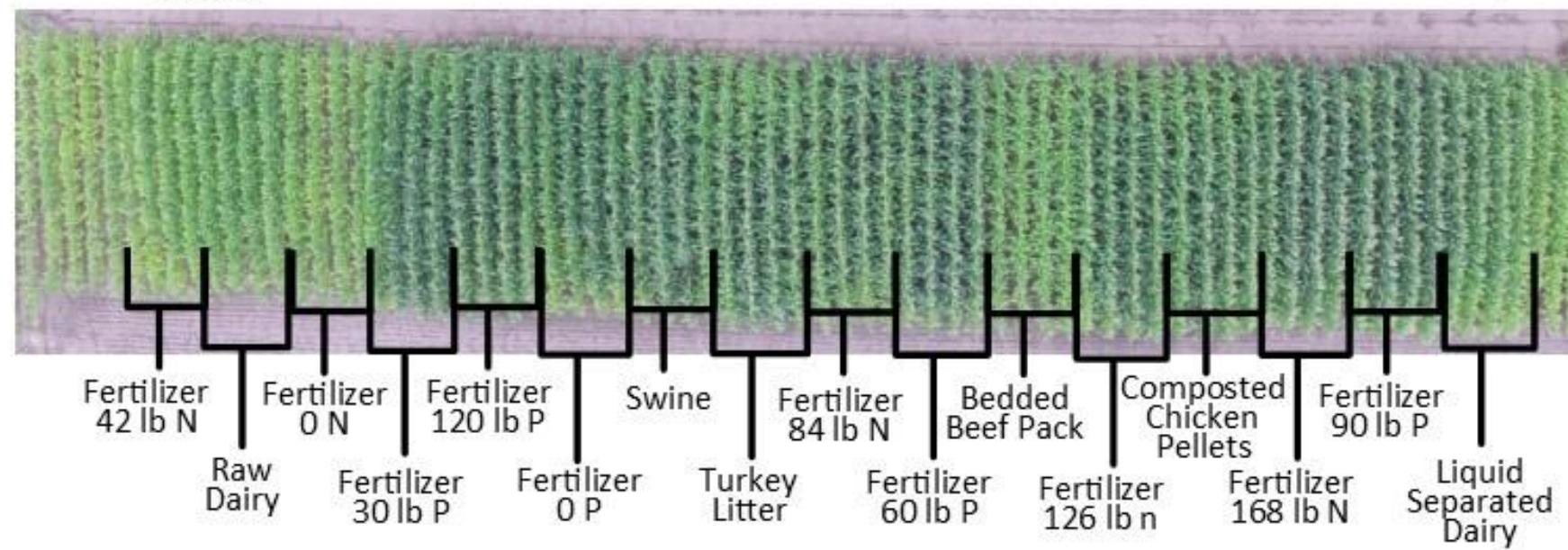
Picture taken
June 18, 2018 at
SROC

July 26, 2018 at SWROC

Rep 2

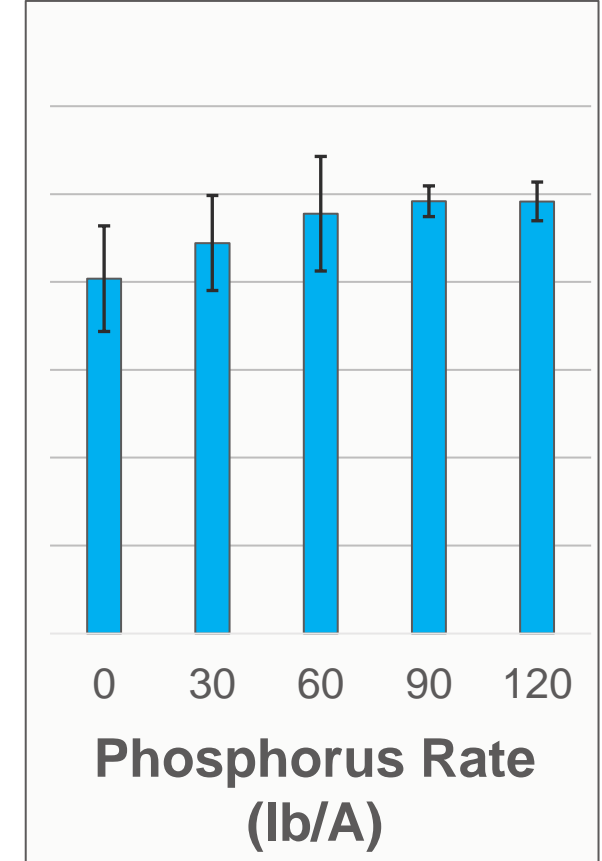
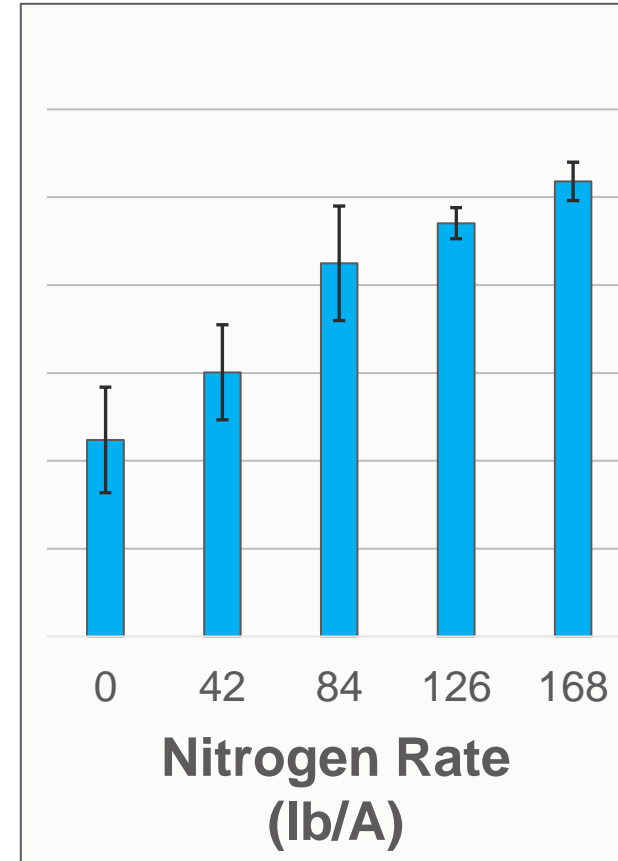
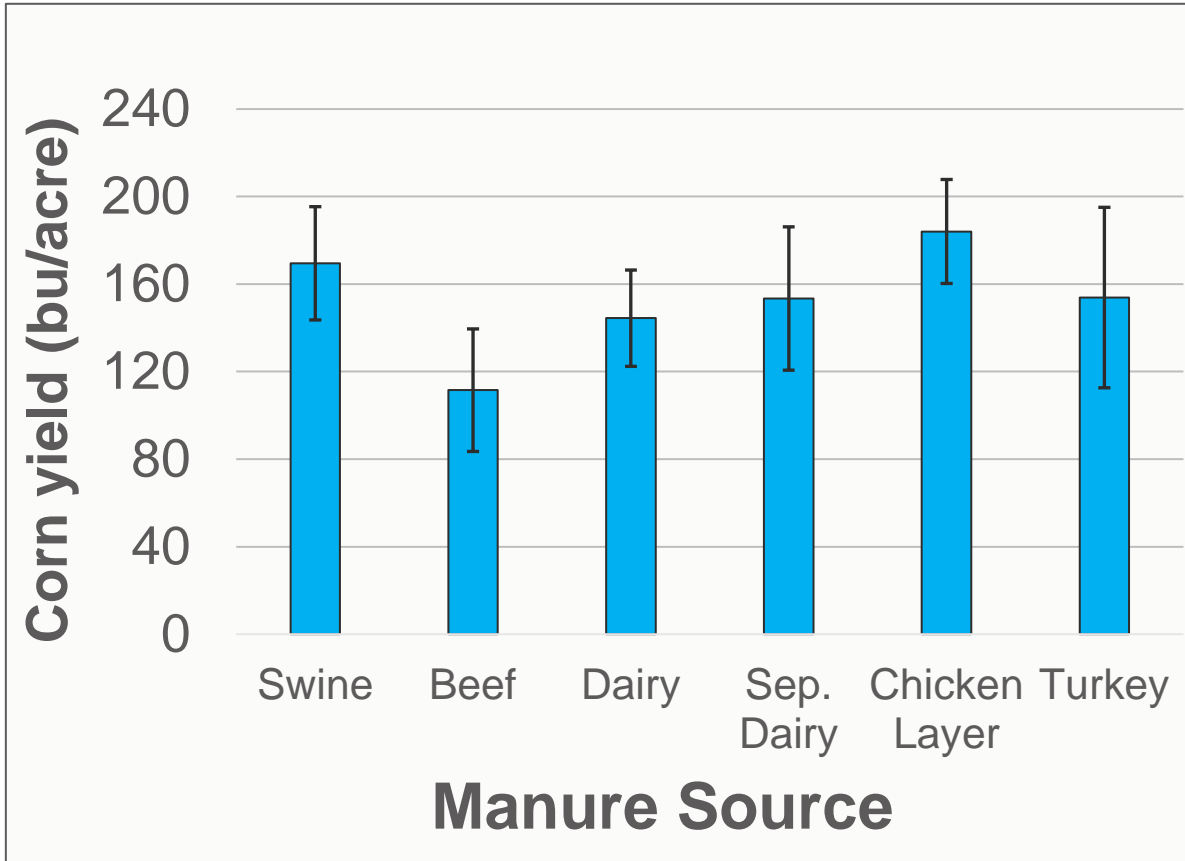


Rep 1



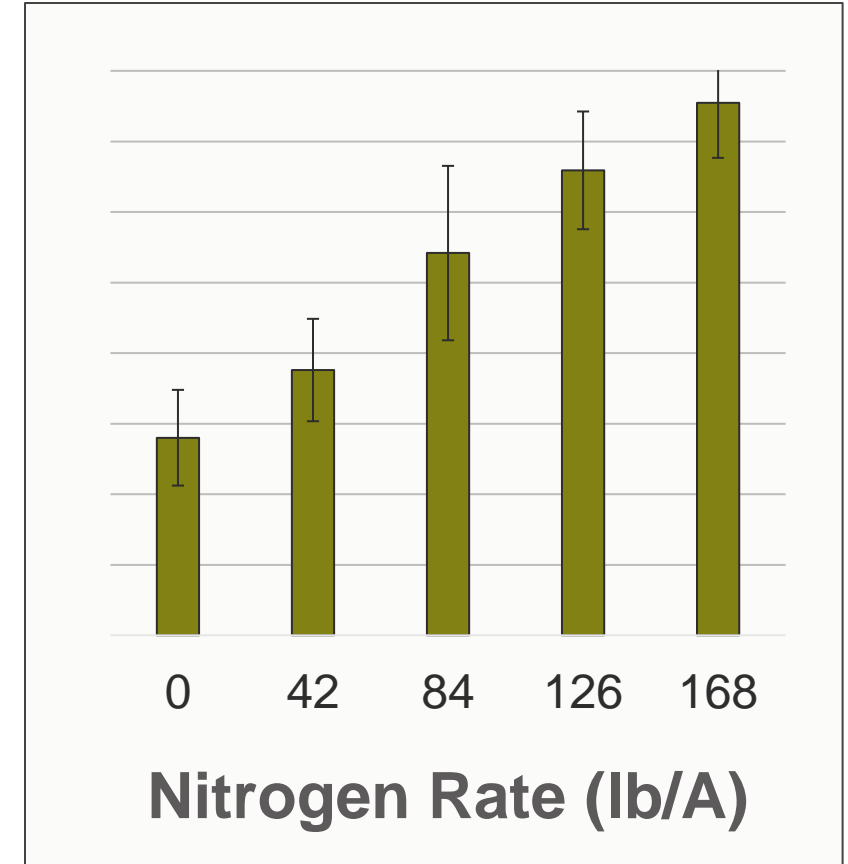
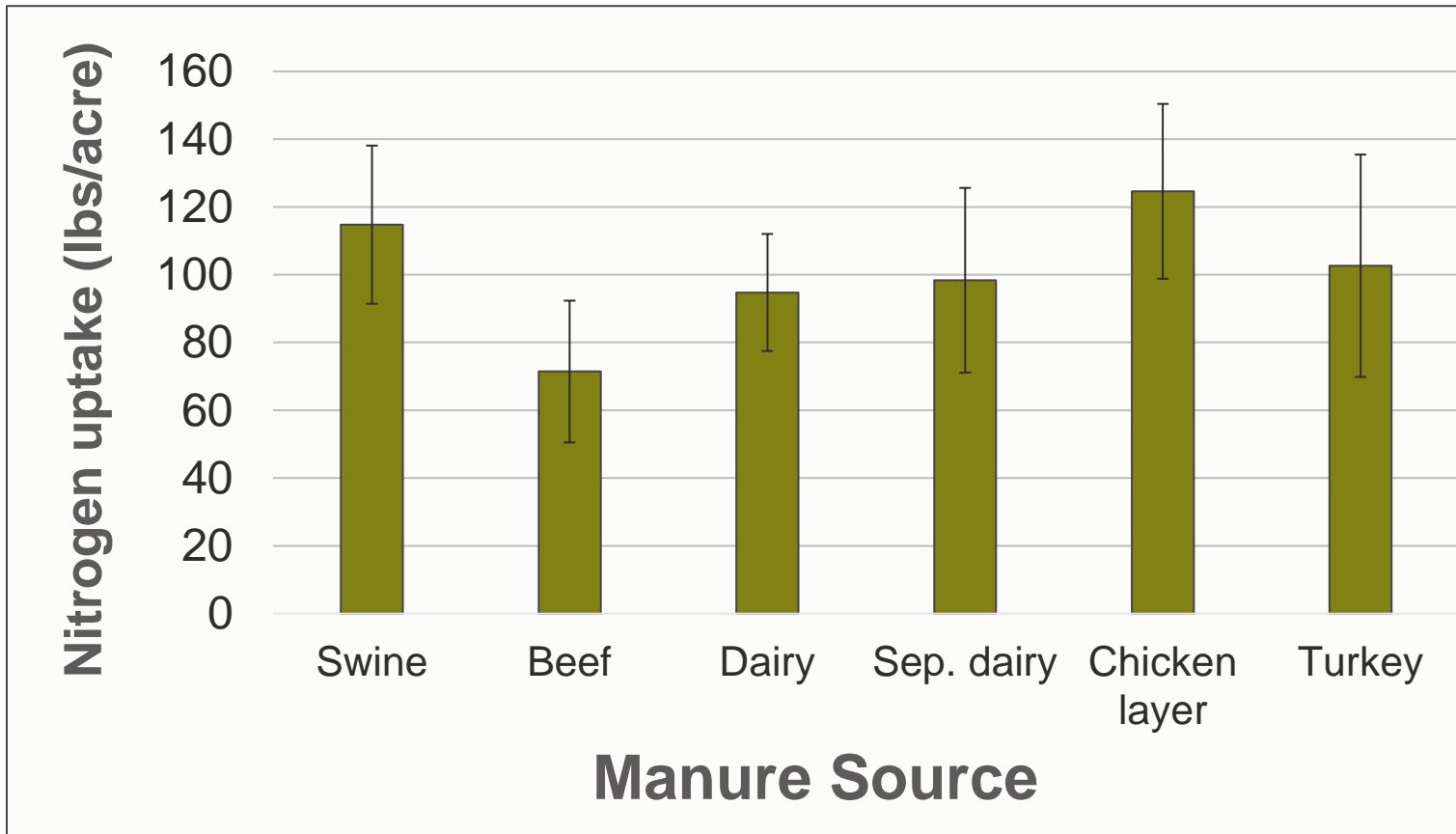
Corn yield – year of manure application

- 1st year of rotation (corn followed soybean)



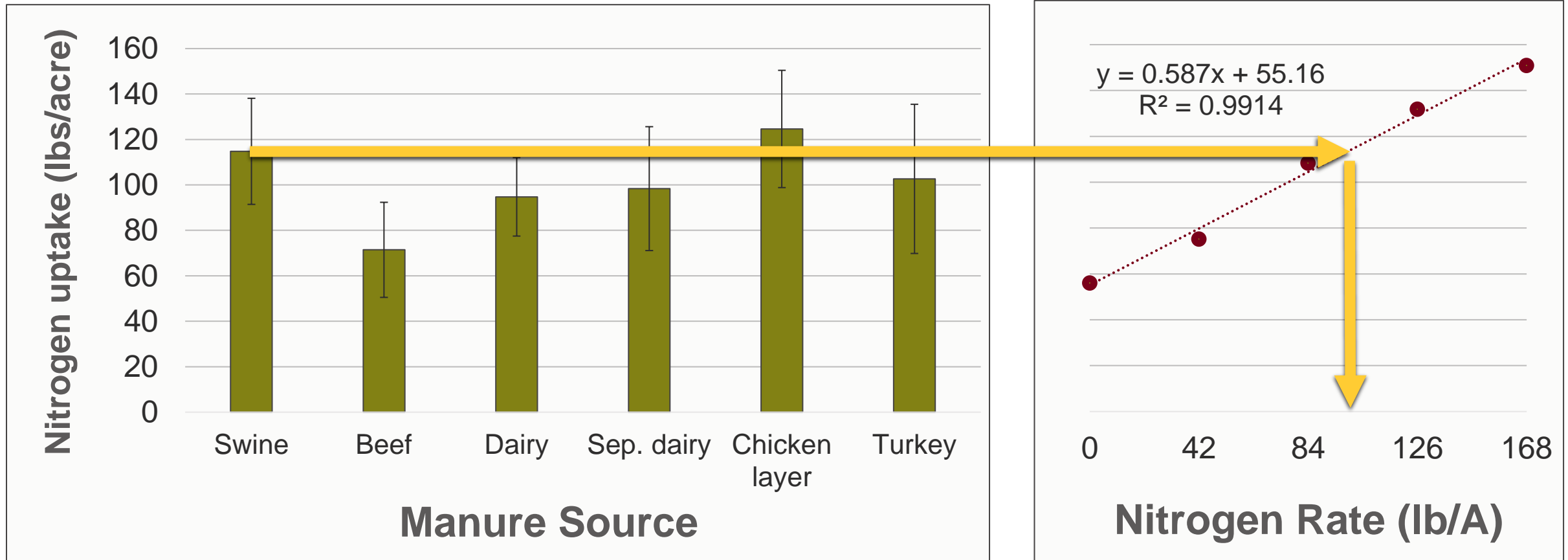
Total nitrogen uptake in corn

- 1st year of rotation



Calculating first year N fertilizer equivalence

- 1st year of rotation (manure applied)

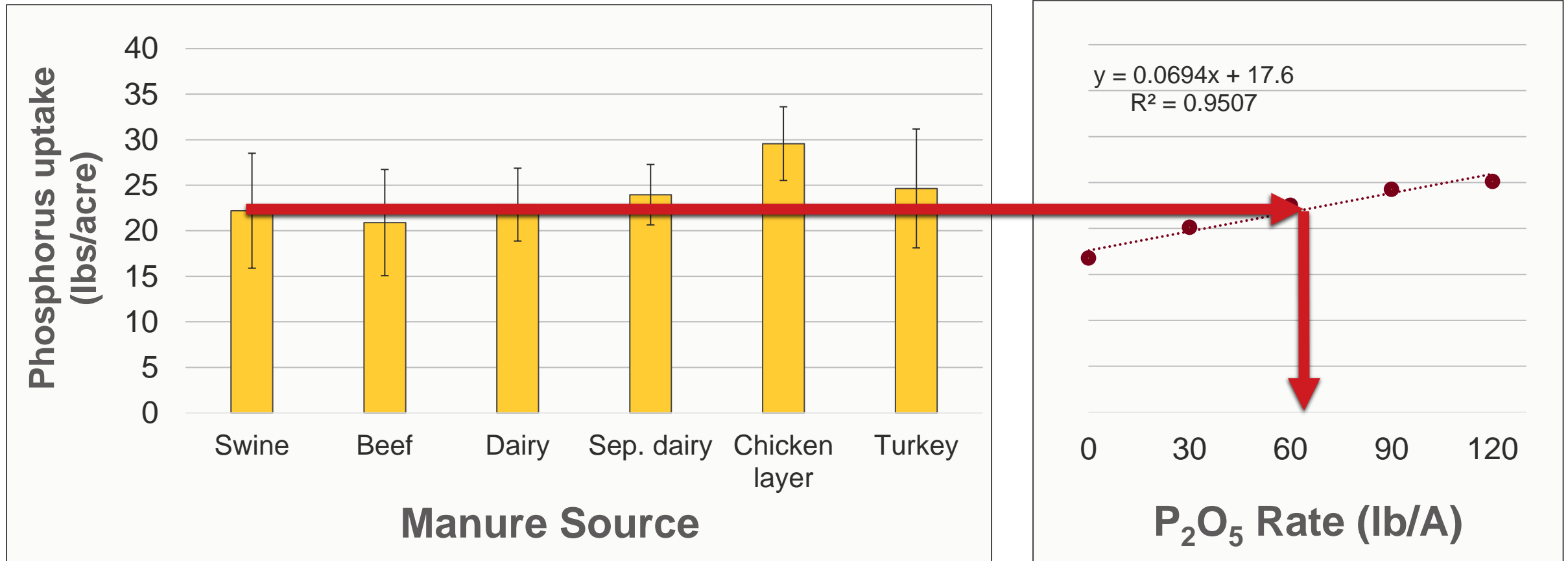


First year manure N fertilizer equivalence

Manure Source	N Fertilizer Equivalent Value (lbs N/acre)	% N available (NFEV/Total N applied)	Assumed %N available
Swine finisher	102	46%	75%
Bedded beef pack	29	10%	60%
Dairy raw	67	24%	55%
Dairy Separated	73	28%	55%
Chicken layer (composted)	118	34%	70%
Turkey Litter	81	34%	70%

Calculating first year P fertilizer equivalence

- 1st year of rotation (manure applied)

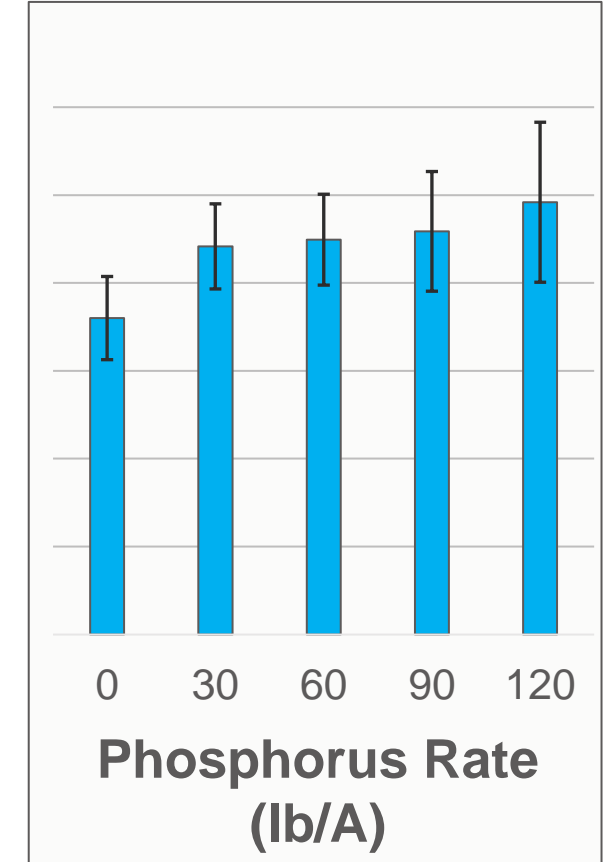
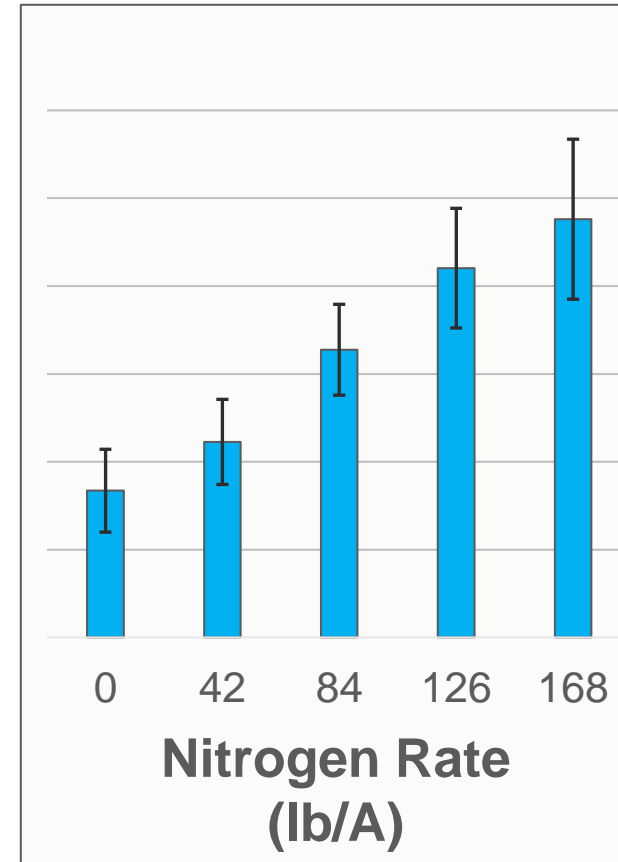
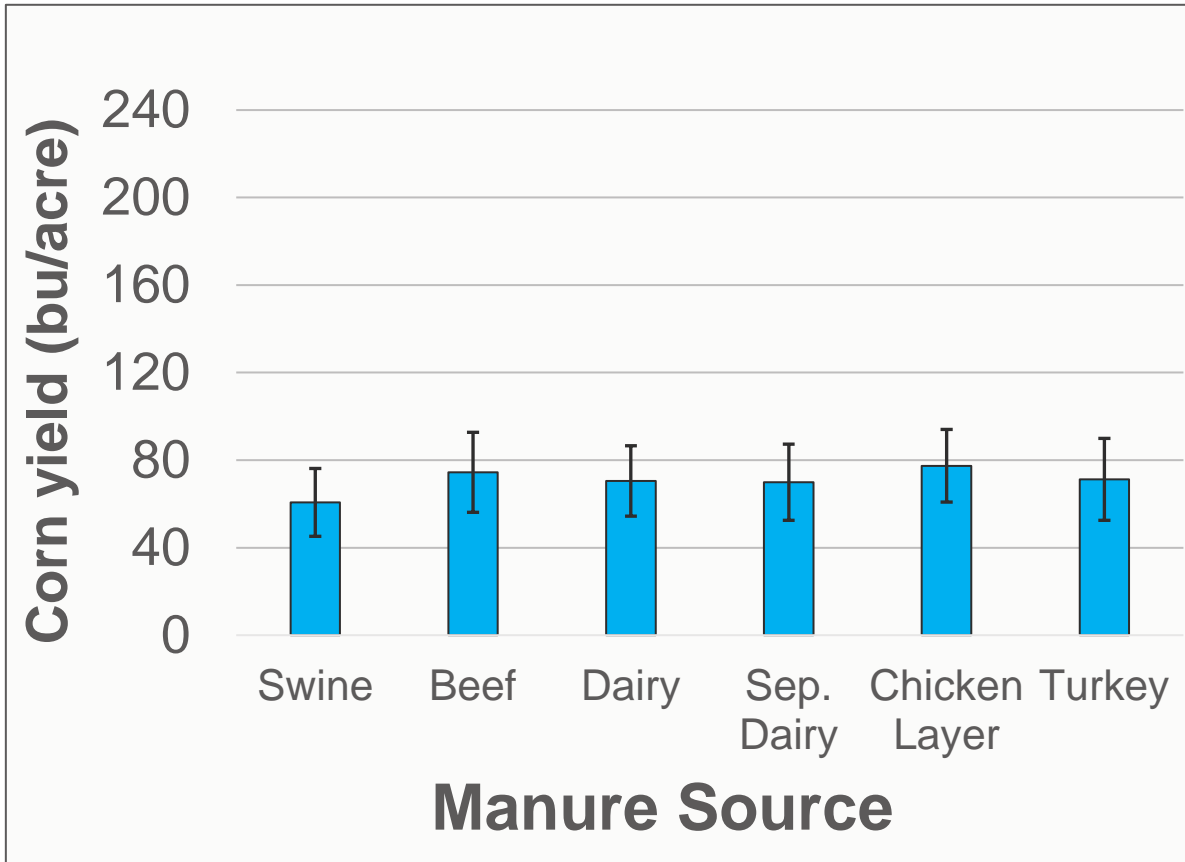


First year manure P fertilizer equivalence

Manure Source	P Fertilizer Equivalent Value (lbs P/acre)	% P available (PFEV/Total P applied)
Swine finisher	33	145%
Bedded beef pack	21	32%
Dairy raw	34	73%
Dairy Separated	38	69%
Chicken layer (composted)	77	39%
Turkey Litter	47	46%

Corn yield – second year after manure

- 2nd year of rotation (corn after corn)

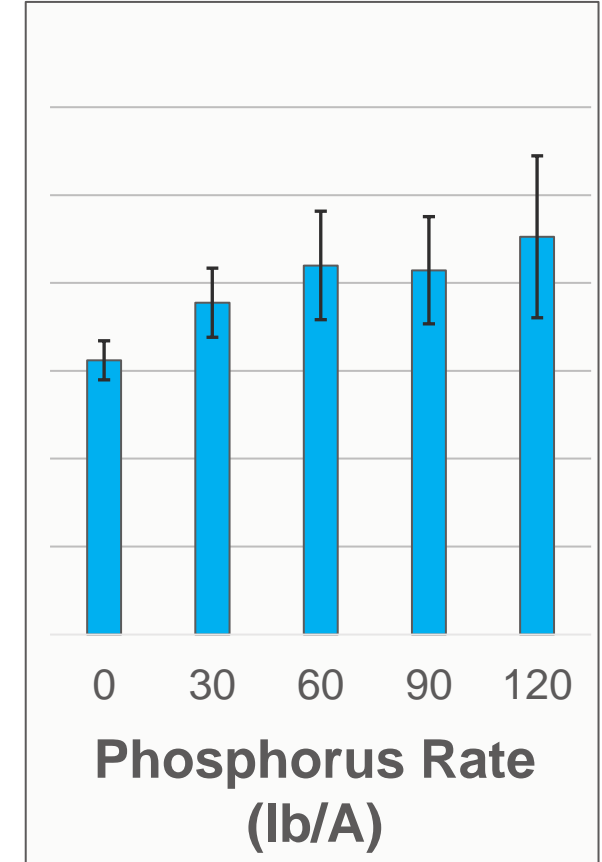
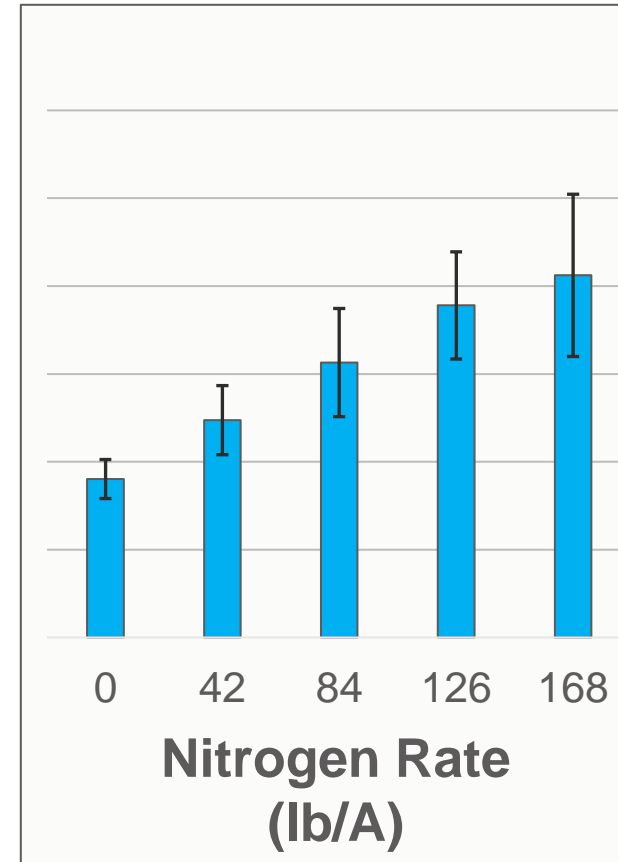
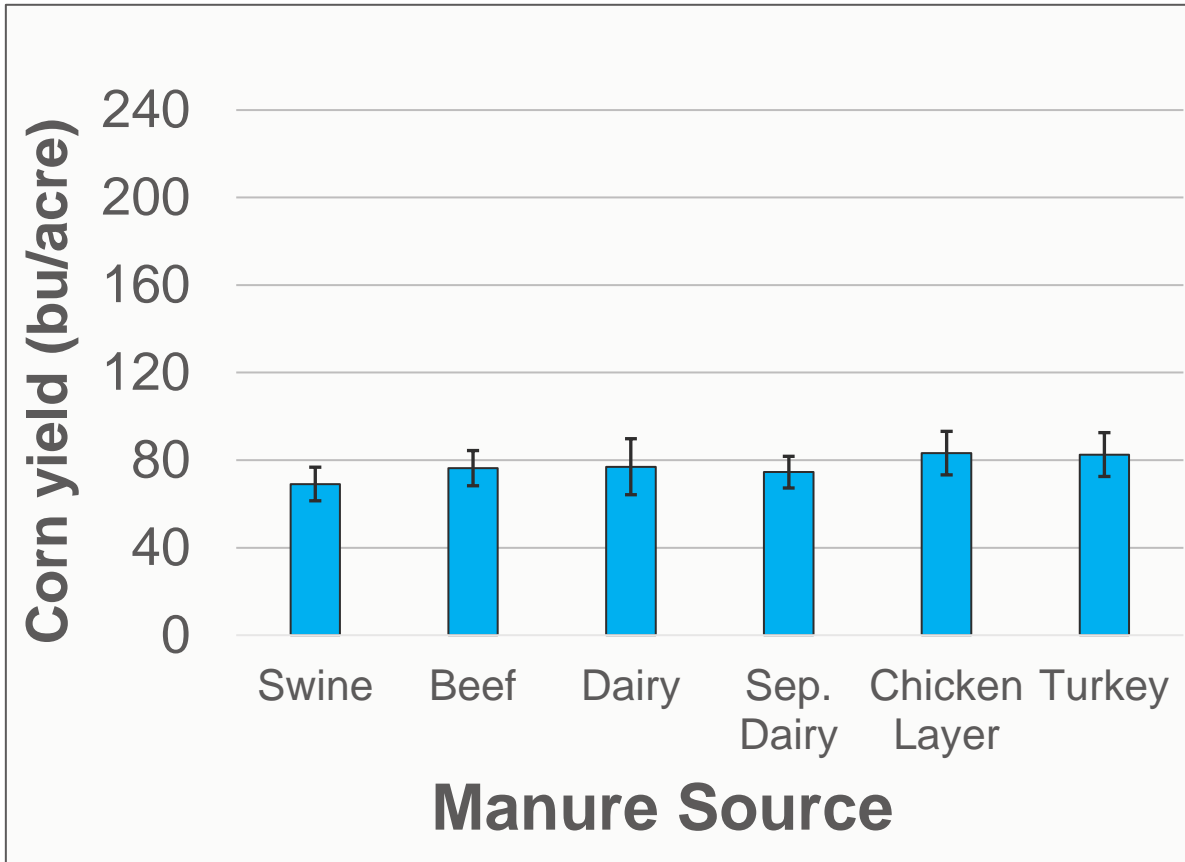


Second year manure fertilizer equivalence

Manure Source	N Fertilizer Equivalent Value (lbs N/acre)	% N available (NFEV/Total N applied)	P Fertilizer Equivalent Value (lbs P/acre)	% P available (PFEV/Total P applied)
Swine finisher	7	3%	1	4%
Bedded beef pack	18	6%	5	6%
Dairy raw	14	5%	2	6%
Dairy Separated	14	5%	3	5%
Chicken layer (composted)	19	5%	17	14%
Turkey Litter	15	6%	10	10%

Corn yield – third year after manure

- 3rd year of rotation (corn after corn)



Third year manure fertilizer equivalence

Manure Source	N Fertilizer Equivalent Value (lbs N/acre)	% N available (NFEV/Total N applied)	P Fertilizer Equivalent Value (lbs P/acre)	% P available (PFEV/Total P applied)
Swine finisher	4	2%	8	6%
Bedded beef pack	6	2%	5	9%
Dairy raw	11	4%	8	18%
Dairy Separated	8	2%	9	16%
Chicken layer (composted)	22	6%	22	12%
Turkey Litter	16	7%	21	30%

Take home messages

What
we've
found so
far:

Manure applied during wet years had lower N availability than expected

Evidence suggests leaching or denitrification occurred

Variable P uptake shows soil sampling is important in years following manure application



Where do we go from here?

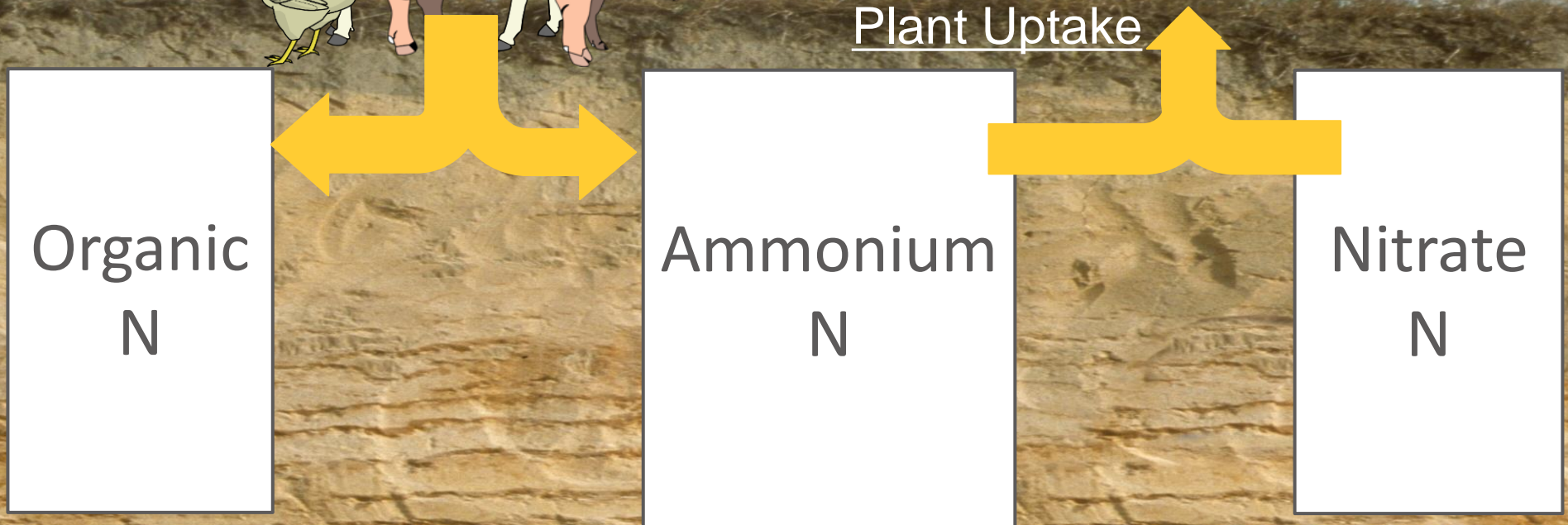
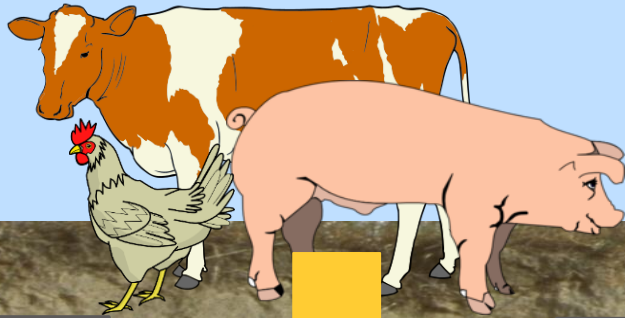
1

Continue research – compare fall versus spring application

2

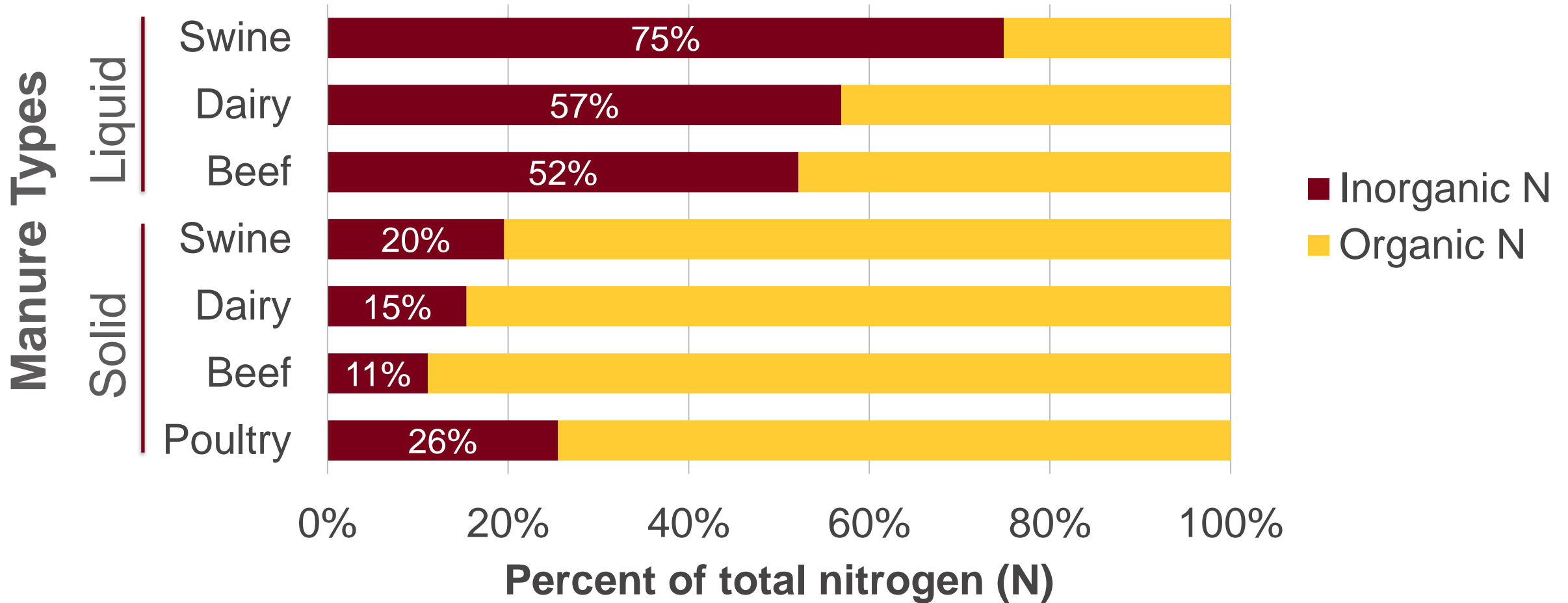
Consider alternate methods of determining nitrogen availability in manure

Nitrogen Cycling



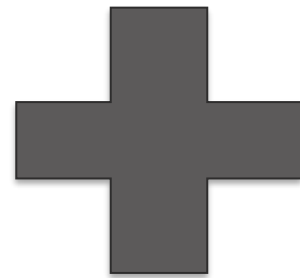
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Manure nitrogen distribution



Instead of using a “total N” availability factor:

Ammonium
that isn't
lost during
application



Organic N
that's released
during
the year

Still a work in progress!!



Where do we go from here?

1

Continue research – compare fall versus spring application

2

Consider alternate methods of determining nitrogen availability in manure

3

Realize that manure nitrogen availability is always variable - adjust practices as needed

Use a “base” N rate and then use a presidedress N test to adjust N if needed?

Recommended Methods of Manure Analysis



A bit of history on manure testing...

- Original methods manual started with a working group in 1996
- Published in 2003 by University of Wisconsin Extension

Editor: John Peters — University of Wisconsin-Madison

Sherry Combs — University of Wisconsin-Madison

Bruce Hoskins — University of Maine

Jan Jarman — Minnesota Department of Agriculture

John Kovar — USDA-ARS

Maurice Watson — Ohio State University

Ann Wolf — Penn State University

Nancy Wolf — University of Arkansas



Recommended Methods of Manure Analysis

SECOND EDITION

Melissa L. Wilson & Scott Cortus, editors



The final product

- Available electronically at: <https://z.umn.edu/Manure-analysis-methods>
- Printed copies can also be purchased at that link



*Book publication was supported by grant no.
NR1874820002C002 from the USDA-NRCS*



Thank you!

Funding: Agricultural Fertilizer Research and Education Council

Colleagues: Amazing SROC and SWROC crews and my staff

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