

Discussion Questions – Please Participate

- On your cell phone or computer, open browser
- Search for “**Slido**” or go to <https://www.sli.do>
- Enter “**8243**”

The Slido logo, featuring the word 'slido' in a green, lowercase, sans-serif font.

slido

Joining
a meeting?

Enter event code

Join

Product Use Cases Pricing Resources

Log In

Sign Up

Give a voice to
your audience

with the ultimate Q&A and polling platform

Get started for free

Watch a video or Schedule a demo


TRANSFORMING MANURE FROM “WASTE” TO “WORTH”



FREMONT CORN EXPO, JANUARY 2020

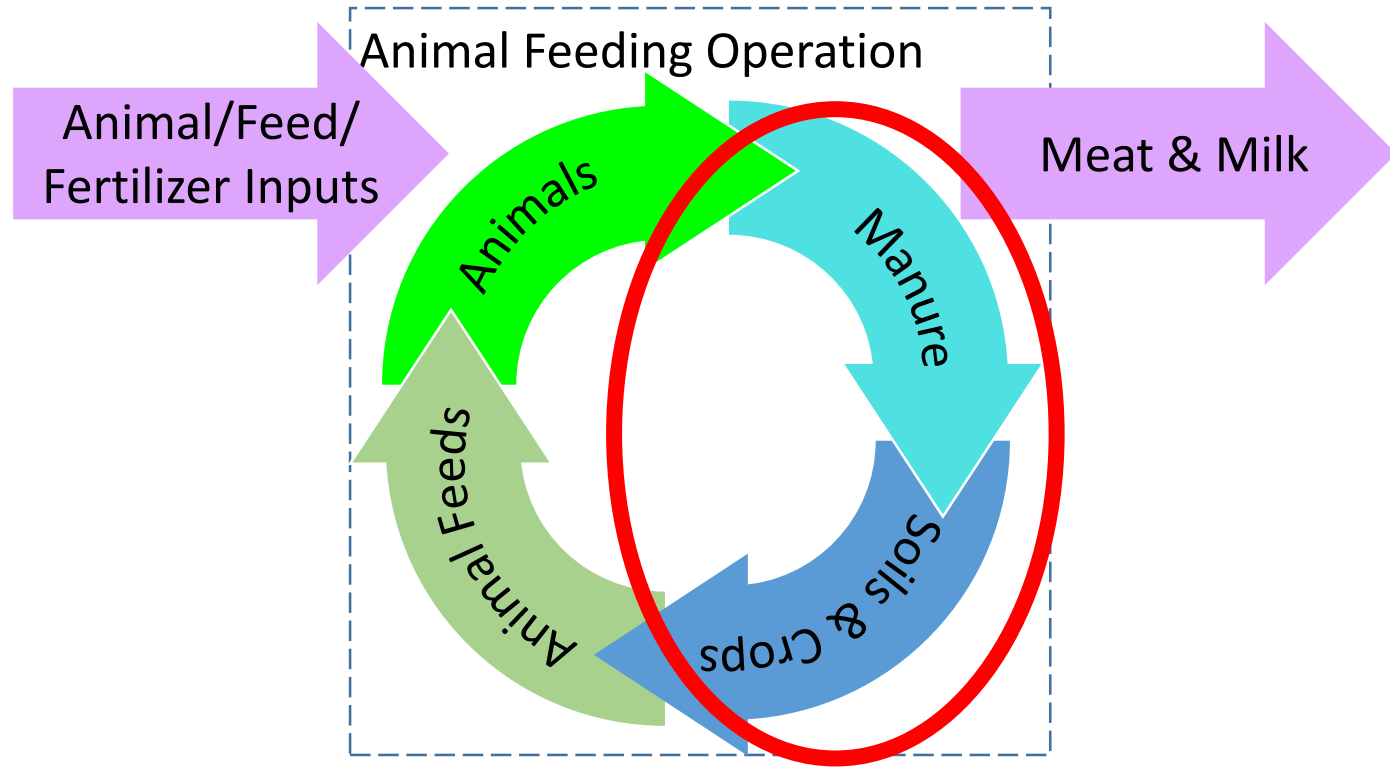
Rick Koelsch and Amy Schmidt
Biological Systems Engineering & Animal Science Departments
University of Nebraska - Lincoln

Today's Discussion Topics

- 
- ✓ Manure ...why should corn farmers be interested?
 - ✓ Manure's agronomic and natural resource value;
 - ✓ Opportunities for utilizing poultry litter;
 - ✓ Precision manure management developments.

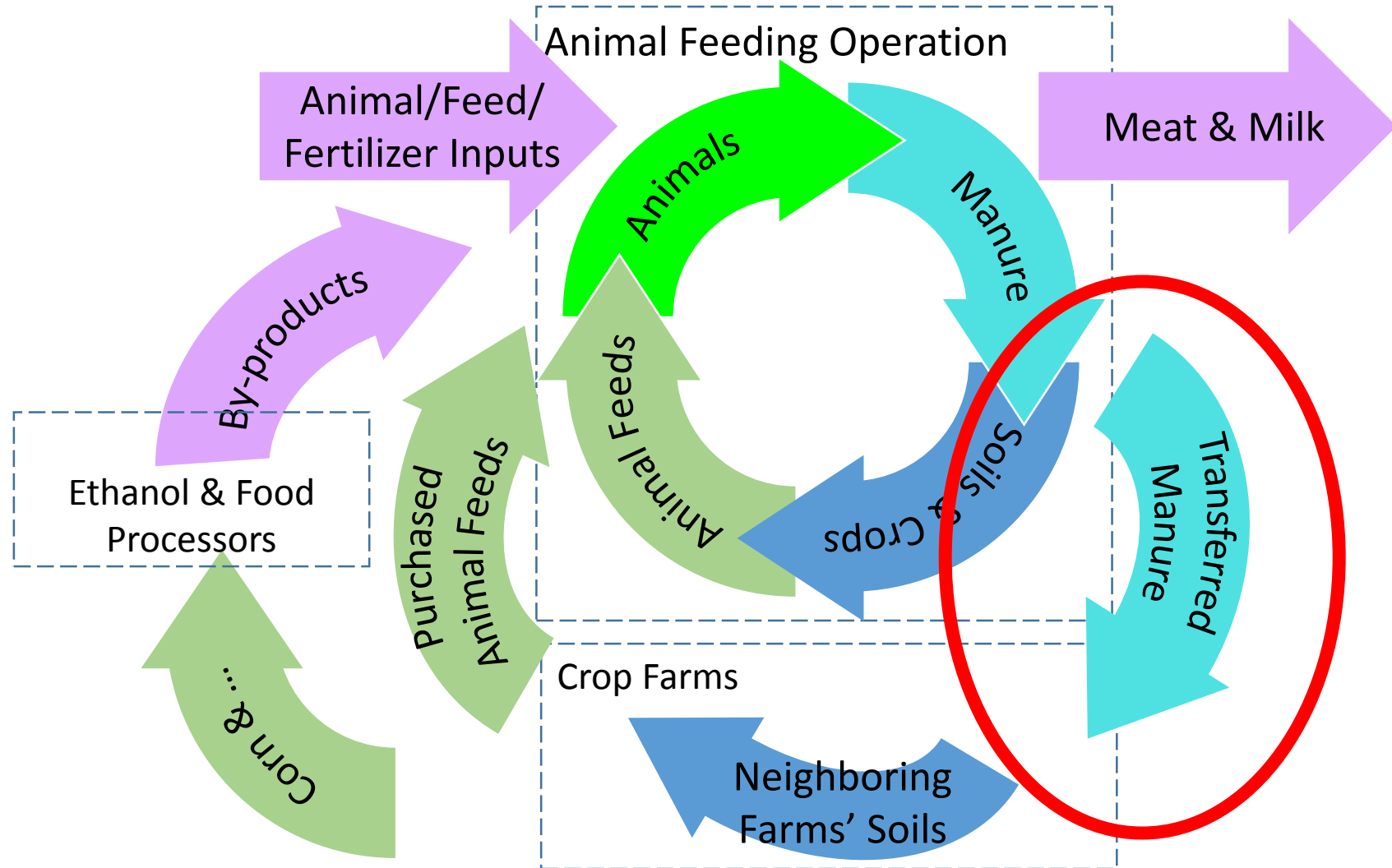
Ability to Recycle N, P, & C

(fundamental to environmental stewardship)



Ability to Recycle N, P, & C

(fundamental to environmental stewardship)

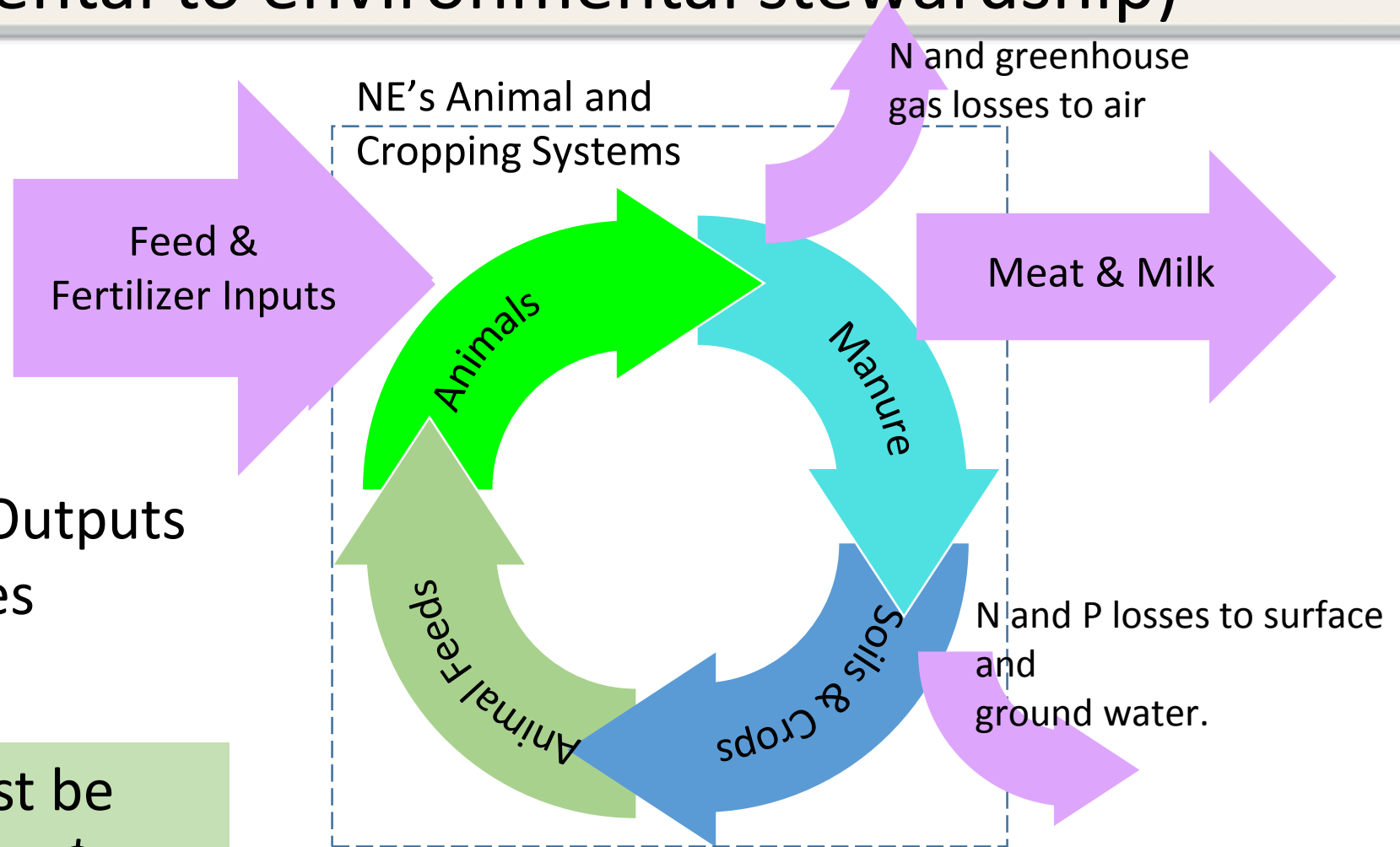


Ability to Recycle N, P, & C

(fundamental to environmental stewardship)

Inputs =
Managed Outputs
+ Losses

Losses must be
replaced by \$
purchases



Key to Environmental Stewardship



Utilize local nutrients in
crop production systems prior to
importing outside nutrients!

Stow High In Transport



DO I VALUE MANURE?

Manure's Value?

Ammonium – N?

Micro-
nutrients?

Soil health?

Organic
Nitrogen?

Potassium?

Water Quality
Improvements
?

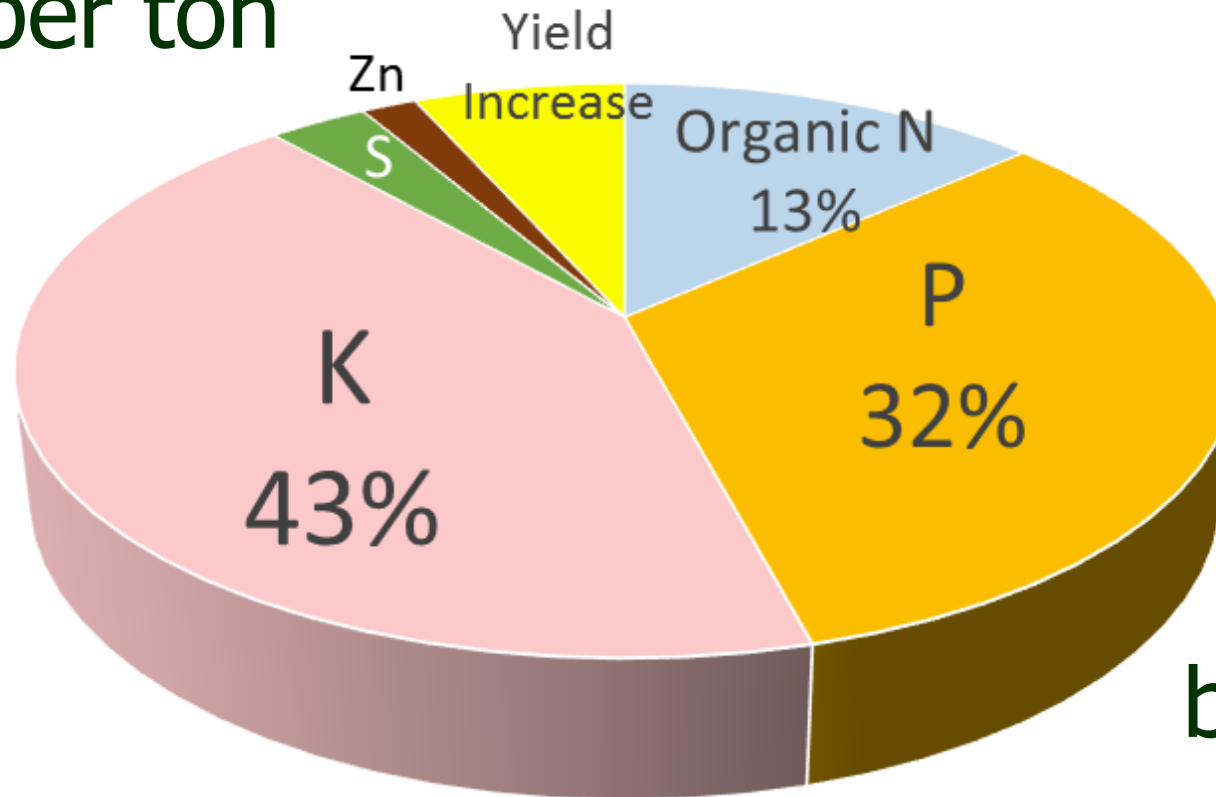
Yield
Increase?

Phosphorus?



Potential Nutrient Value of Beef Feedlot Manure

\$28 per ton



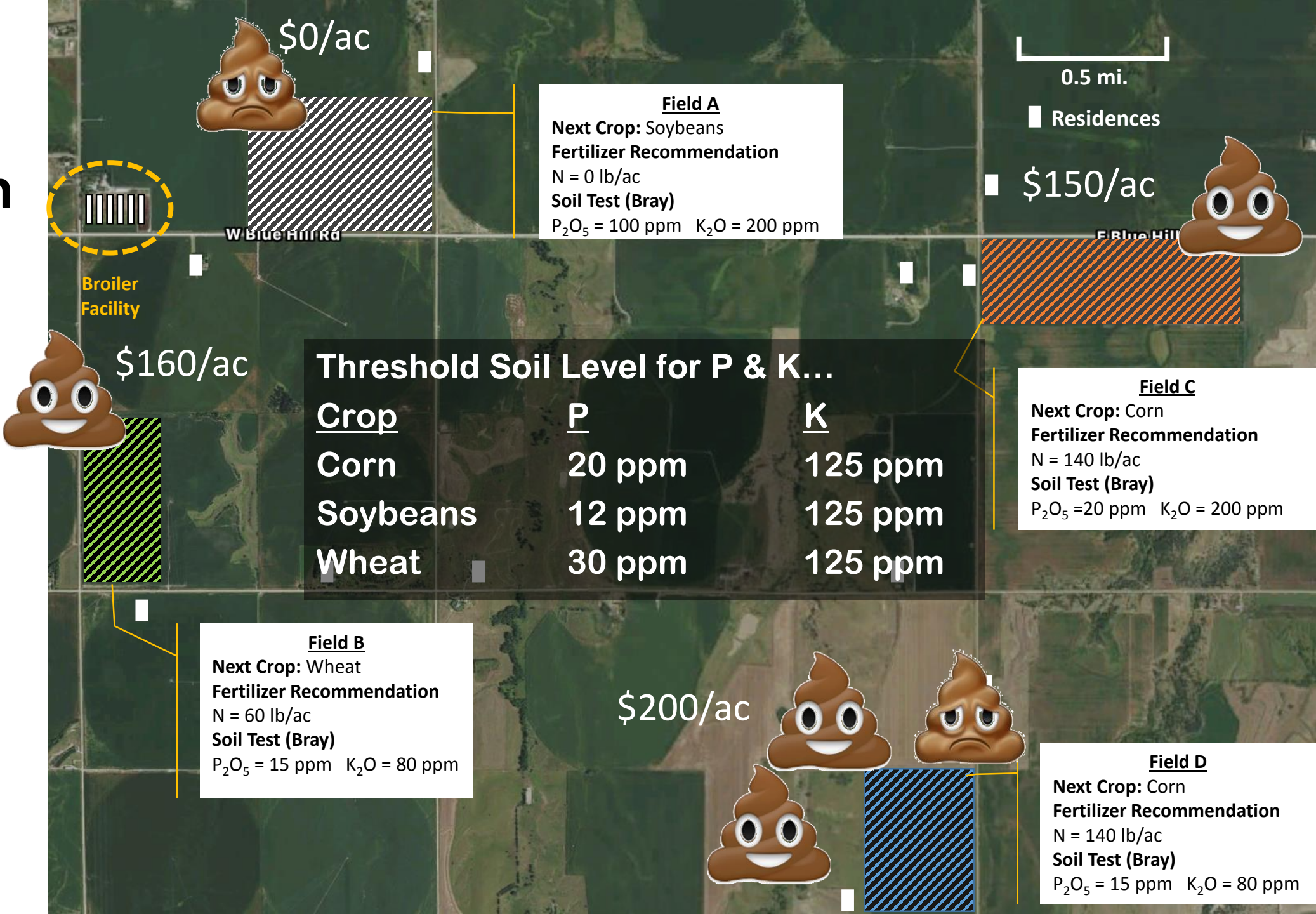
20 ton
beef manure =
\$560/ac

1. 2019 fertilizer prices + value for potash + 5% yield increase

Which
Fields
would you
prefer to
haul
manure
to?



Which Fields Win from Manure's Fertility Value?



Which Fields Win from Manure's Fertility Value?

Phosphorus. Target fields/crops:

- With < 15 to 30 PPM P Bray
- Benefitting from higher soil P requirements such as wheat
- With higher P uptake (corn silage, irrigated alfalfa)



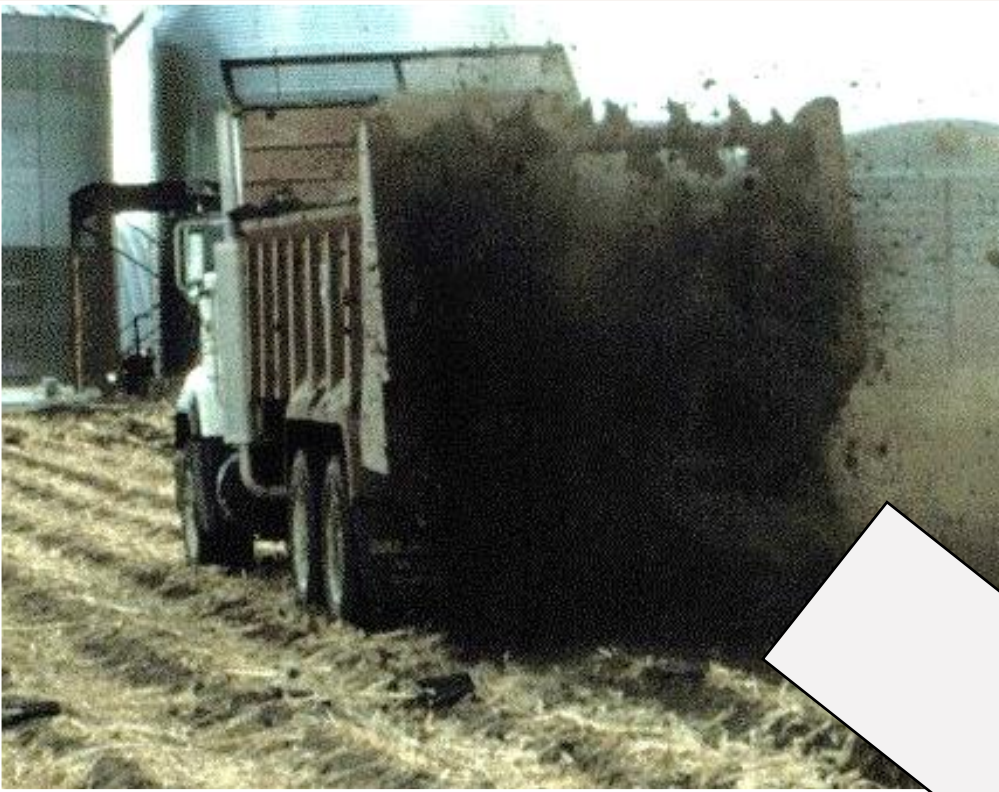
Many manure applications deliver P needs for multiple years - Delay returning to the same field.

Which Fields Win from Manure's Fertility Value?



Next, target fields/crops needing:

- Potassium
- Nitrogen (apply ahead of non-legume crops)



Manure benefits “Soil Health”

**Manure improves
soil physical
properties and
biological properties.**



Soil photo courtesy of USDA NRCS Soil Health flickr collection.

Manure effects on soil organisms and soil quality

OVERVIEW:

Soil quality was first defined by the Soil Science Society of America in 1997 as "the capacity of a specific kind of

Authors:

- ▶ Elizabeth Graham, Michigan State University Department of Crop and Soil Sciences
- ▶ Stuart Grandy, Michigan State University Department of Crop and Soil Sciences

"When manure ... is added to the soil it is quickly colonized by millions of bacteria...bacteria producing large quantities of polysaccharides. These polysaccharides function like sticky glue in the soil and can actually stick particles together into aggregates."

cal characteristics that determine soil quality include: mobilization of nutrients, microbial and enzyme activity, effects of soil fauna and suppression of plant disease. Physical characteristics include aggregate structure, poros-

for the variety of ways soils respond to manure additions. Studies have shown that adding organic amendments such as manure results in increased microbial biomass (soil bacteria and fungi) and

mineralize the organic nitrogen (N) and phosphorus (P) contained in manures into plant-available inorganic forms.

Soil enzymes are also crucial to nutrient cycling and the decomposition of soil

gression
soil
increases
explained
bility
ents.
d
quality be-
a key role
celerate
ances and

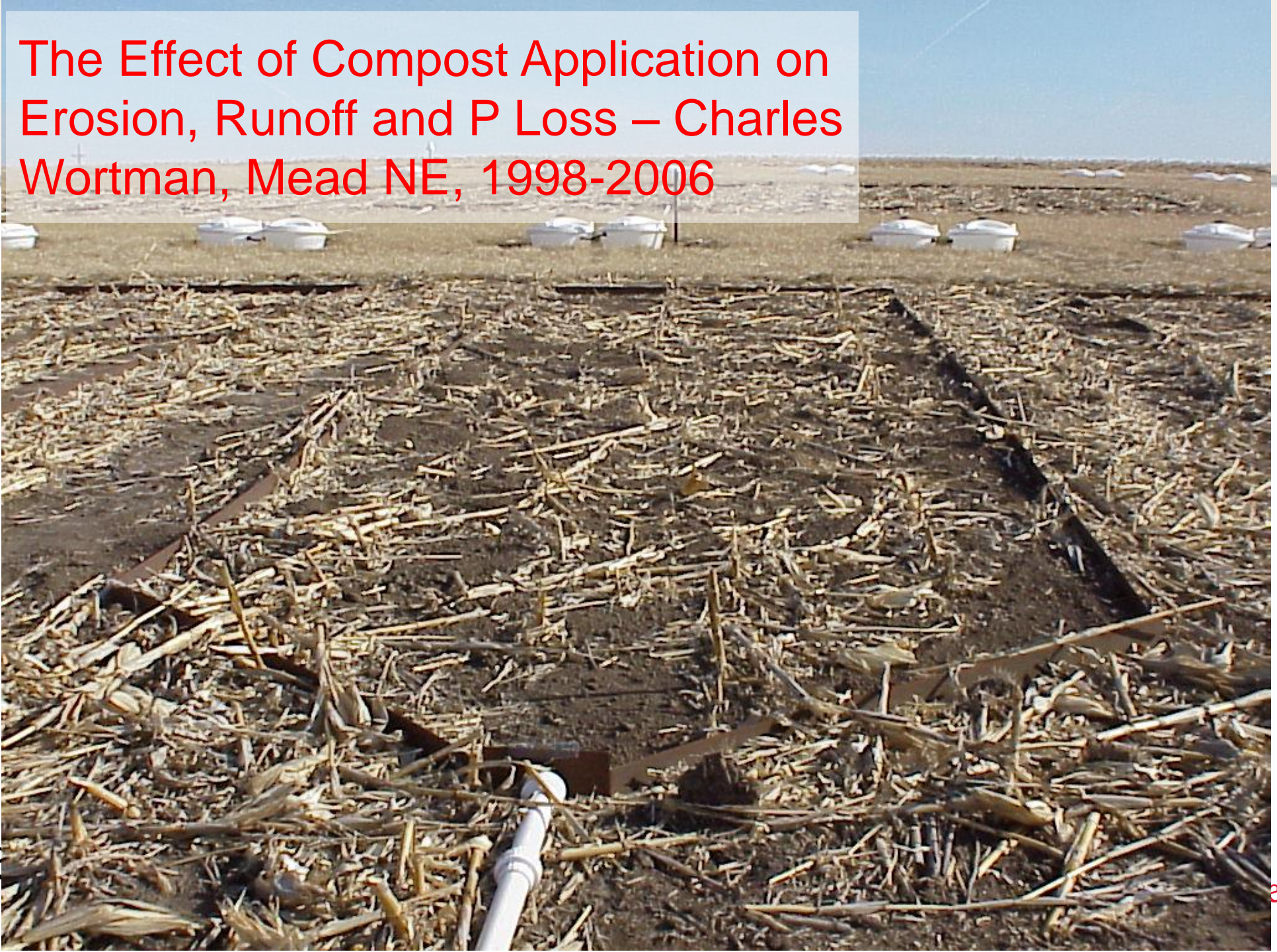
Impacts of Manure on Soil Aggregates on eastern NE loams, silt loams, and silty clay loams –

C.Wortman & C. Shapiro

Conclusions from Wortmann & Shapiro research in Nebraska:

1. All manures increased macro-aggregates.
2. Aggregates form quickly (within 2 weeks) & persist through crop season.

The Effect of Compost Application on Erosion, Runoff and P Loss – Charles Wortman, Mead NE, 1998-2006

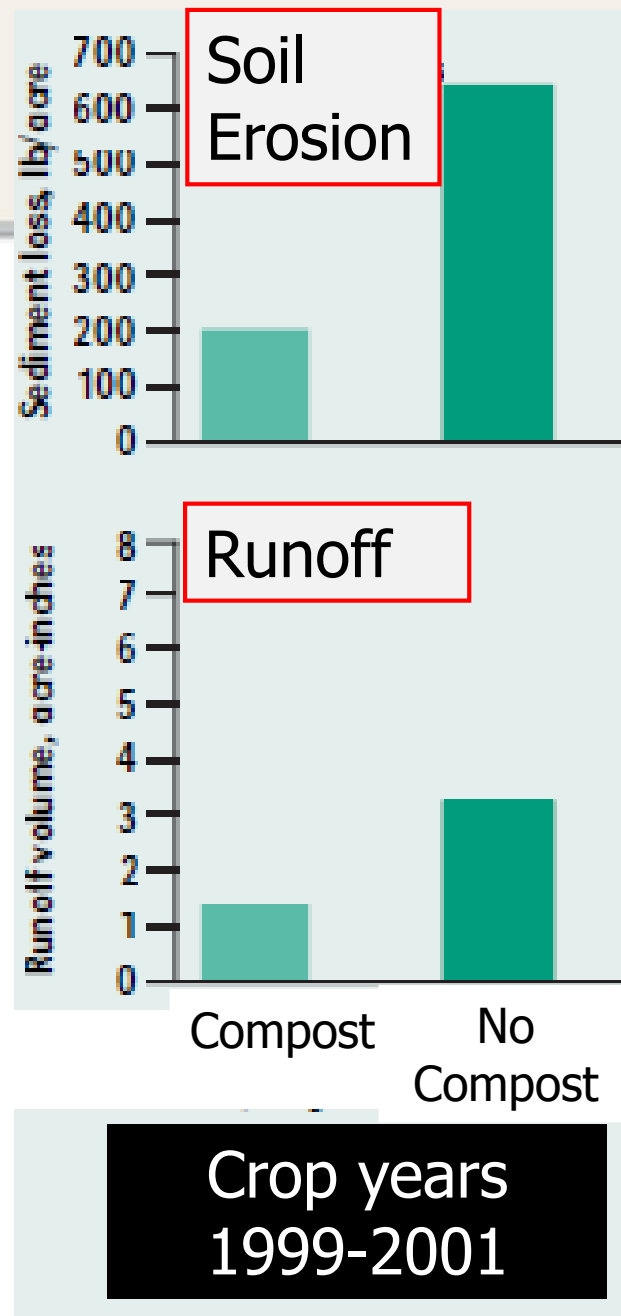


Ne

Impact of Compost on Runoff and Erosion

- Composted feedlot manure;
- Applied - 1998, 1999, 2000 at crop N rate.

Reference: Ag P Management & Water
Quality Protection in the Midwest, July 2013



Which Fields Win from Manure's Organic Value?

Target Fields with:

- Finer texture soils.
- Lower organic matter.
- Crusting
- Low biological activity - earthworms
- Fields commonly experiencing ponding and drown out.





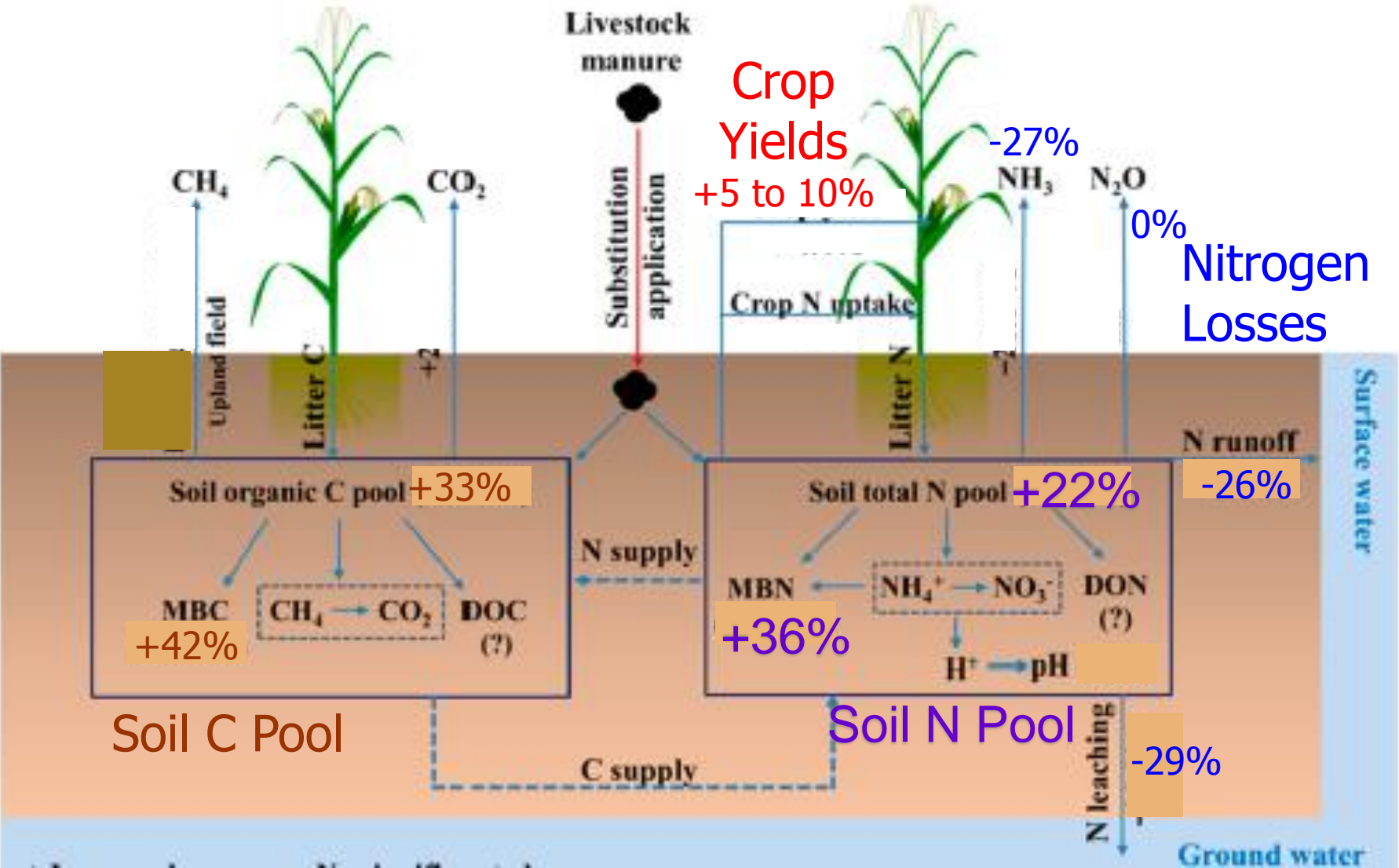
Does Manure Offer Water Quality Benefits?



Manure's Value: Summary of 141 Studies

Reviewing Substitution of Manure for Fertilizer:

L. Chen, et al. 2017. How Does Recycling of Livestock Manure in Agroecosystems Affect Crop Productivity, Reactive Nitrogen Losses, and Soil Carbon Balance? Environmental Science & Technology.

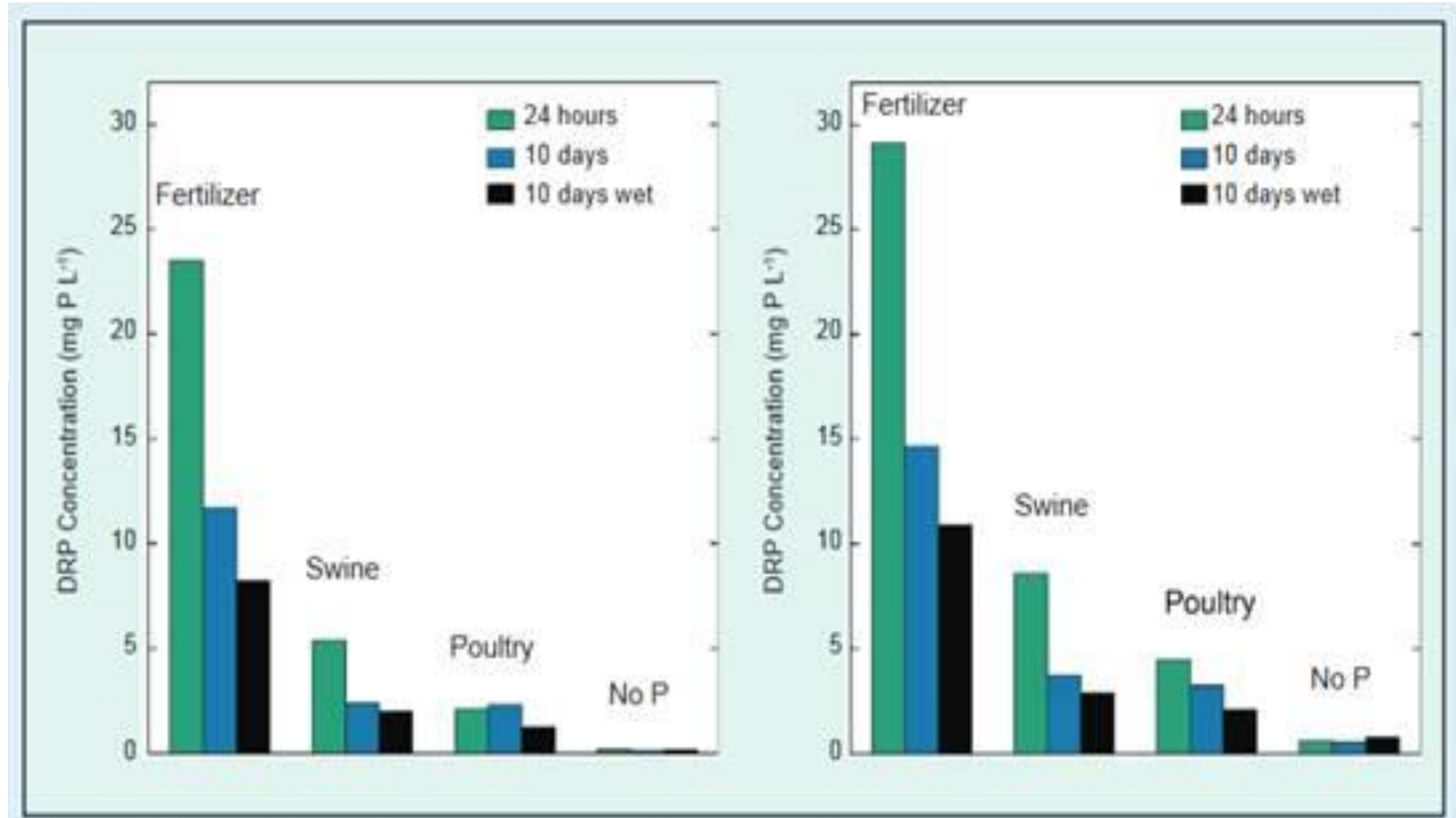


MBC:
Microbial
Biomass
Carbon
MBN:
Microbial
Biomass
Nitrogen

ISU research comparing similar rates of P application (manure is surface applied).


Reference: Ag P Management & Water Quality Protection in the Midwest, July 2013

- Manure P is less soluble, less runoff risk compared to fertilizer (compares similar P application rates)
- Risk of P runoff dramatically declines with time.

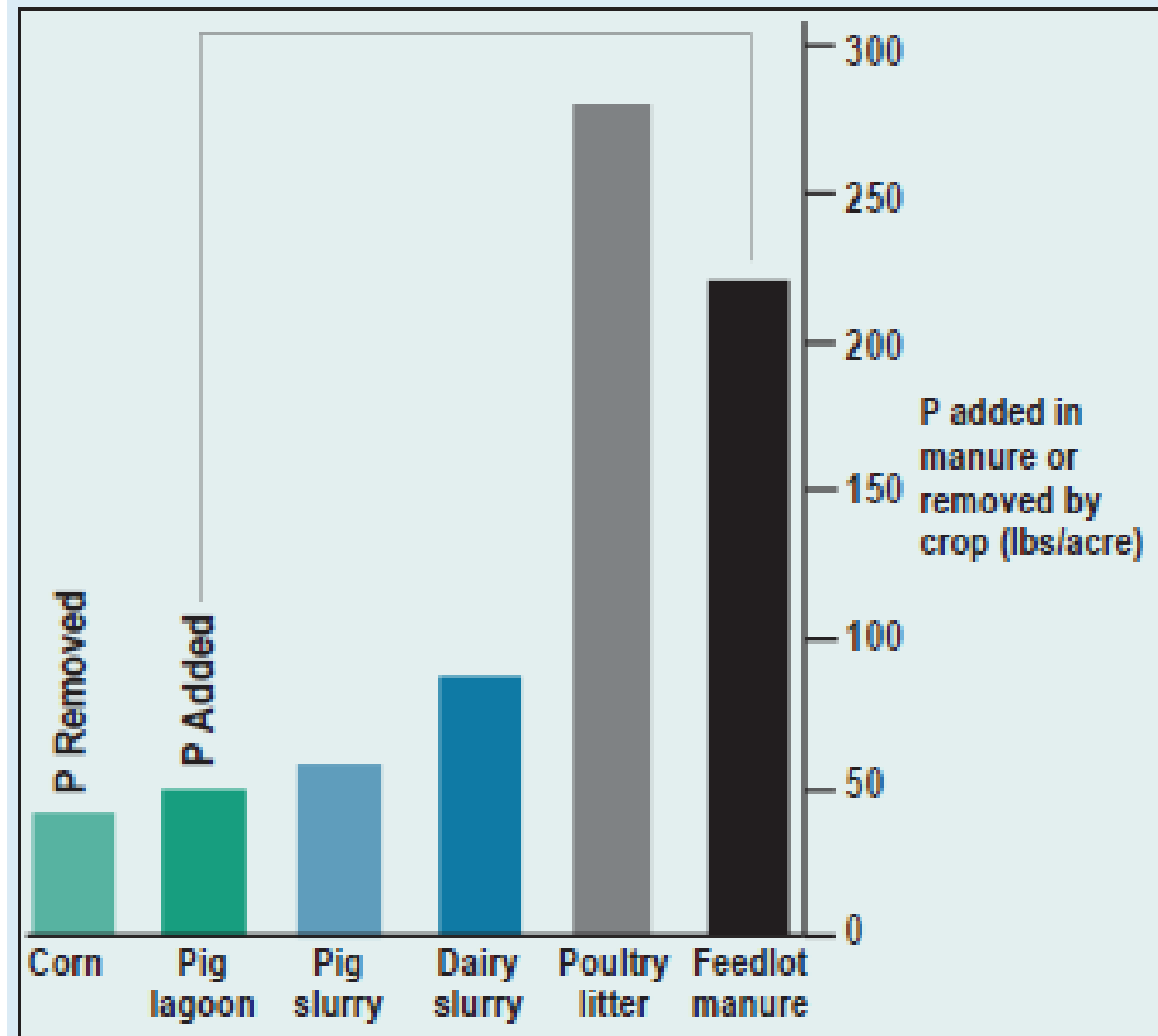


But...Imbalance of N & P in manure

Reference: Ag P Management & Water Quality Protection in the Midwest, July 2013



If manure is applied to meet N requirements, how does it match corn P requirements?



Manure's water quality benefit only if...

- Manure + fertilizer is applied at an agronomic N rate.
- Soil P levels are maintained near thresholds for recommending P application.



Keys to Transforming from “Waste” or “Worth”?



How well is manure's value and cropland needs aligned?

Minimizing Manure's Challenges (odor, transportation costs, ...)

Poultry Litter's Value



Photo courtesy of Arron Mittlestet

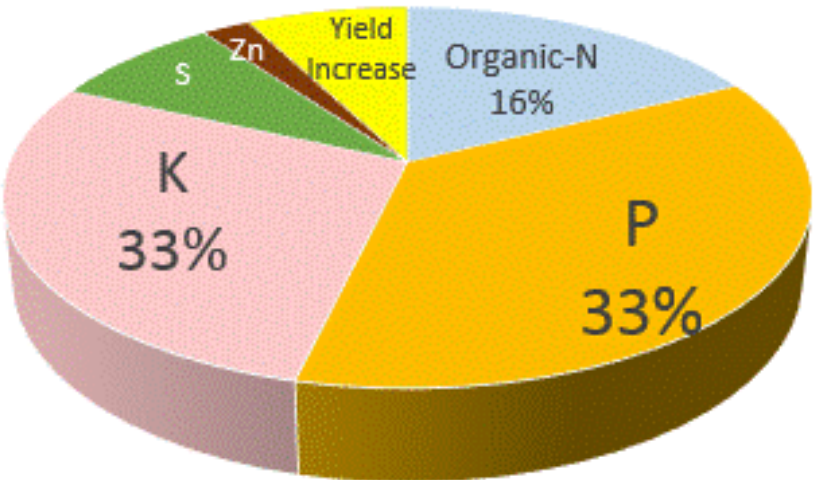


Poultry Litter's Value

What is Poultry Litter's Nutrient Value?
(from [University of Georgia](#))

Total - N	NH ₄ -N	Phos- phate	Potash	Sulfur	Iron
<i>lb/ton</i>					
64	10	54	48	12	3

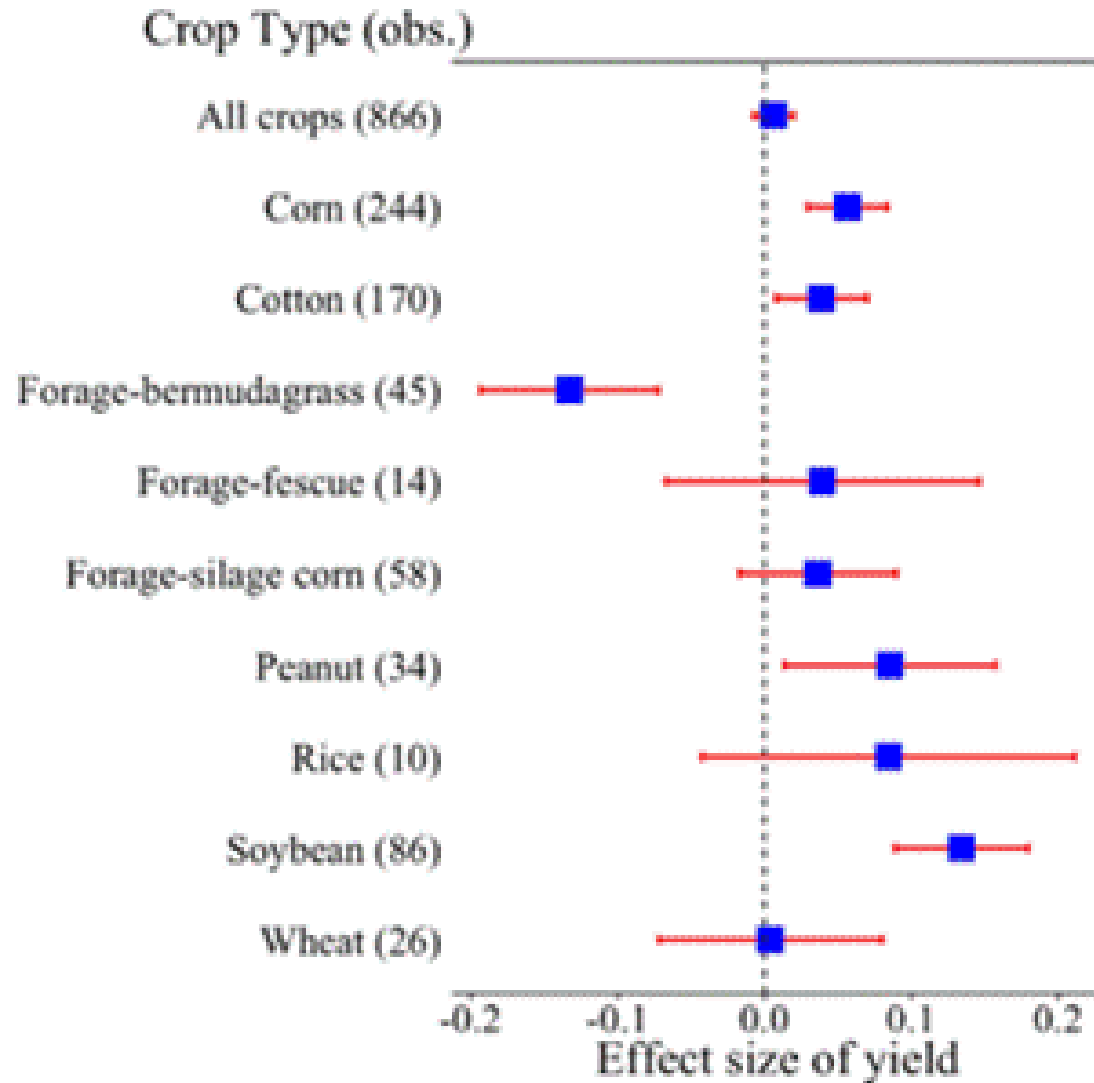
Potential value of surface
applied poultry litter estimated
to be \$60/ton



Poultry Litter's Value

Is there a yield benefit from poultry manure?

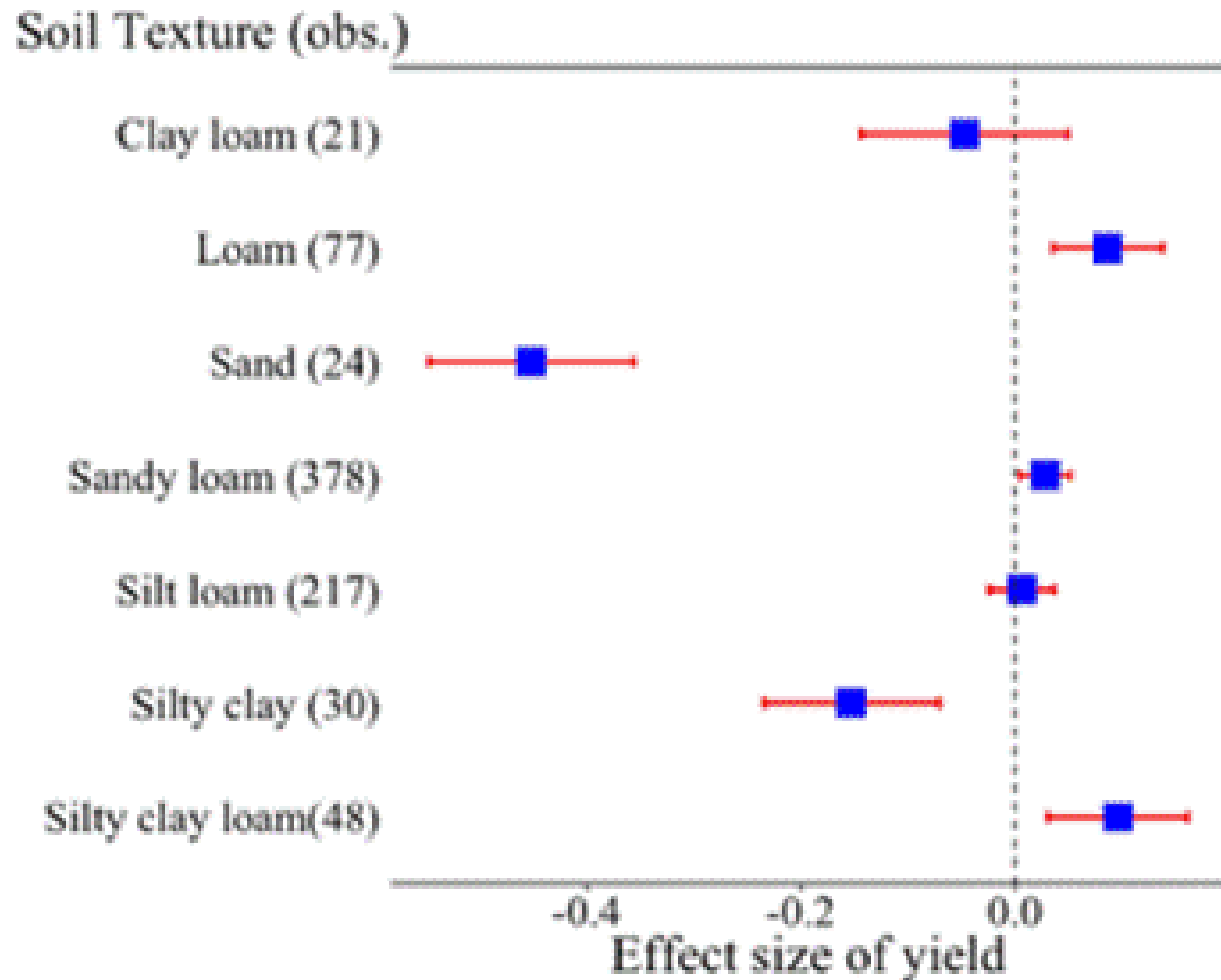
Auburn University review of the results from 90 research studies and 866 field observations comparing poultry litter with inorganic fertilizer.



Poultry Litter's Value

Which soils benefit from poultry manure?

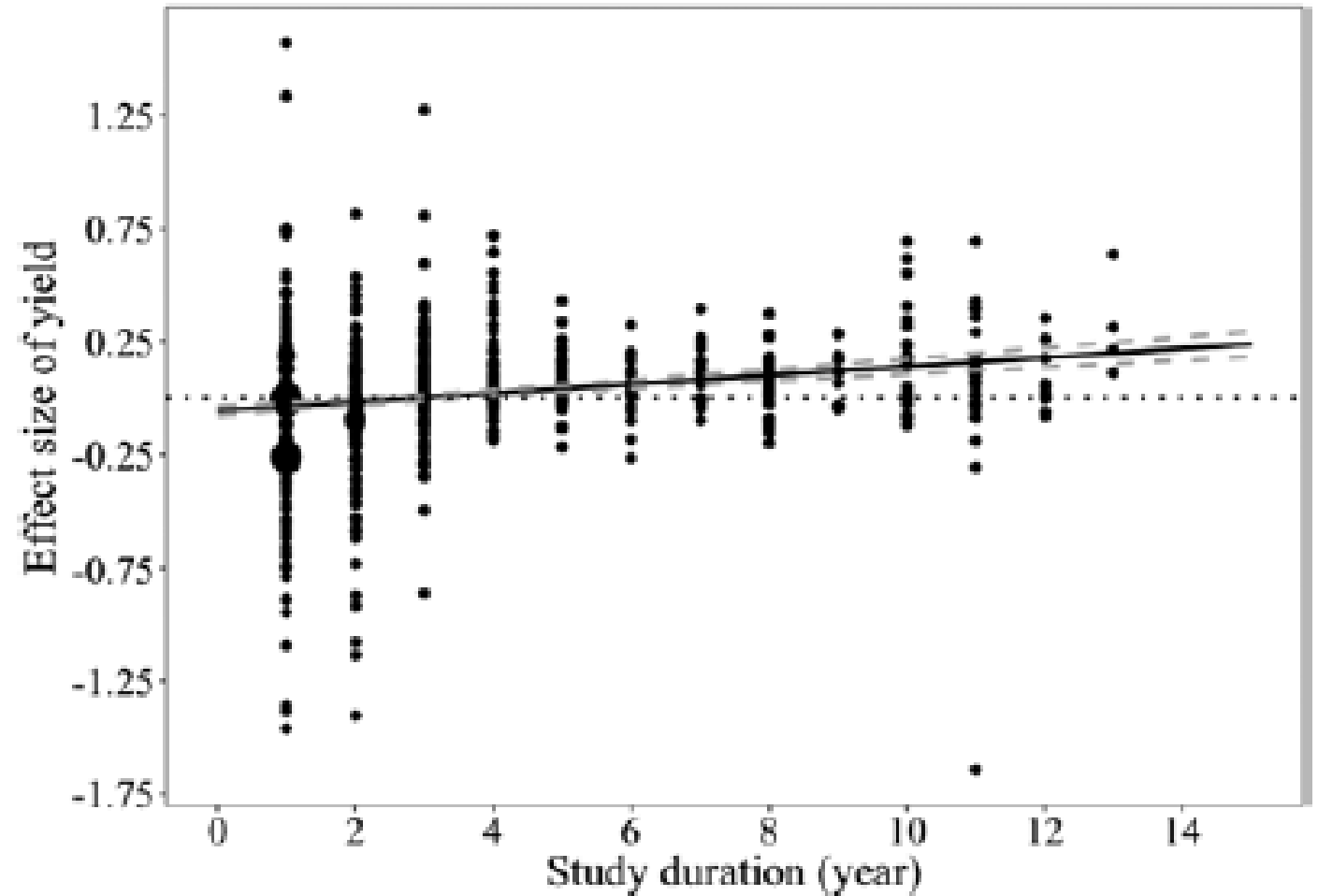
Auburn University review of the results from 90 research studies and 866 field observations comparing poultry litter with inorganic fertilizer.



Poultry Litter's Value

Is there
value from
sustained
use of
poultry
manure?

Auburn University review
of the results from 90
research studies and 866
field observations
comparing poultry litter
with inorganic fertilizer.



Precision Manure Application Technology





Precision Manure Application Technology

Benefits:

- ✓ More uniform manure application.
- ✓ Documentation of application rates for public policy compliance.
- ✓ Ensuring no manure application in restricted regions.
- ✓ Targeting fertility and soil quality improvements to specific field regions.

Precision Manure Application Technology



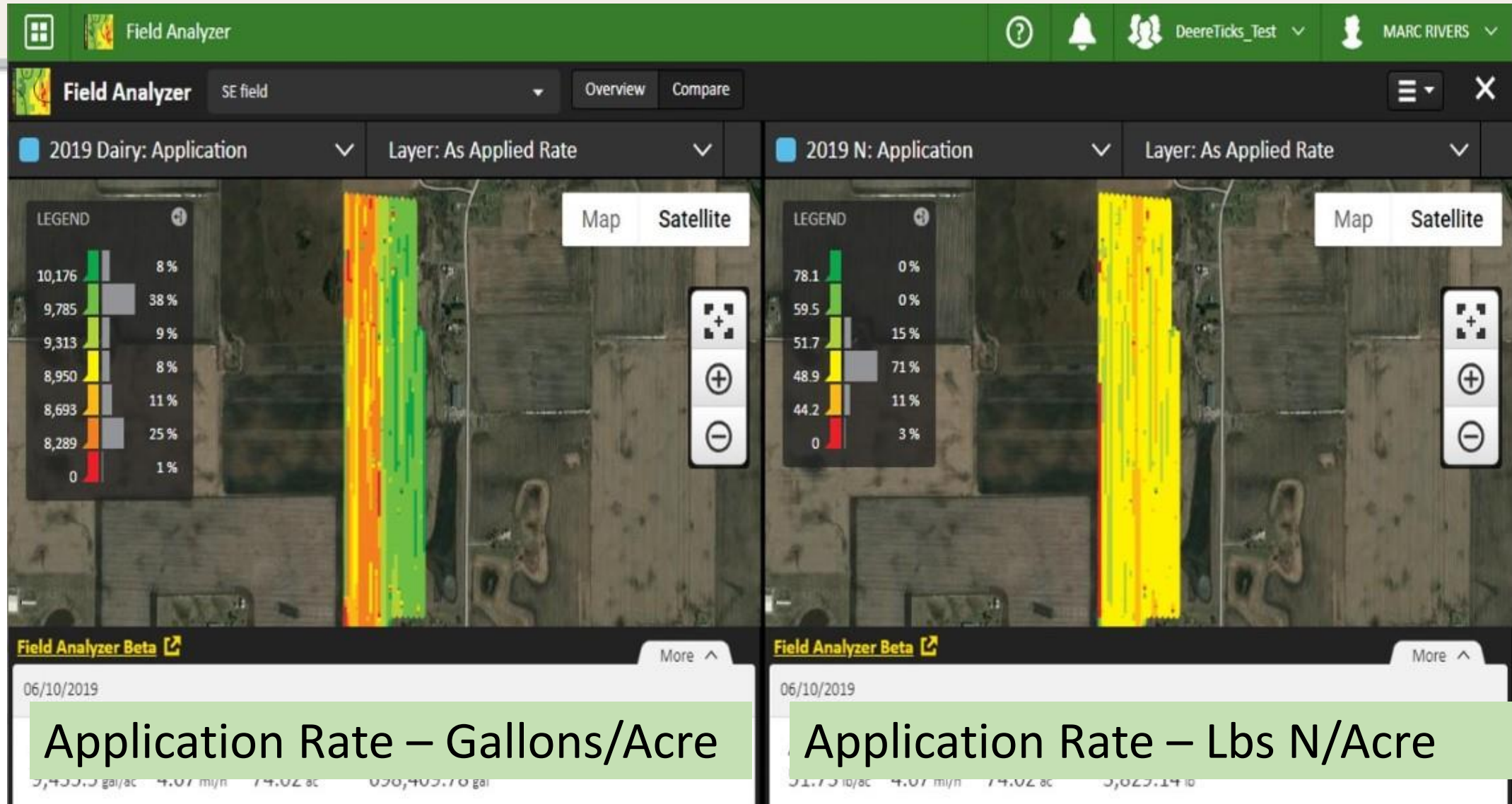
John Deere manure nutrient sensor (top) combined with flow meter (bottom).

Manure Constituent Sensing unit is based on Near Infrared (NIR) technology.

Developed originally for mobile feed nutrient analysis.




Precision Manure Application Technology



Courtesy of John Mishler, John Deere

My Big Piles of Manure for Today



Match
manure's values with
fields benefitting most

Good Stewards:
Recycle Manure
N, P and C
Efficiently

Good Stewards:
Use
Local Nutrients before
Importing Outside
Nutrients

Ship High in Transport



Manure has
Crop Fertility,
Soil Quality &
Water Quality Value

Questions & Comments

Rick Koelsch, rkoelsch1@unl.edu,
402/472-3935

Amy Schmidt, aschmidt@unl.edu,
402/472-0877

Suggested References

University of Nebraska Manure web site

- <http://manure.unl.edu>

Calculating the Value of Manure for Crop Production

- Nebguide ... <http://extensionpublications.unl.edu/assets/pdf/g1519.pdf>
- Spreadsheet: <https://unl.box.com/shared/static/nb4wod1oc3m1hy2e6cjvg0id913jcftk.xlsx>

Determining Crop Available Nutrients from Manure

<http://extensionpubs.unl.edu/publication/9000017123651/determining-crop-available-nutrients-from-manure-g1335/>

Manure effects on soil organisms and soil quality – Michigan State
Extension publication ...

<http://msue.anr.msu.edu/uploads/files/AABI/Manure%20effects%20on%20soil%20organisms.pdf>