

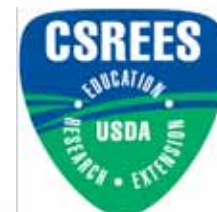
Reducing P Pollution of Surface Waters in Corn-Ethanol-Beef Ecosystems of the Midwest

Charles Wortmann

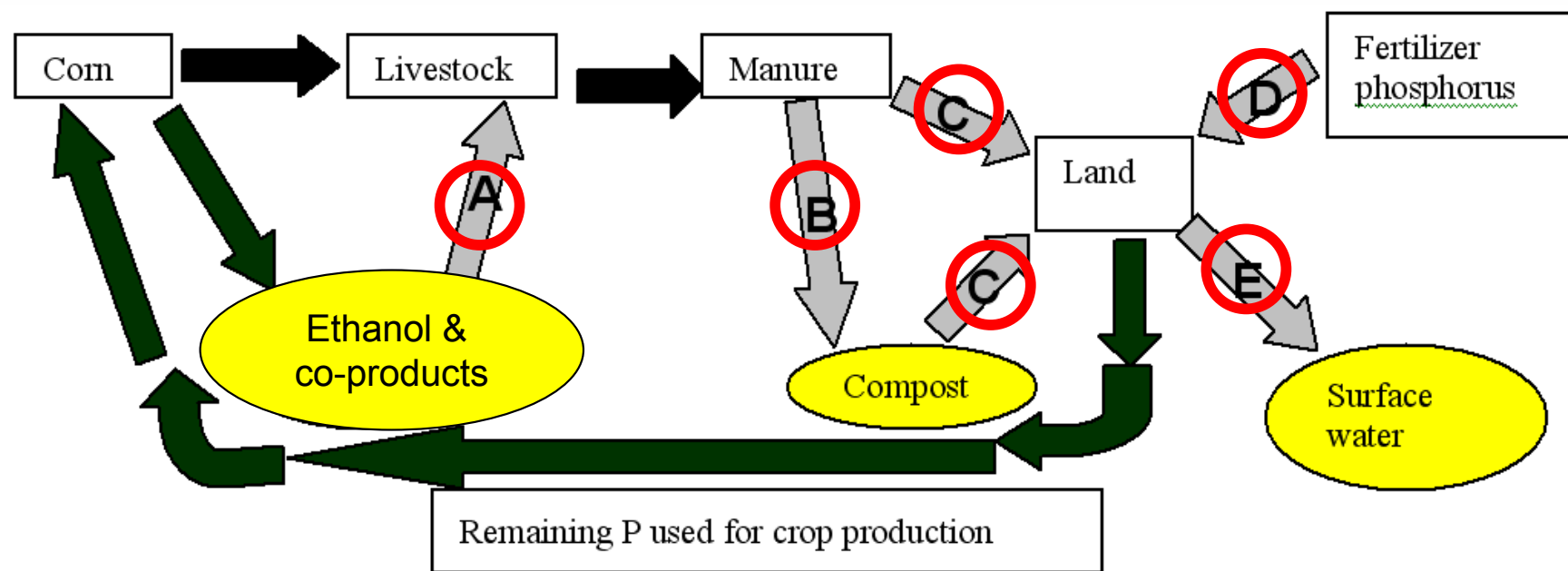
University of Nebraska-Lincoln

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CSREES Managed Ecosystems



Feeding beef ration of 40% bi-products is profitable with improved feed use efficiency but results in 100% more P excretion (and >75% more NH₃ volatilization)



- Feeding beef a ration of 40% bi-products results in
 - ◆ more profitable beef production
 - ◆ 100% more P excretion
 - ◆ >75% more NH_3 volatilization

Managing Manure Application for Reduced Phosphorus Runoff Loss

Graduate student: Ahmed Alwadaey

Research at the UNL – ARDC

1998 - 2008



Objectives: 5 phases

- Determine the effects of compost application on runoff, sediment loss, and P loss
 - ◆ During the years of application, 1998-2000
 - ◆ The residual effects during 2001 to 2008
- Effect of
 - ◆ one-time plowing of extremely high P soil
 - ◆ grass filters
 - ◆ gypsum application

Methods

- Composted feedlot manure was applied annually for 3 years at ~ 33 t/Ac/yr
- Two compost types were used
 - ◆ Low P compost: 670 lb/A P_2O_5 applied
 - ◆ High P compost: 1025 lb/A P_2O_5 applied

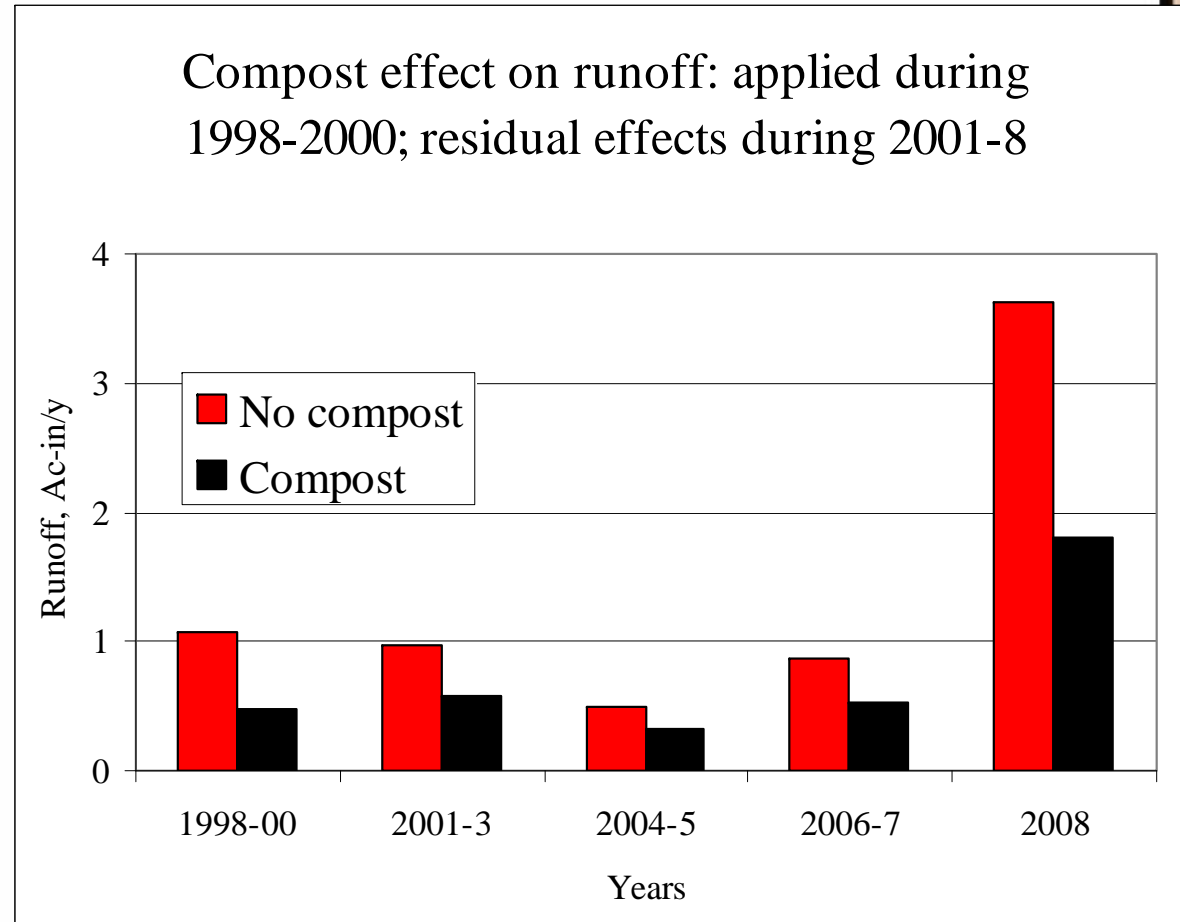
Compost effect on soil test P (Bray-P1) in March 2004

Depth, inches	Hi-P compost	Lo-P compost	No compost
0-2	779	380	16
2-4	307	154	9
4-8	53	37	10
8-12	38	26	10

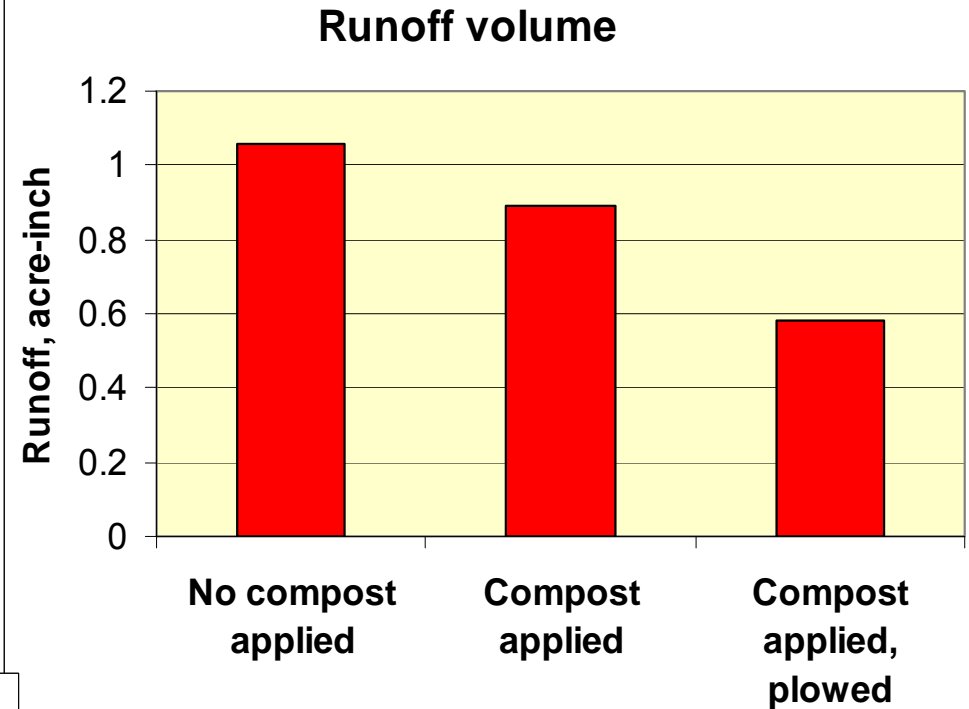
Water infiltration was improved and runoff was reduced

➤ during the 3 yr of composted feedlot manure application

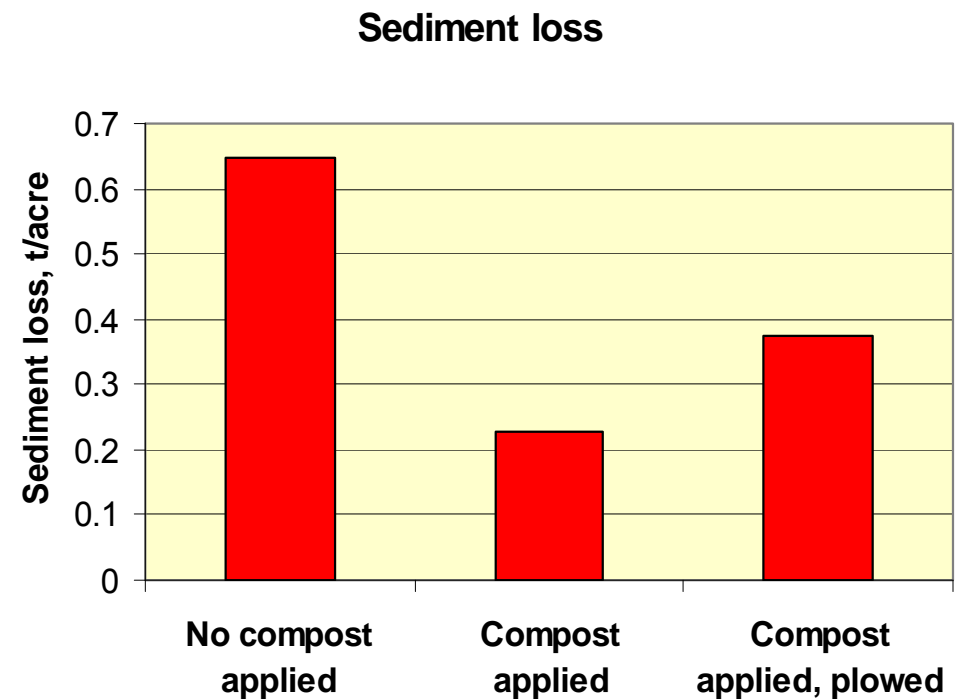
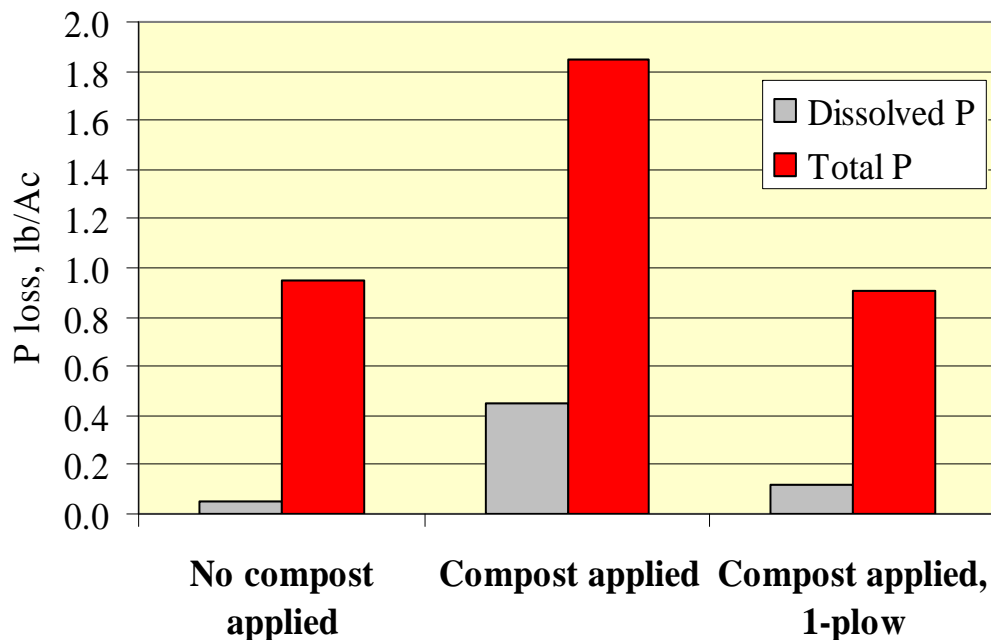
➤ during 8 yr following the last application.



The effect of plowing once to reduce P runoff with extremely high surface soil P: 4-5 yr after application



P loss at 4-5 yr after application



Phase IV, 2006-2007

- Grass filters occupying 0, 1 or 4% of the plot area



Grass filter effects

- 1% of the drainage area in well-placed grass filters was effective
 - ◆ Greatly reduced runoff
 - ◆ Reduced P and sediment loss
 - primarily to reduced runoff

Filter area	Runoff	TP	DP	Sediment
%	Ac-in/yr	Lb/Ac/yr		
0	0.97 a	0.52 a	0.18 a	318 a
1	0.45 b	0.17 b	0.05 b	103 b
4	0.20 b	0.21 b	0.06 b	52 b

V. Effect of gypsum application

- Will gypsum improve soil aggregation and water infiltration with reduced runoff?
- Will soil P react with the Ca in gypsum to reduce the dissolved P in runoff?
- Started in 2008
 - ◆ 0, 2, 4 t/Ac of gypsum
 - ◆ Disked

Effect of gypsum application

- Preliminary results: non-significant reduction in runoff with 4 t/Ac; no effect of 2 t/Ac rate on runoff and no gypsum effect on runoff P concentration
- Will continue and complete in 2009

Are non-application **setbacks** for manure around risers of tile-outlet terraces effective in reducing P loss from the field?



- Setbacks in such fields are required for fields managed by large feeding operations if the tile outlets feed directly into a conduit to surface waters
 - ◆ 100 ft annual crop setback
 - ◆ 30 ft perennial vegetative setback
- Setbacks greatly complicate nutrient management on such fields
- Tile-outlet terraces greatly reduce risk of P runoff



Setbacks



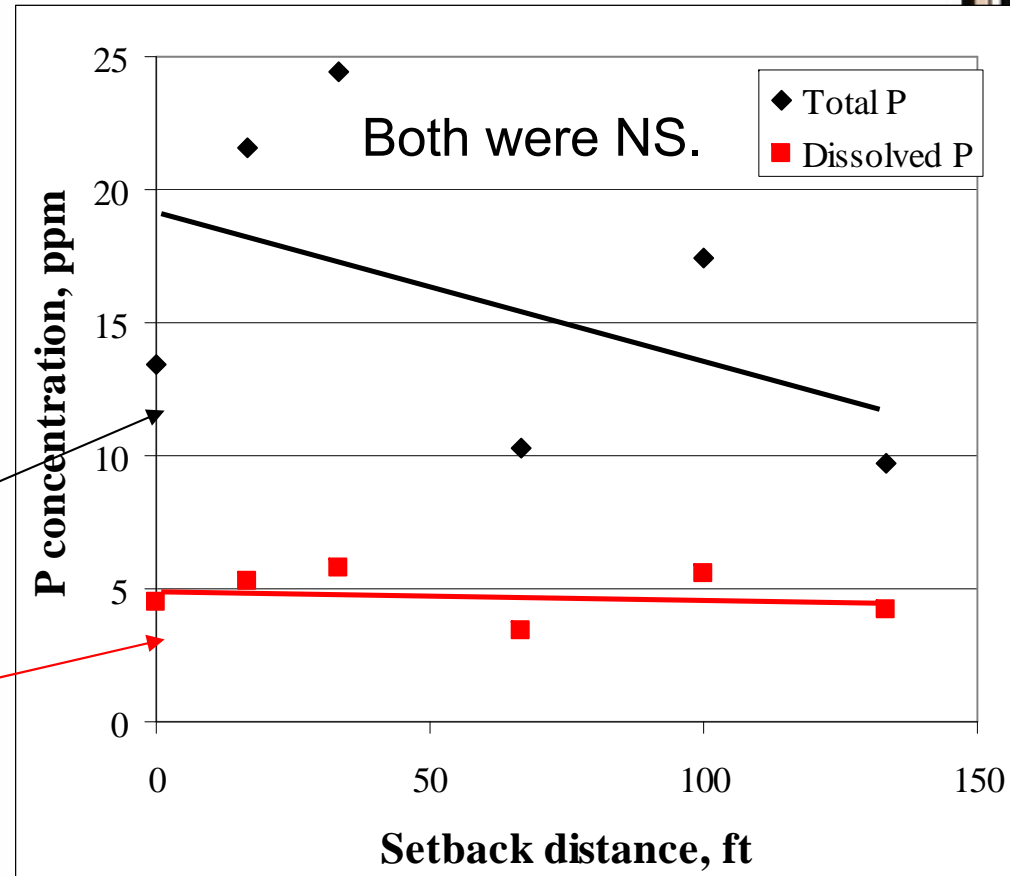
Setback

- Composted feedlot manure applied in February
 - ◆ 30 t/Ac
 - ◆ 310 lb/Ac P_2O_5

Setback effect

- Setbacks did not significantly reduce P concentration in runoff.
- Sediment concentration was greatest with no compost applied.

Total P (11.9) and dissolved P (2.9 ppm) with no compost applied



Setback effect: ISCO samples

- 0 setback compared with 100 ft setback
- No setback effect on P or sediment concentrations (ppm)



Setback distance	TP	DP	Sediment
	ppm		
0 ft	2.74	1.72	840
100 ft	2.78	1.69	1240
	NS	NS	NS

Setback effect: summary

- Results of Franti et al. also found that setbacks were not effective in reducing runoff loss of herbicide
- We conclude that setbacks to terrace tile inlets are not likely to significantly reduce loss of manure associated pollutants, including antibiotic residuals, to surface waters.
- Consider asking NDEQ for an exemption from the setback rule for such fields

Compost versus stockpiling feedlot manure

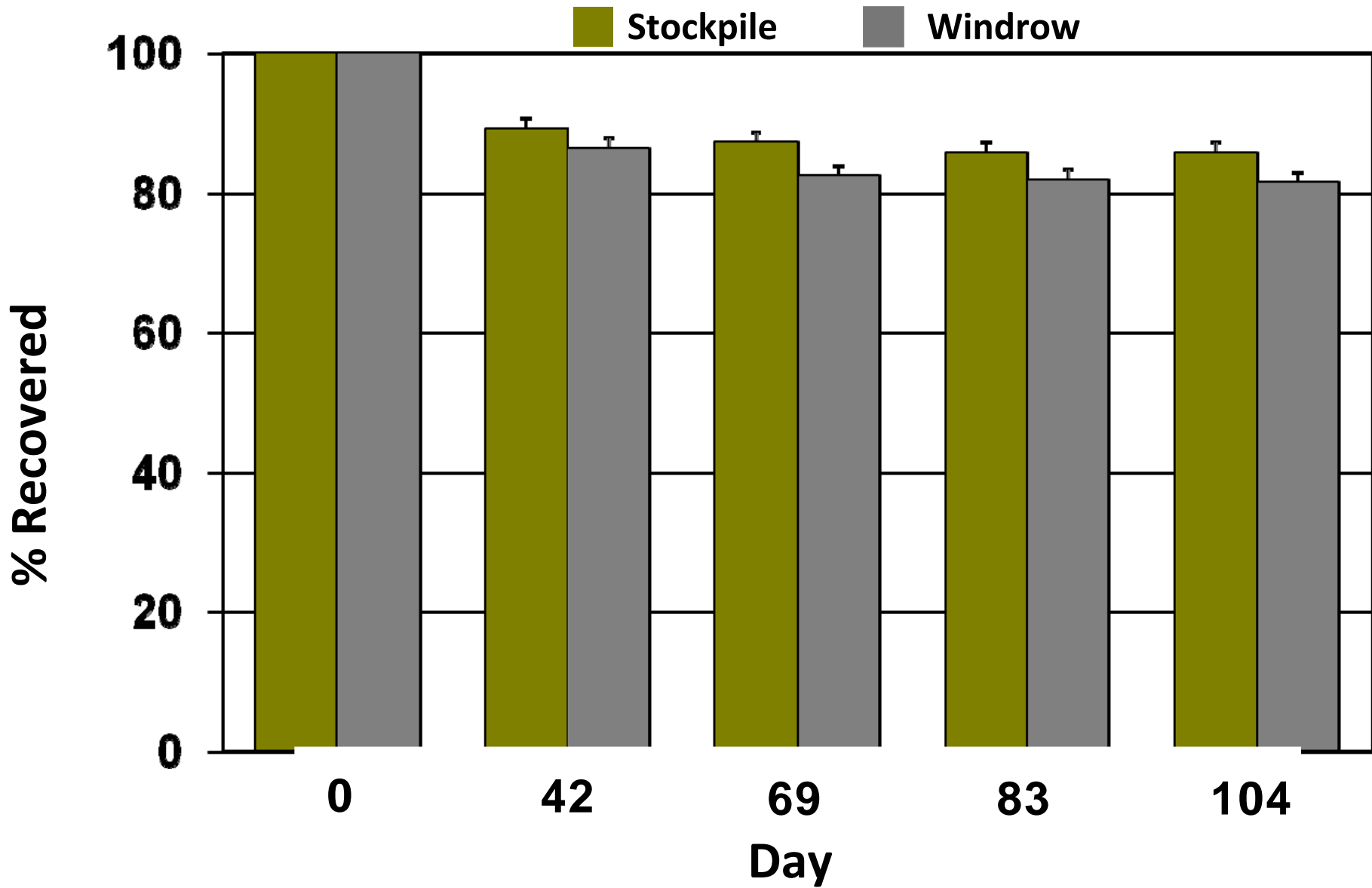
Galen Erickson
and Matt Luebben

- Fresh
- Stockpiling
- Composting



DM Recovery

2006



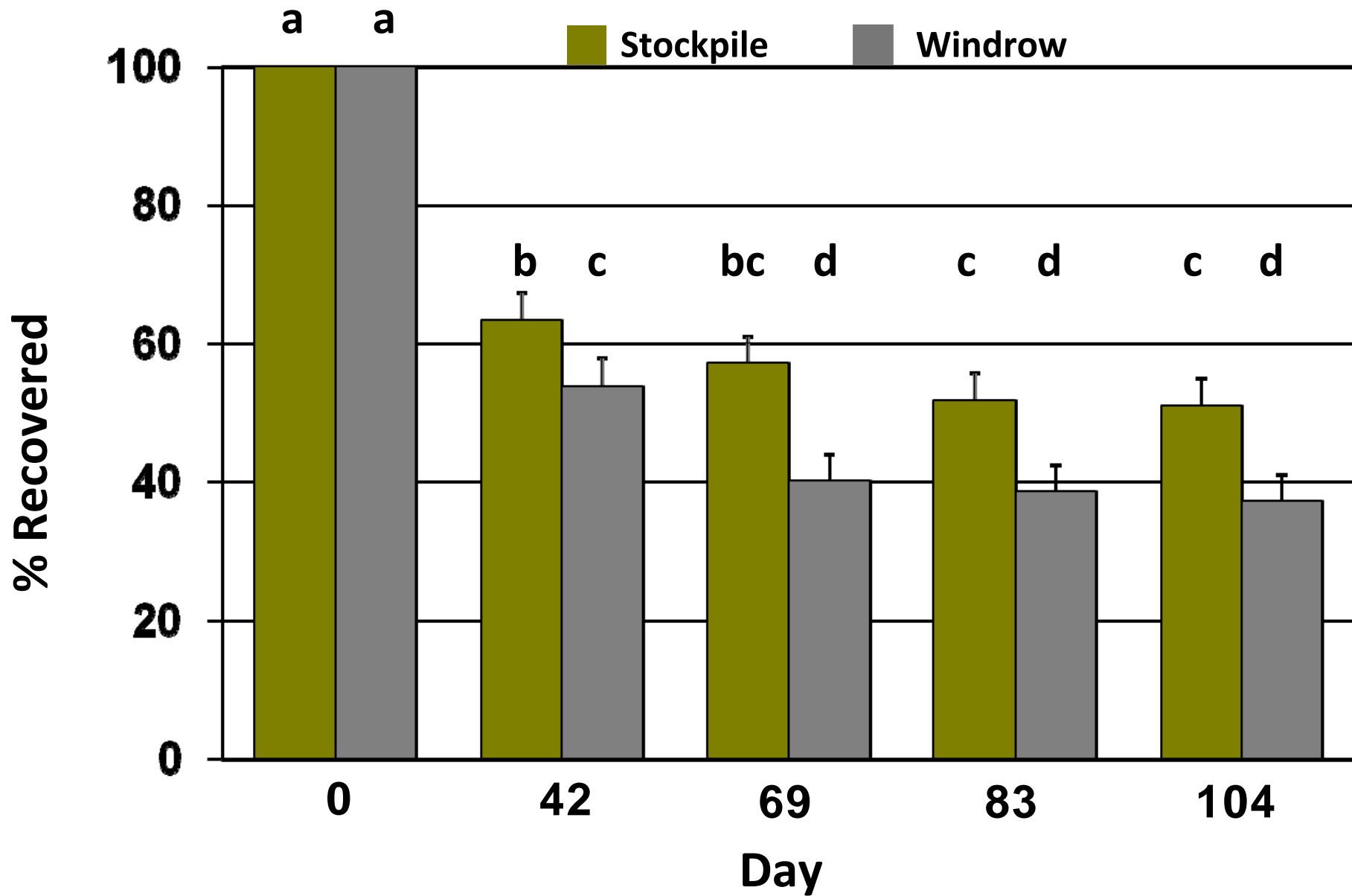
Storage*Day $P=0.14$

Storage $P<0.01$

Luebbe et al., 2008 beef report

OM Recovery

2006



Storage*Day $P < 0.01$

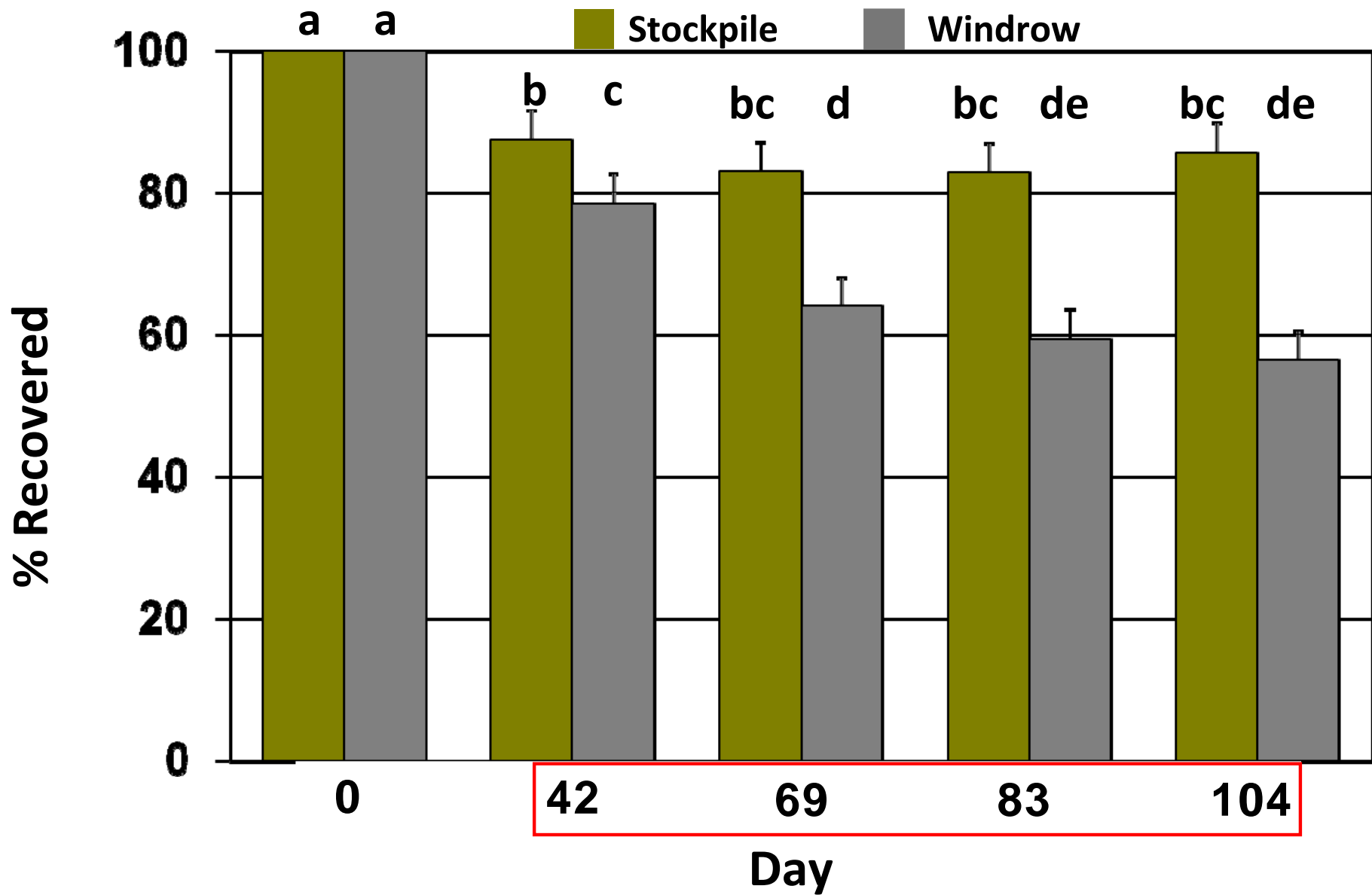
a,b,c,d $P < 0.05$

Storage $P < 0.01$

Luebbe et al., 2008 beef report

Total N Recovery

2006



Storage*Day $P < 0.01$

a,b,c,d,e $P < 0.05$

Storage $P < 0.01$

Luebbe et al., 2008 beef report

Not much benefit to composting except possibly for a high value market where the improved uniformity and reduced odor and water content are important.

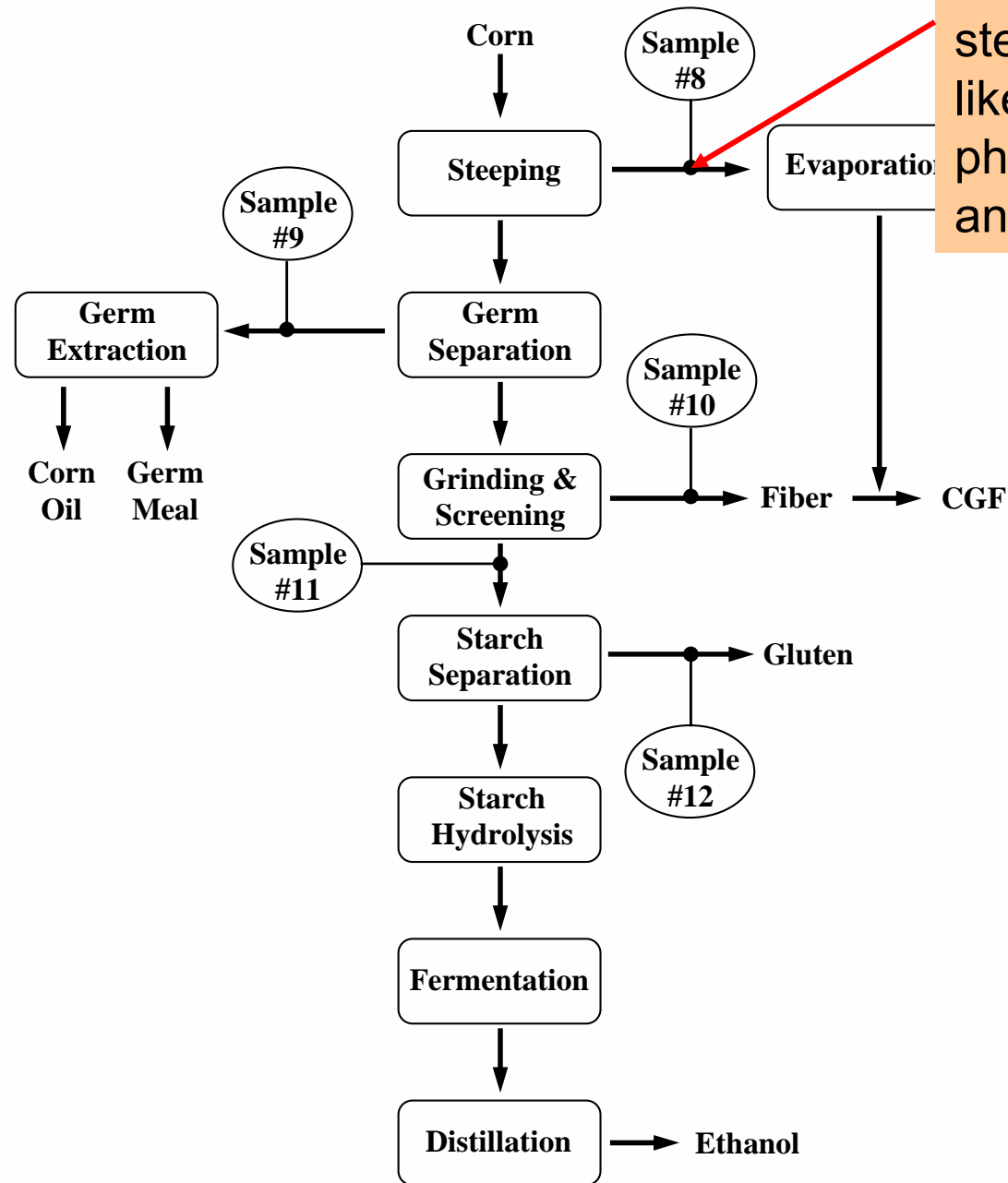
Remove P from the ethanol stream

Hossein Noureddeni

- P distribution in corn wet and dry milling processes.
- The degradation of phytate using enzymatic hydrolysis.
- Removal and purification of the degradation products including inositol and other phosphate compounds.

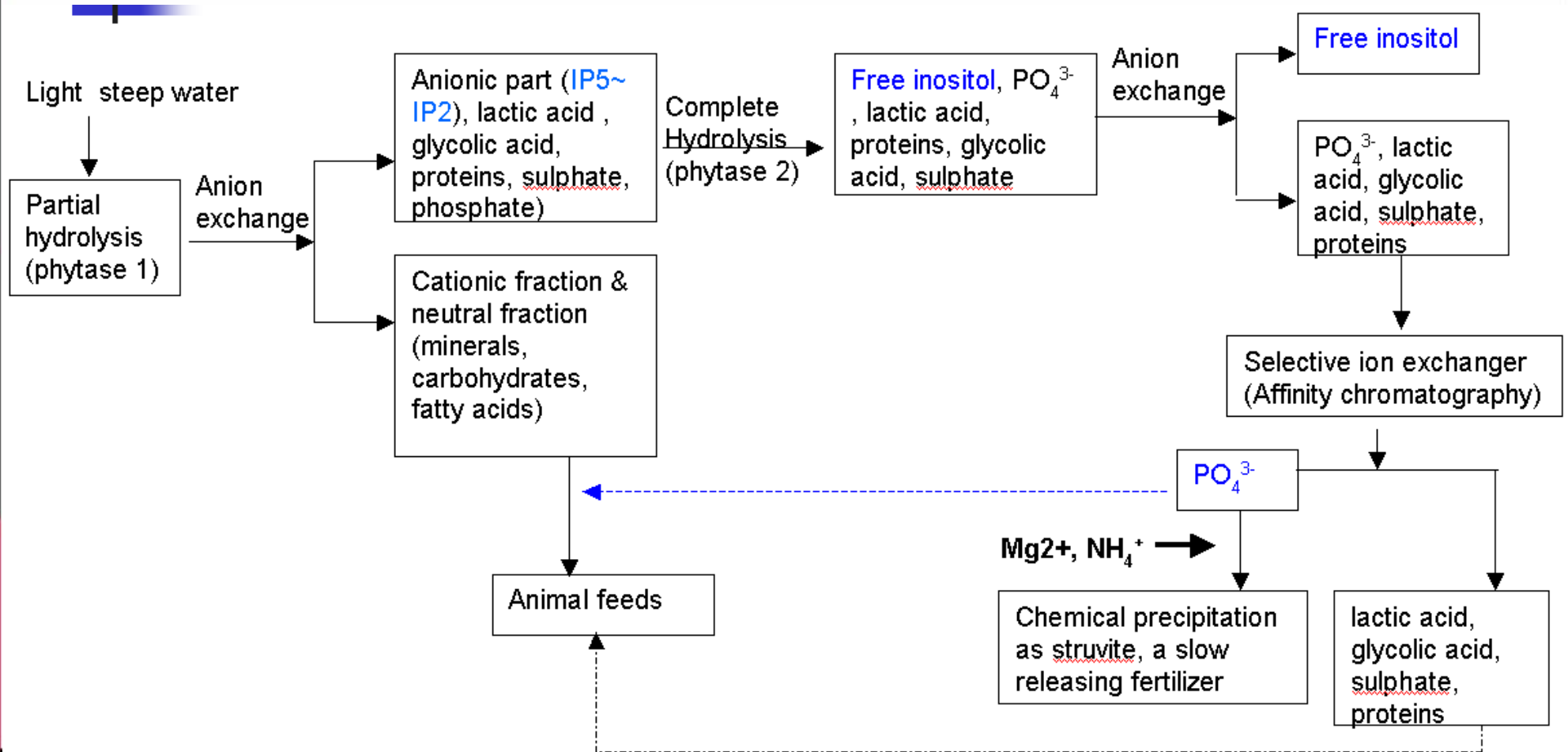


Wet milling process



3.4% P d.wt. in light steep water (LSW); likely point of phytate hydrolysis and P removal.

Separation and removal of P compounds is being studied.



Questions???