Whole Farm P Management & Economic Tool: FNMP $

University of Nebraska Lincoln

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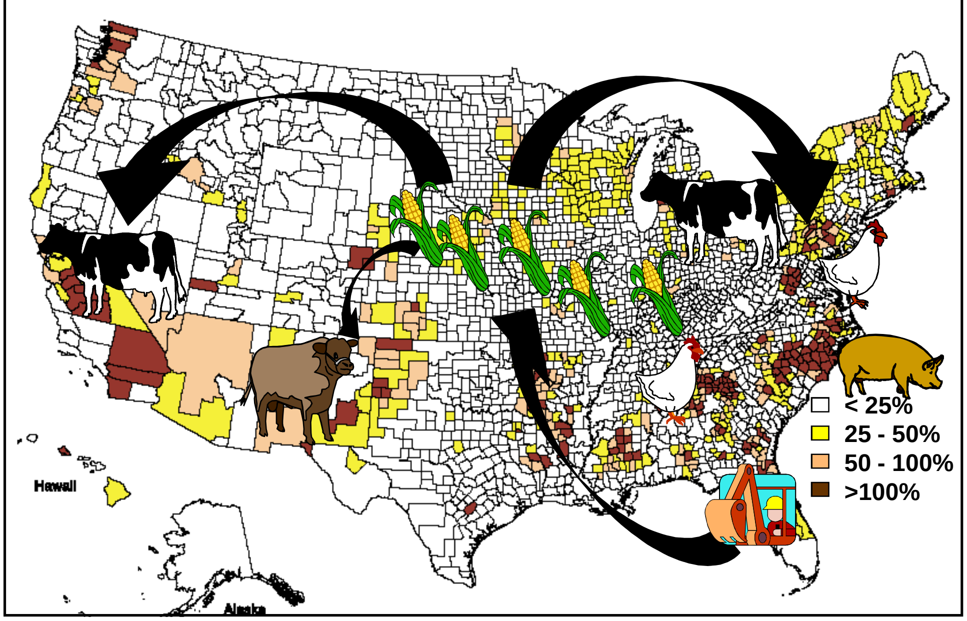
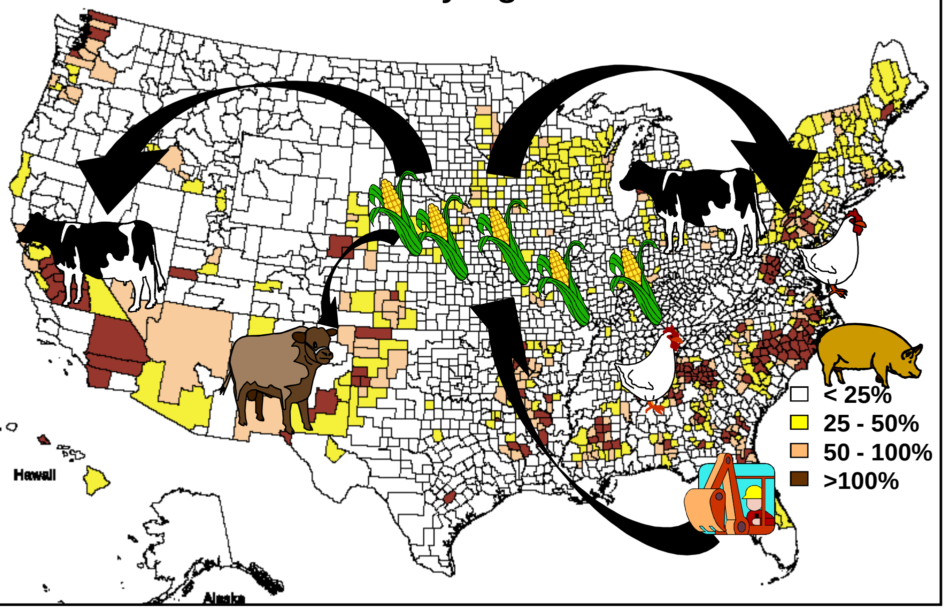
Manure P vs. Crop Land P Use



One-Way Flow of Nutrients Is Underlying Cause

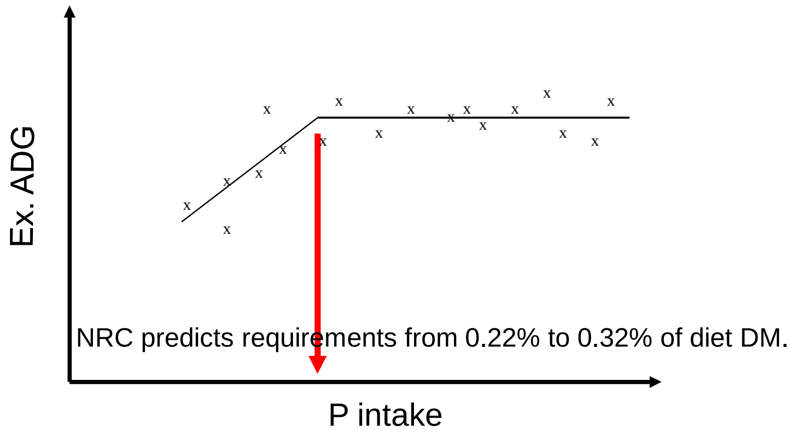


Public Policy Response

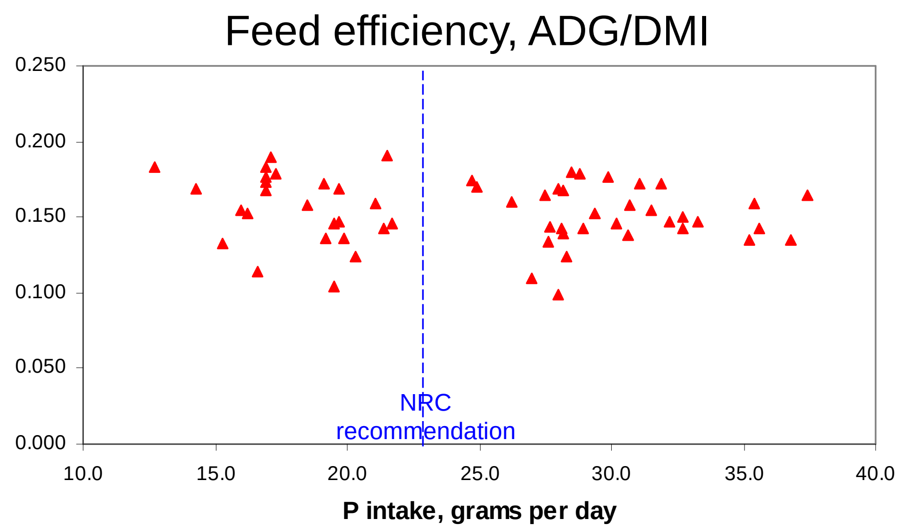
- Nutrient Management Plan
  - Use manure nutrients efficiently within the land base managed by the livestock operation.
- Phosphorus Risk Assessment –
  - Potential for P to move from land application site
  - Based upon “source” and “transport” factors
- Preference to imported commercial nutrients over recycled manure nutrients.

P requirements

P requirements

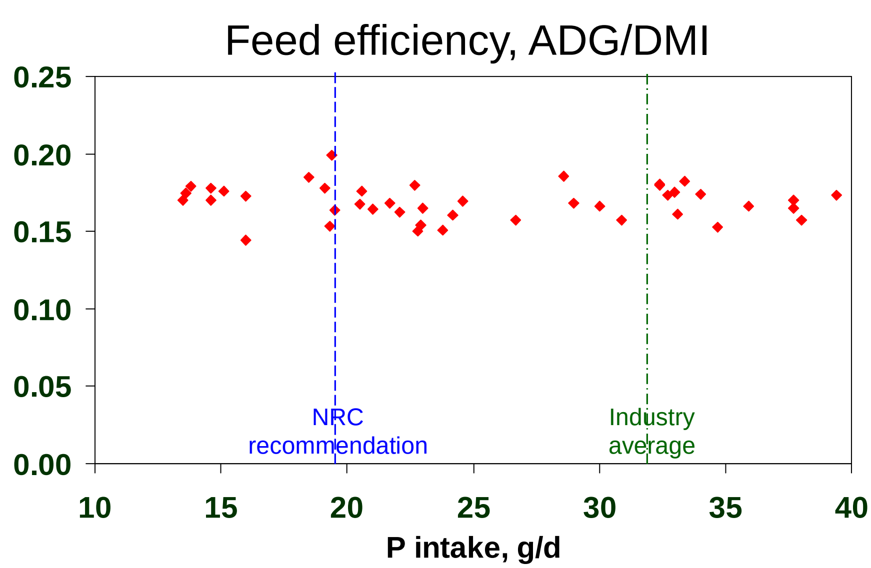


P requirements



Erickson et al., 1999 J. Anim. Sci.

P requirements



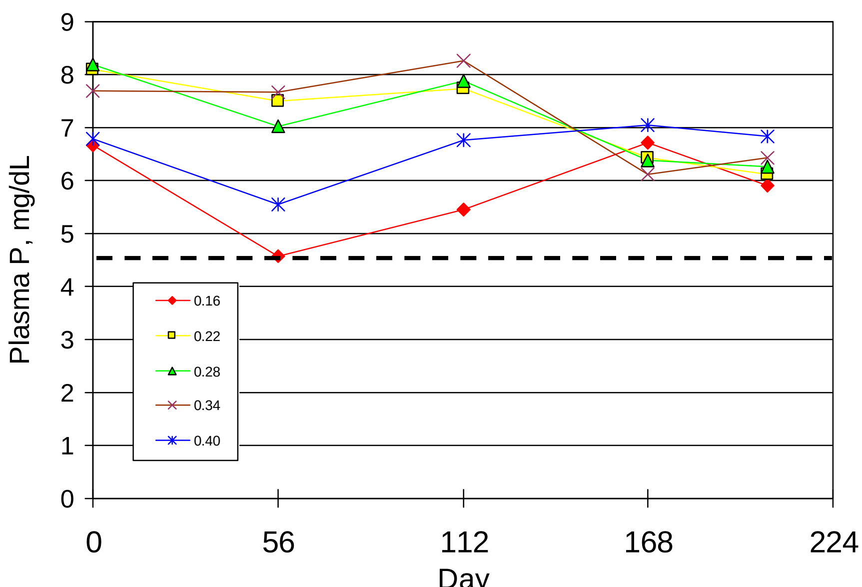
Erickson et al., 2002 J. Anim. Sci.

P requirements

- Cromwell (JAS '95,2000; '95,449; '94,2653) with valid assumption that total ash is proportional to bone P due to non-discrimation during resorption

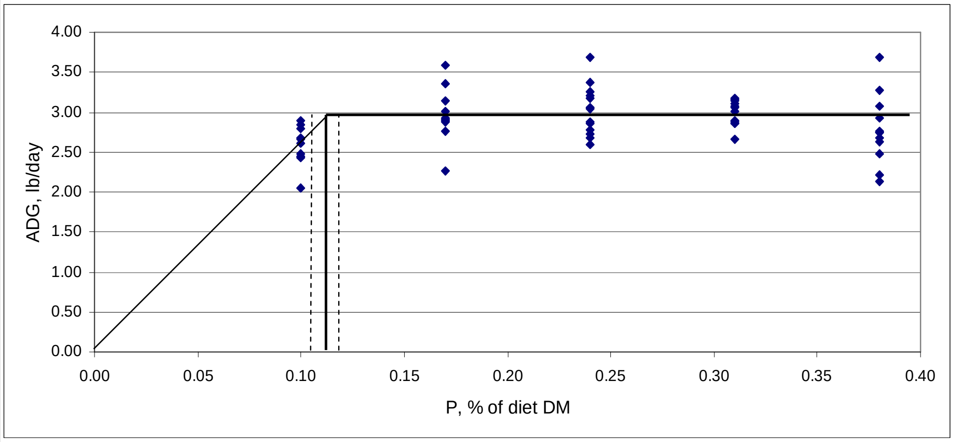
Erickson et al., 1999 and 2002 J. Anim. Sci.

P requirements



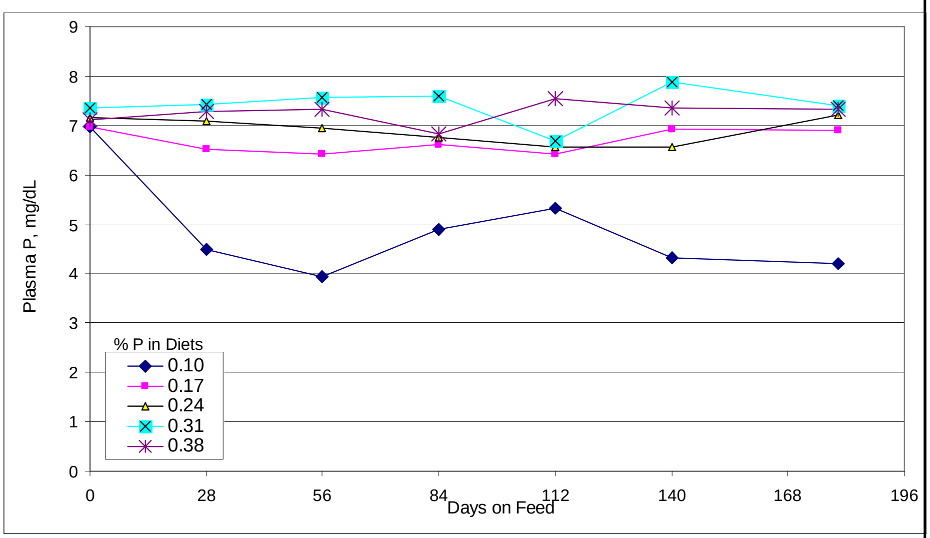
Erickson et al., 2002 J. Anim. Sci.

P requirements



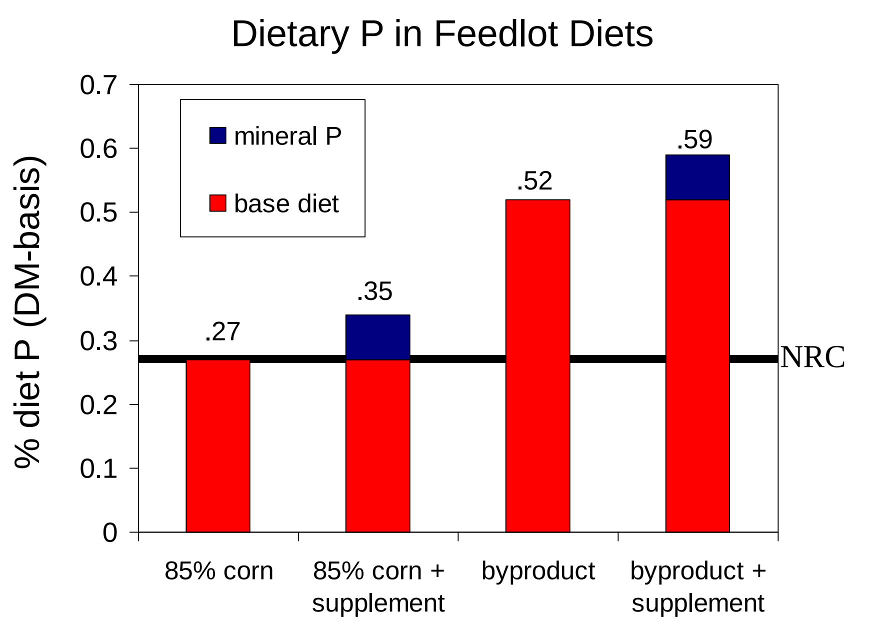
Giesert et al., 2004 Nebraska Beef Report

P requirements

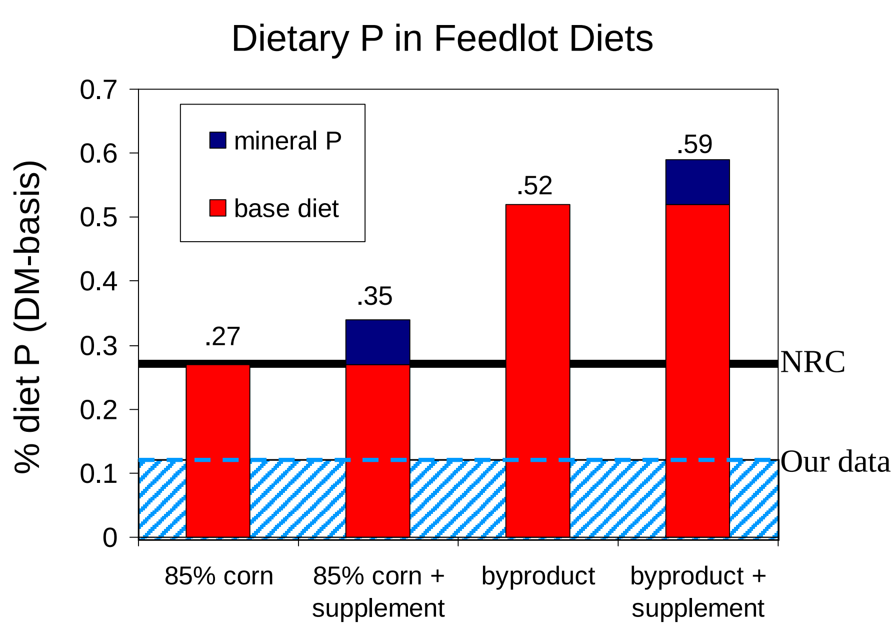


Giesert et al., 2004 Nebraska Beef Report

Impact of DGS on P challenge



Impact of DGS on P challenge



Why overfeed phosphorus?

- **Ingredient variability between batches**
- **Uncertainty in recommended levels**
- **Feeding to meet demands of greatest producing animals**
- **"*More is better*" – no negative performance effects**
- **Belief that reproductive performance will suffer without abundance of P**

Book values vs Ingredient testing:

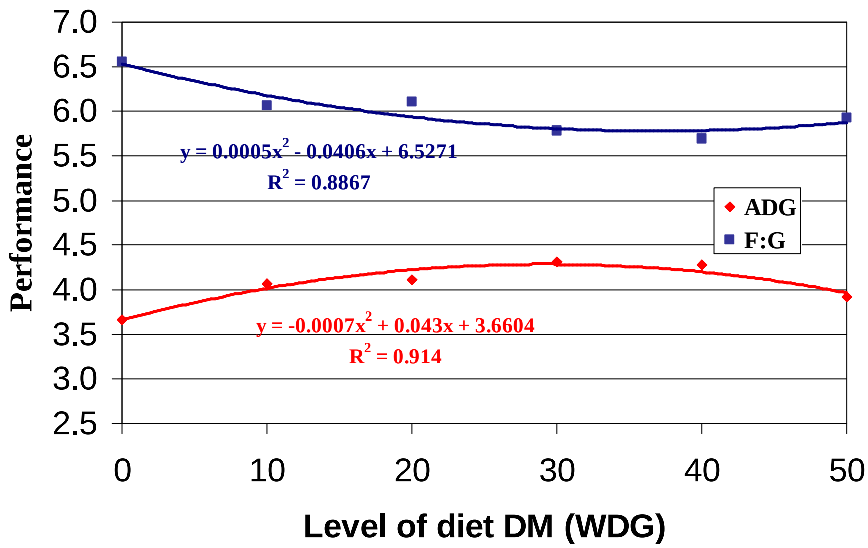
- **Book values have limited value**
- **Ingredient testing only as good as the sample taken**

Why overfeed phosphorus?

- In beef (and dairy?)
  - Challenge is not fine-tuning P mineral supplementation
  - Never supplement mineral
  - How to deal with P in "normal" feeds
    - Corn: 0.31% P
    - DGS: 0.75 to 0.90%
    - CGF: 0.90 to 1.0%
    - Etc.

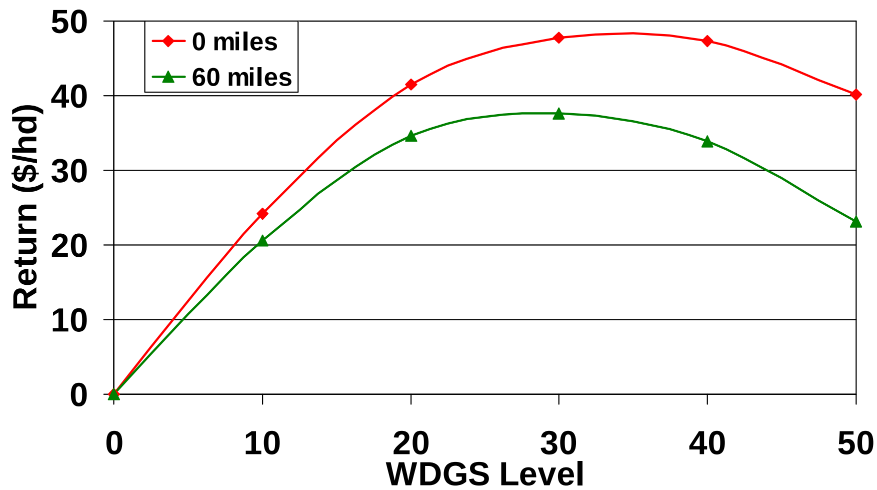
FNMP $

Performance for DGS



Vander Pol et al., 2006 Nebraska Beef Rep. and 2005 Midwest ASAS

Economics for WDGS



Corn at $3.50/bu; WDGS at 95% of corn price; miles are distance from ethanol plant to feedlot

FNMP $

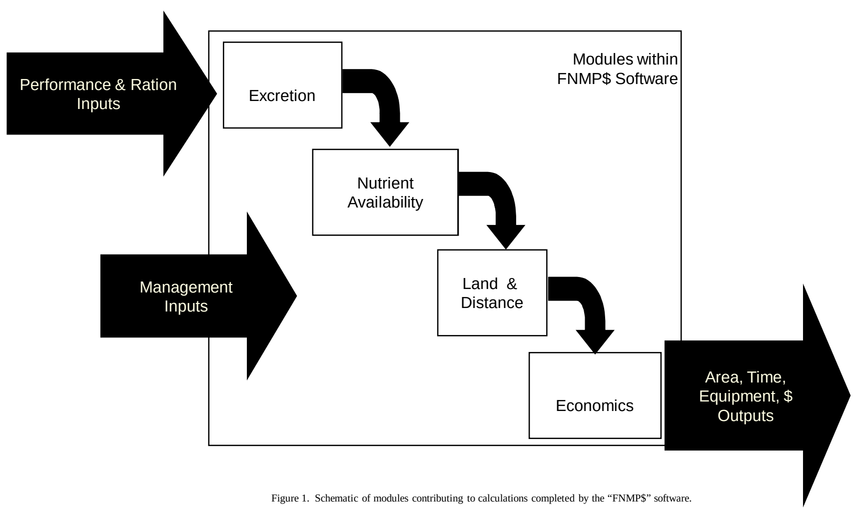
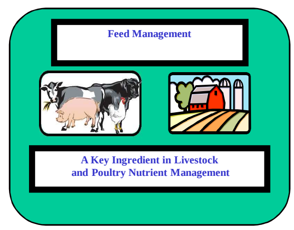


Figure 1. Schematic of modules contributing to calculations completed by the "FNMP$" software.

Economic Evaluation

Comparing a Ration Change
Vs
Manure Transport

Step 3



Economic Evaluation

Is it more profitable to change diet or spread manure further?

- Economics of feed change (*Nutritionist*)

- Economics and time requirements for manure transport (*NRCS, TSP, and Nutritionist*)

- Land access requirements including costs (*Producer*) (*Rent, lease, or purchase*)

Feed Nutrient Management Planning Economics (FNMP$)…

Connecting Feed Decisions with Crop Nutrient Management Plans

Version - Draft for Field Evaluation   Last Updated on August 15, 2007

Purpose:

This spreadsheet estimates the quantity of manure nitrogen, phosphorus, and solids excreted based upon user inputs of feed program and animal performance (based upon procedures contained within ASABE Standard D384.2). In addition, using procedures defined in USDA Natural Resources Conservation Service publication "Agricultural Waste Management Field Handbook", an estimate of harvested and crop available nutrients are estimated. This information is then used to develop an estimate of 1) land requirements for agronomic utilization of the manure, 2) time requirements for land application, and 3) costs associated with land application and potential nutrient value (N and P only) of manure.

Step 1. Will units be Metric or English? English   Will feeds be reported on a wet or dry basis? Dry Basis

Step 2. Enter farm contact information and sources of manure: **Farm Name: Meadow**

Step 3. Enter farm specific information to estimate manure excretion

Animals - Head Capacity

Dairy, Lactating Cows - 100 head
Dairy, Lactating Cows - 110 head
Dairy, Lactating Cows - 110 head
Dairy, Lactating Cows - 100 head
Dairy, Lactating Cows - 42 head

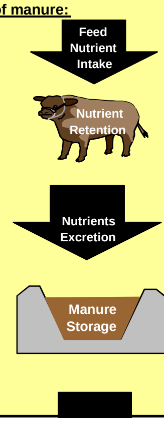
Excreted Nutrients:

215,992 lbs N/year
24,935 lbs P/year

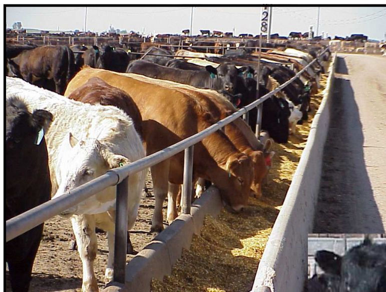
Step 4. Enter manure management factors and view excreted and harvested manure

Harvested Nutrients

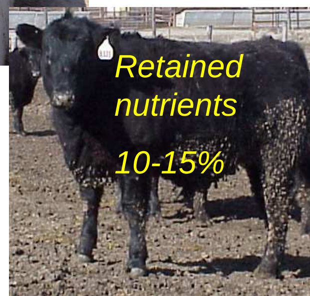
27,864 lbs N/year



Nutrient Excretion & Manure amounts



Intake



Intake-Retention=Excretion

Excretion in feces & urine

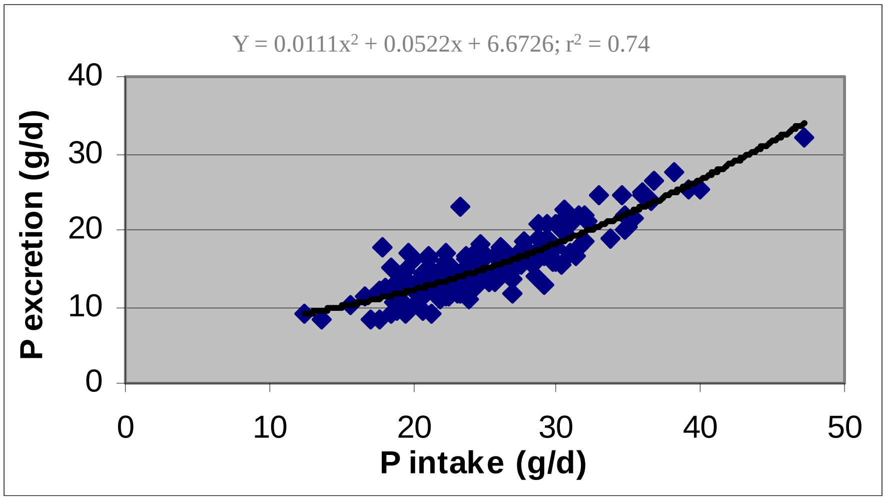
Impact of DGS on excretion

- Excretion numbers using ASABE std approach

	AVG	MIN	MAX
Diet P, %	0.31	0.25	0.50*
P Excretion	7.0 lb	4.6 lb	**14.1 lb**
“old” std	13.9 lb		

150 days fed for an "average" steer

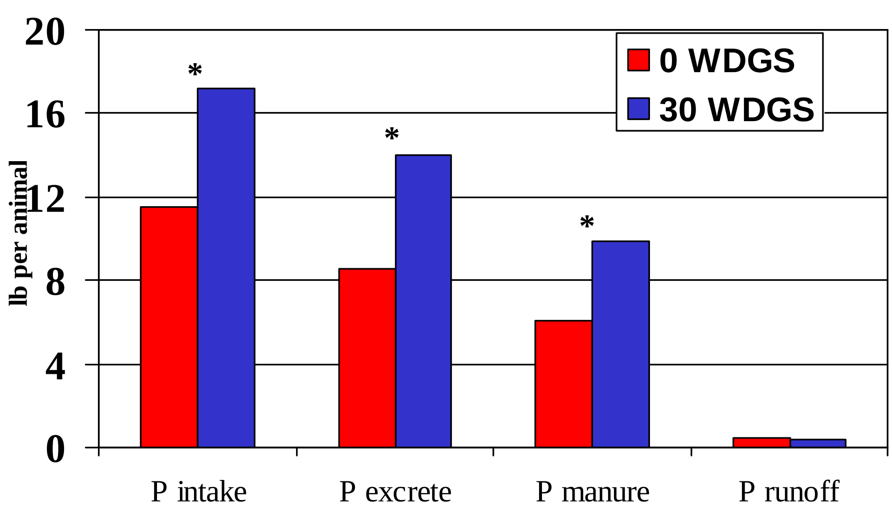
Dietary P effect on excretion



Meyer and Trenkle, ISU research

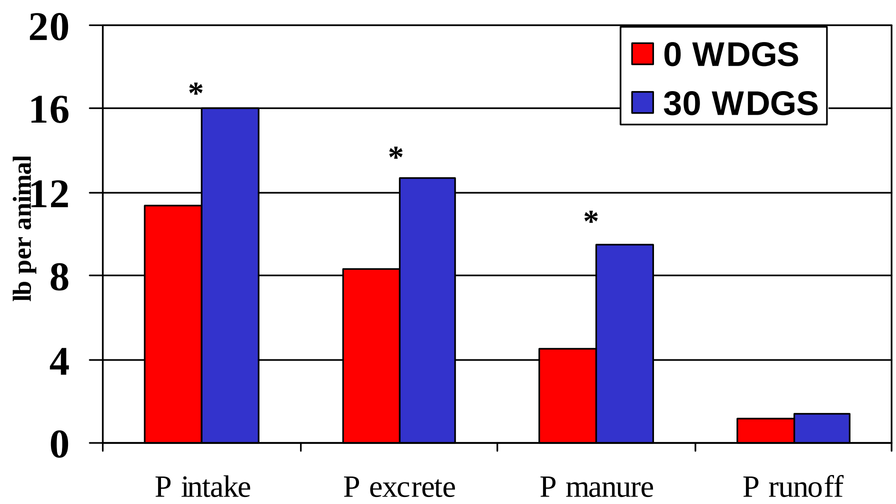
Impact of DGS on P challenge

P mass balance-Winter



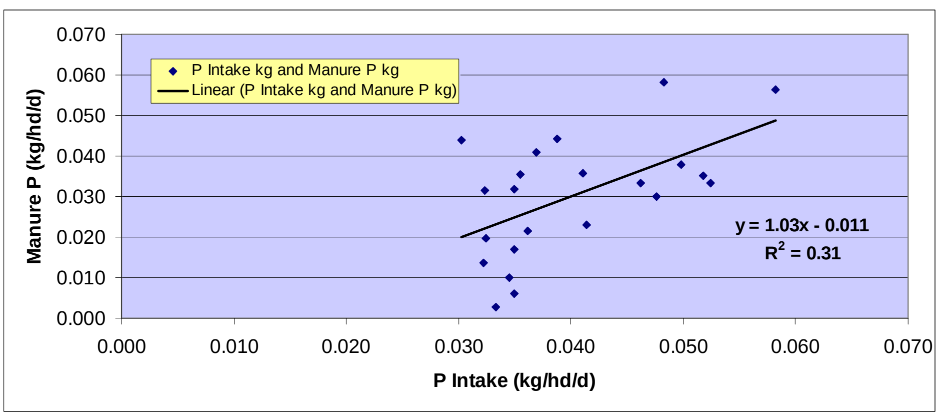
Impact of DGS on P challenge

P mass balance-Summer



Impact of DGS on P challenge

Dietary P effect on manure



Relationship between P intake and manure harvested P (kg/hd/d) for cattle lots.

Kissinger et al., 2006 NE Beef Report

Land area needed
&
Application costs

Impact of DGS on P challenge

Land Requirements, 4yr P basis (acres)

Diet:	DGS at 0%	DGS at 40%
Excreted P, kg/yr	61,000	116,000
Land required, ac	5800	11,110
Time, hrs/yr	824	1,175
Cost	$ 48,000	$ 72,000

Assumes: 40% of land area accessible
175 bu corn, 60 bu soybean rotation

Koelsch et al., 2007

Impact of DGS on P challenge

Land Requirements, 4yr P basis (acres)

Diet:	DGS at 0%	DGS at 40%
Excreted P, kg/yr	61,000	116,000
Land required, ac	5800	11,110
Time, hrs/yr	824	1,175
Value	$ 109,000	$ 192,000
Cost	$ 48,000	$ 72,000
Net	$ 61,000	$ 120,000

Assumes: 40% of land area accessible
175 bu corn, 60 bu soybean rotation

Koelsch et al., 2007

Impact of application “scheme”

N rate compared to a P rate application scheme, with P rate based on 1 yr

scheme:	N rate	P rate
Excreted P, kg/yr	116,000	116,000
Land required, ac	2406	11,110
Annual land	2406	11,110
Time, hrs/yr	920	2100
Value	$ 192,000	$ 192,000
Cost	$ 52,200	$ 144,130
Net	$ 139,800	$ 48,070

Assumes: 40% of land area accessible
175 bu corn, 60 bu soybean rotation

Koelsch et al., 2007

Impact of application "scheme"

N rate compared to a 4 yr P rate application scheme, with P rate based on 4 yr

scheme:	N rate	P rate
Excreted P, kg/yr	116,000	116,000
Land required, ac	2406	11,110
Annual land	2406	2,780
Time, hrs/yr	920	1,200
Value	$ 192,000	$ 192,000
Cost	$ 52,200	$ 71,700
Net	$ 139,800	$ 120,300

Assumes: 40% of land area accessible
175 bu corn, 60 bu soybean rotation

Koelsch et al., 2007

Impact of DGS on P challenge

Land Requirements, 4yr P basis (acres)

Feedlot size (hd):	2500	10,000	25,000
0 byp 0.30 P	1,320	5,300	13,200
40 byp 0.50 P	2,500	10,000	25,000

Assumes: 50% of land area accessible
185 bu corn, corn-soybean rotation, ~35 lb P per acre (80 lb P_2O_5)

Kissinger et al., 2006 NE Beef Report

Impact of DGS on P challenge

Costs and Net Value, C-SB rotation
4-Yr P Basis, ($/hd)

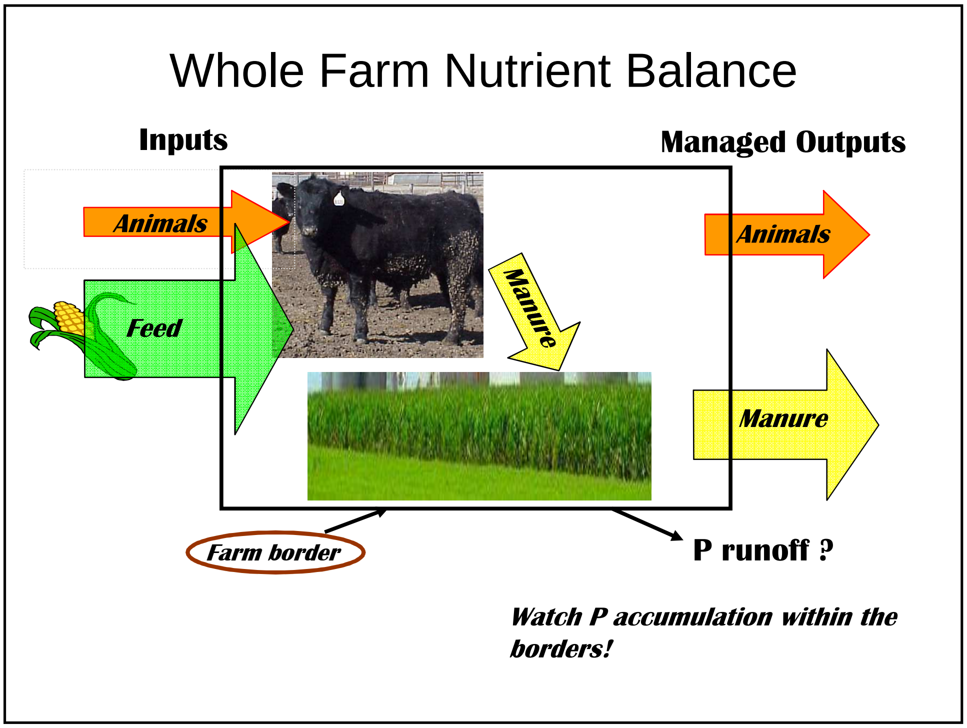
	2500	10,000	25,000
COSTS			
0 byp 0.30 P	3.00	2.10	3.00
40 byp 0.50 P	3.90	3.30	5.75
NET VALUE			
0 byp 0.30 P	2.50	3.50	2.50
40 byp 0.50 P	6.10	6.80	4.30

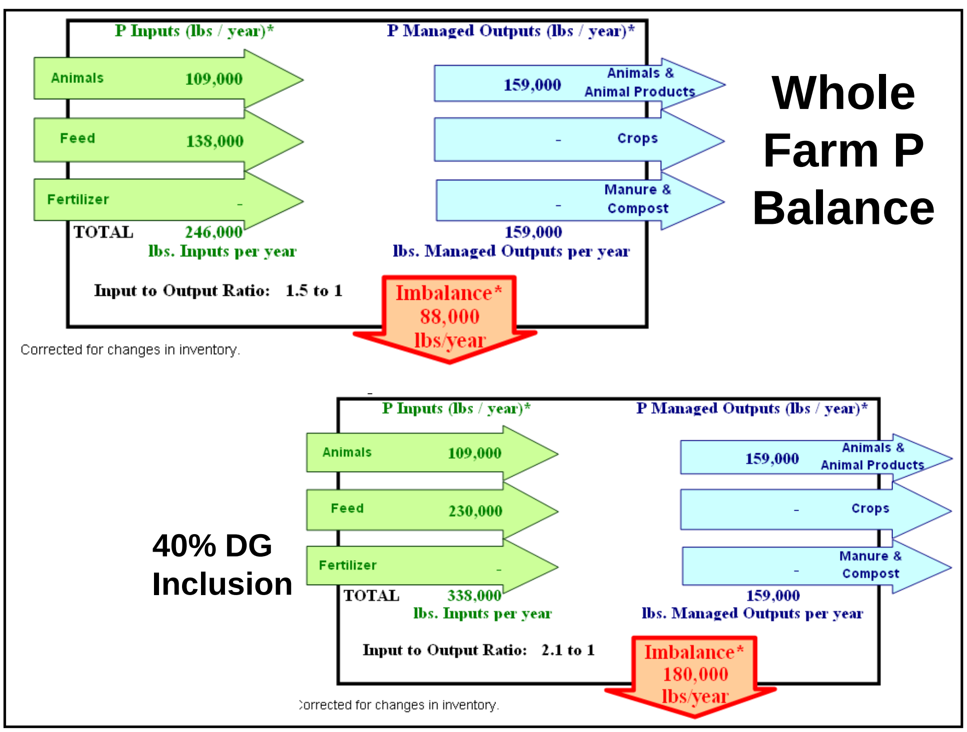
Kissinger et al., 2006

Manure P vs Fertilizer P

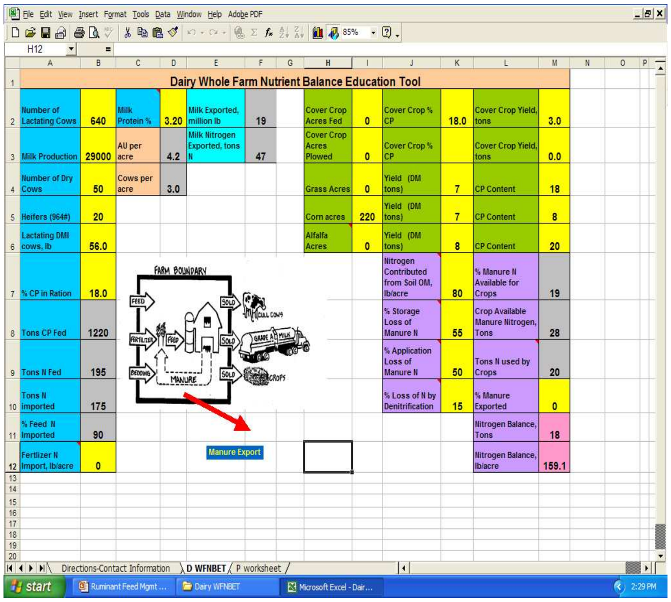
- 79% of corn acres fertilized in 2003
- average = 35 lb/ac
- 8.1 million acres planted
  - (141,750 tons P_2O_5)
  - (54,871 tons P at 79% acres)
- 4.5 million feedlot cattle
- Excrete 12 lb = 54 mil. Lb.
  - (27,000 tons)

http://www.nass.usda.gov/ne/special/agchem04.pdf


Whole Farm Nutrient Balance
Inputs
Managed Outputs
Animals
Feed
Manure
Animals
Manure
Farm border
P runoff ?
Watch P accumulation within the borders!


P Inputs (lbs / year)*
P Managed Outputs (lbs / year)*
Animals 109,000
Feed 138,000
Fertilizer -
TOTAL 246,000
lbs. Inputs per year
159,000 Animals & Animal Products
- Crops
- Manure & Compost
159,000
lbs. Managed Outputs per year
Input to Output Ratio: 1.5 to 1
Imbalance* 88,000 lbs/year
Corrected for changes in inventory.
Whole Farm P Balance
40% DG Inclusion
P Inputs (lbs / year)*
P Managed Outputs (lbs / year)*
Animals 109,000
Feed 230,000
Fertilizer -
TOTAL 338,000
lbs. Inputs per year
159,000 Animals & Animal Products
- Crops
- Manure & Compost
159,000
lbs. Managed Outputs per year
Input to Output Ratio: 2.1 to 1
Imbalance* 180,000 lbs/year

Strategies to Reduce N & P And Achieve Whole Farm Balance



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Dairy Whole Farm Nutrient Balance Education Tool												
2	Number of Lactating Cows	640	Milk Protein %	3.20	Milk Exported, million lb	19		Cover Crop Acres Fed	0	Cover Crop % CP	18.0	Cover Crop Yield, tons	3.0
3	Milk Production	29000	AU per acre	4.2	Milk Nitrogen Exported, tons N	47		Cover Crop Acres Plowed	0	Cover Crop % CP		Cover Crop Yield, tons	0.0
4	Number of Dry Cows	50	Cows per acre	3.0				Grass Acres	0	Yield (DM tons)	7	CP Content	18
5	Heifers (964#)	20						Corn acres	220	Yield (DM tons)	7	CP Content	8
6	Lactating DMI cows, lb	56.0						Alfalfa Acres	0	Yield (DM tons)	8	CP Content	20
7	% CP in Ration	18.0								Nitrogen Contributed from Soil OM, lb/acre	80	% Manure N Available for Crops	19
8	Tons CP Fed	1220								% Storage Loss of Manure N	55	Crop Available Manure Nitrogen, Tons	28
9	Tons N Fed	195								% Application Loss of Manure N	50	Tons N used by Crops	20
10	Tons N imported	175								% Loss of N by Denitrification	15	% Manure Exported	0
11	% Feed N Imported	90										Nitrogen Balance, Tons	18
12	Fertlizer N Import, lb/acre	0										Nitrogen Balance, lb/acre	159.1

Implications of Greater P Inputs

- P Inventory within farm increases at rate of 88,000 vs 180,000 lb P/year faster.
- Short Term - P Risk Assessment will…
  - Erosion control practices will allow banking of excess P for some period of time…
  - Bank will be filled more quickly with DGS.
- Long Term - P Risk Assessment will…
  - Reduce fields receiving manure to meet N needs
  - Increase fields receiving manure to meet P needs
  - Increase fields ineligible for manure application

Implications of Greater P Inputs

- Using DGS and Beef Feedlots as example
- Two options
  - Export manure across more acres
    - At a cost, and that < feed cost improvement
    (LAND RICH AREAS)
  - Discontinue use of high P feeds
    (LAND RESTRICTED AREAS)

- Ignoring the problem (ignorance) is not an option

Public Policy Needs

- Value recycled manure over imported fertilizer nutrients
  - Encourage export of manure
  - Encourage alternative uses of manure
  - Recognize environmental benefits of manure
- Cautiously apply P-Index triggers for “No Manure” application.
- Recognize critical differences in nutrient plans for cattle operations based upon DGS use.

Conclusions

Use the tool, make more informed decisions

Be sure your feed ingredient decisions

- make more $ than manure costs
- increase $ of manure
- account for nutrients fed, it impacts CNMP!

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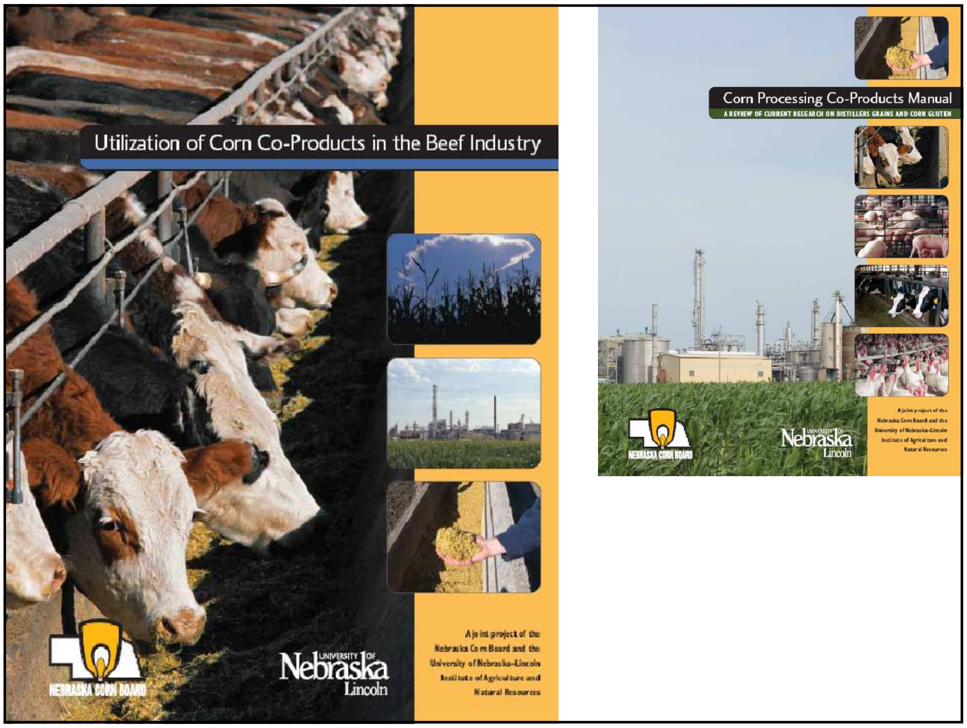
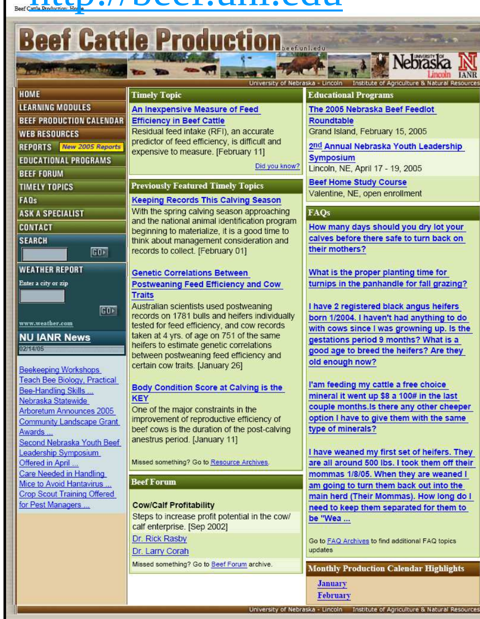
Acknowledge:

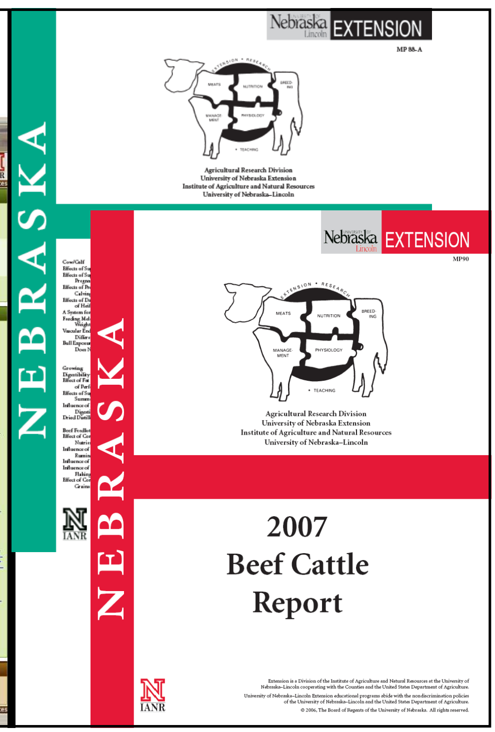
NRCS Conservation Innovation Grant



Beef Extension Page

http://beef.unl.edu





Phosphorus

	Ethanol Plant					
	1	2	3	4	5	6
Avg	0.83	0.79	0.87	0.85	0.80	0.78
CV[1]	2.55	5.03	2.80	2.57	2.20	2.88
Min	0.78	0.72	0.79	0.80	0.77	0.70
Max	0.88	0.89	0.91	0.90	0.83	0.81

1 Correlation of Variation for all 50 Plant Samples.