Economic Returns of Gypsum Application in Organic Corn Crops

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COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Does this look familiar?

Did you get a survey?

2017 ORGANIC CORN & SOIL MANAGEMENT SURVEY
A Collaborative Effort of Ohio State University
& Organic Certification Organizations

Why are we sending this survey?

The acreage under organic corn in the U.S. has increased rapidly in recent years, rising from 32,650 to 234,470 acres between 1995 and 2011. Because organic corn producers cannot rely on conventional chemical inputs to supply nutrients or control weeds and pests, they have adopted a wide range of innovative crop and soil management practices. Our research team is particularly **interested in how organic farmers manage their soil, and how the use of different soil amendments and management practices affect crop productivity, soil and crop quality, and farm profitability.**

The best place to learn about the effectiveness of different organic corn management practices is from the experiences and observations of working farmers. **To do this, we need your help.** We are inviting a group of randomly-selected, certified organic corn farmers to share information about their 2017 production year. Participation in the survey is entirely voluntary, but we need responses from everyone to ensure that the results are representative of the experiences of organic corn farmers in this region. Results of our analysis will be shared with the organic farming community to help identify the relative performance of alternative soil management practices.

Initially, we want to check if your farm qualifies for this study.

A1. Did you raise certified organic corn in 2017? *(Check ✓ one)*

○ NO → *If not – please return the survey in the enclosed stamped envelope.*
○ YES → *If yes – continue.*

Next, we want to begin by learning more about your overall farm operation.

B1. What kinds of farm products did you produce in 2017? *(✓ all that apply, note if organic)*

Crop Enterprises	Raised organic	Raised conventional	Livestock Enterprises	Raised organic	Raised conventional
Corn	○	○	Dairy	○	○
Soybeans	○	○	Beef	○	○
Wheat	○	○	Hogs	○	○
Barley or oats	○	○	Poultry	○	○
Alfalfa or other hay	○	○	Horses	○	○
Vegetable crops	○	○	Sheep or goats	○	○
Other (specify):			*Other (specify):*		
	○	○		○	○
	○	○		○	○

B2. Please circle the one crop or livestock enterprise above that provided the most amount of gross income on your farm in 2017.

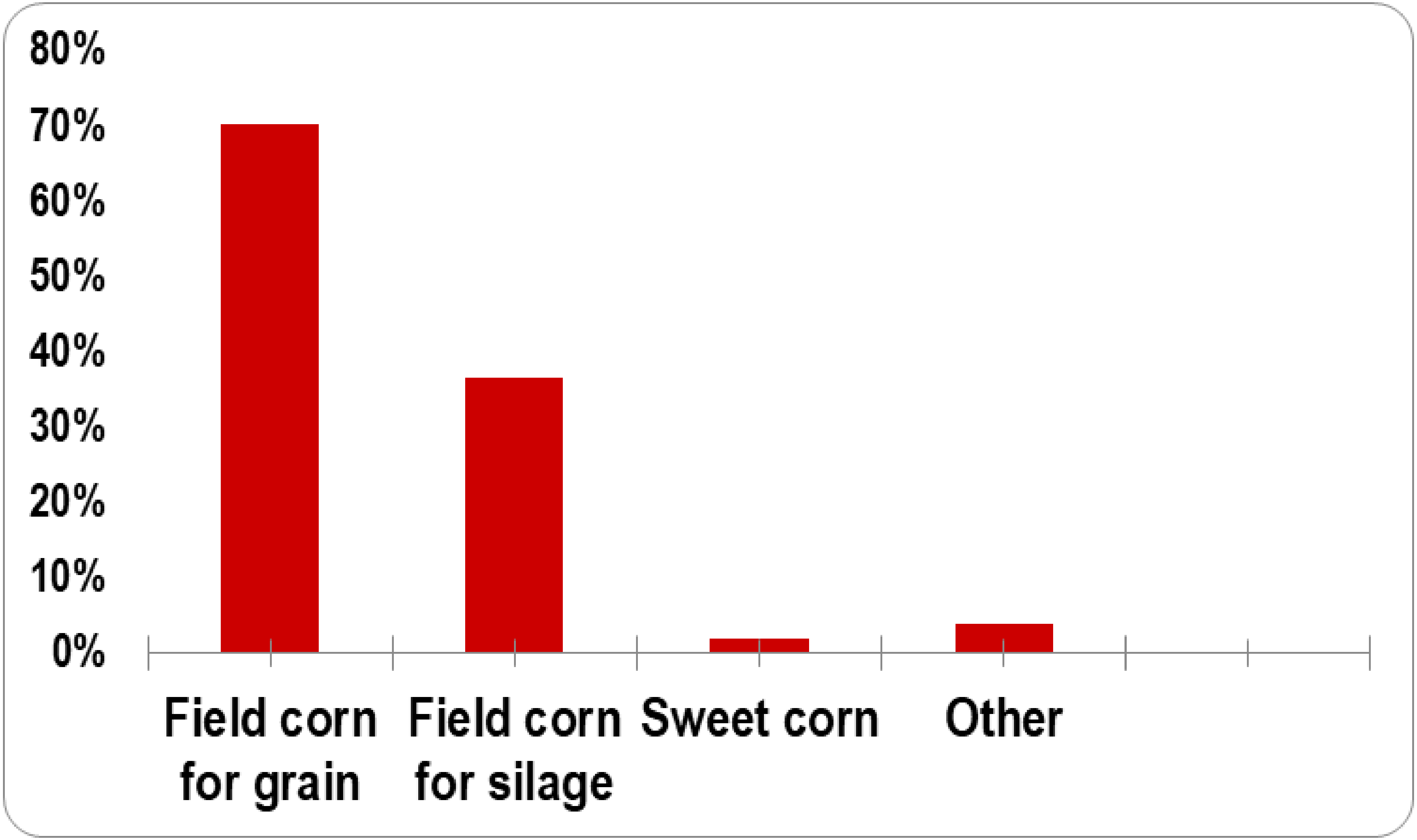
Data and Methods

- All the organic corn farmers (N=1662) in the states of IN, MI, OH, and PA.
  USDA Organic Integrity Database

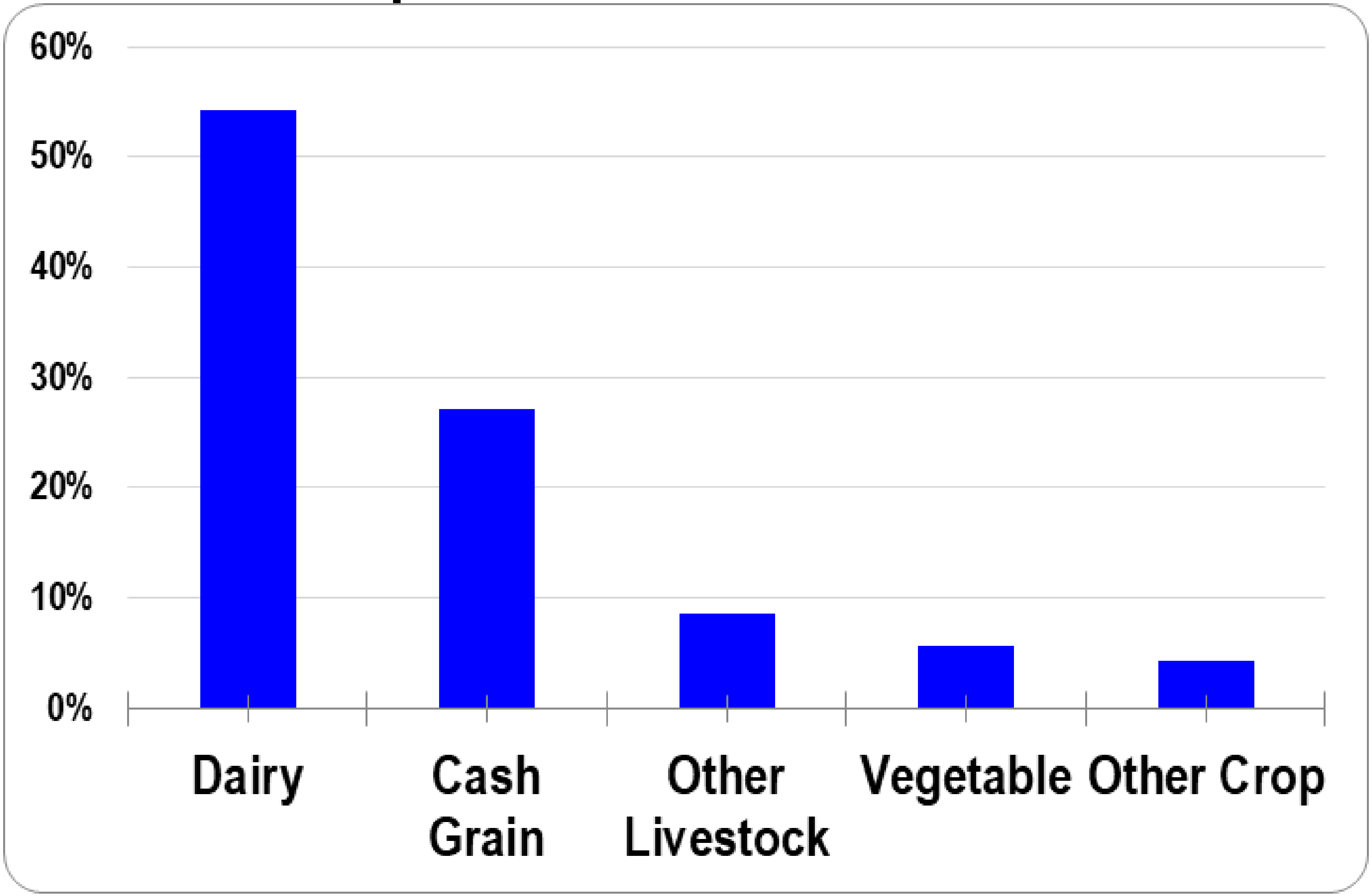
- Three waves of the survey
  Introductory letters and reminder postcards

- 859 organic corn growers responded

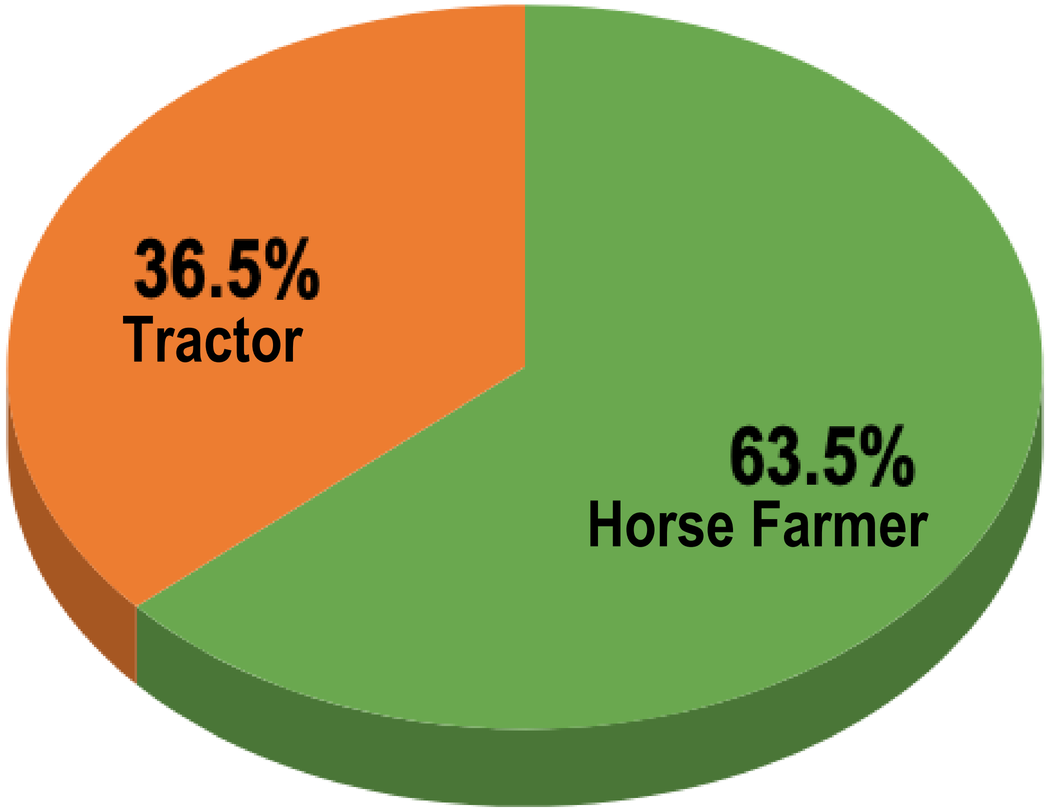
Types of Corn Raised (%)



% of Corn Growers Classified by Principal Source of Farm Income



Many rely on horses for fieldwork



Soil Amendment Use Overall

	All Farms
INPUTS USED IN 2017:	
Any manure	89%

Soil Amendment Use Overall

	All Farms
Ca Input Use last 4 yrs	
Any Ca input	**51%**
Lime	11%
Hi-Cal	25%
Gypsum	25%

Calcium will be a combo of different types over last four years in following calculations

Economics of Soil Amendments

Economics

Info on Yield, Prices,

and Inputs

Input Use in Organic Corn Production

- Info on manure, compost, NPK, microbial products, and soil amendments
  - Various ways of applications, wide range in quantities
  - Dollar values in many cases, quantity values in some cases
- Machinery
  - Passes for planting, intercultivation, nutrient application, and harvesting
  - Imputed values for horses vs. tractor use
- Seed Rates
  - imputed based on the yield rates
- Land Rent
  - 20% responded with $ values; supplemented with USDA data

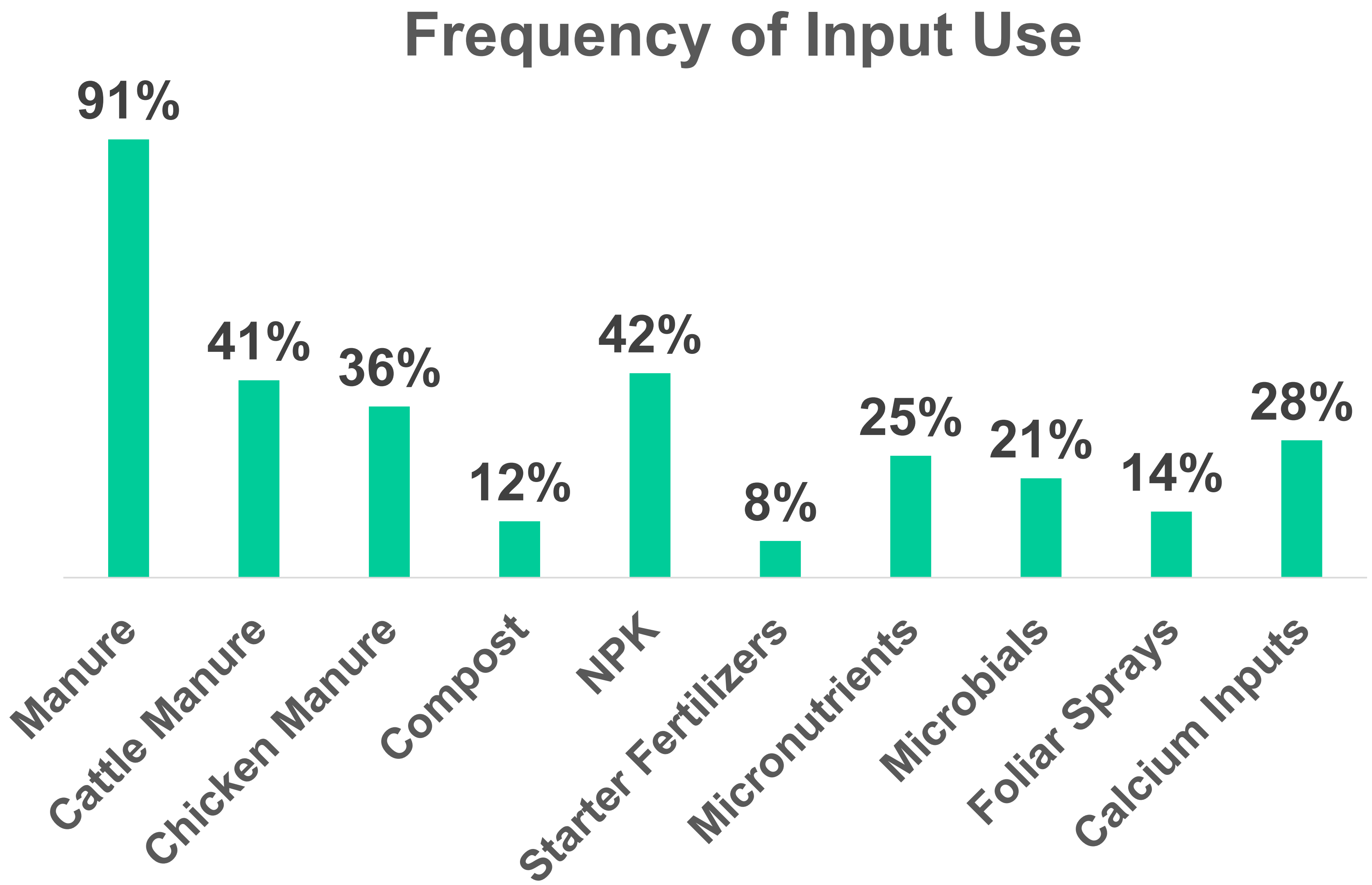
Quantity Info

- Wide variations in application rates and methods

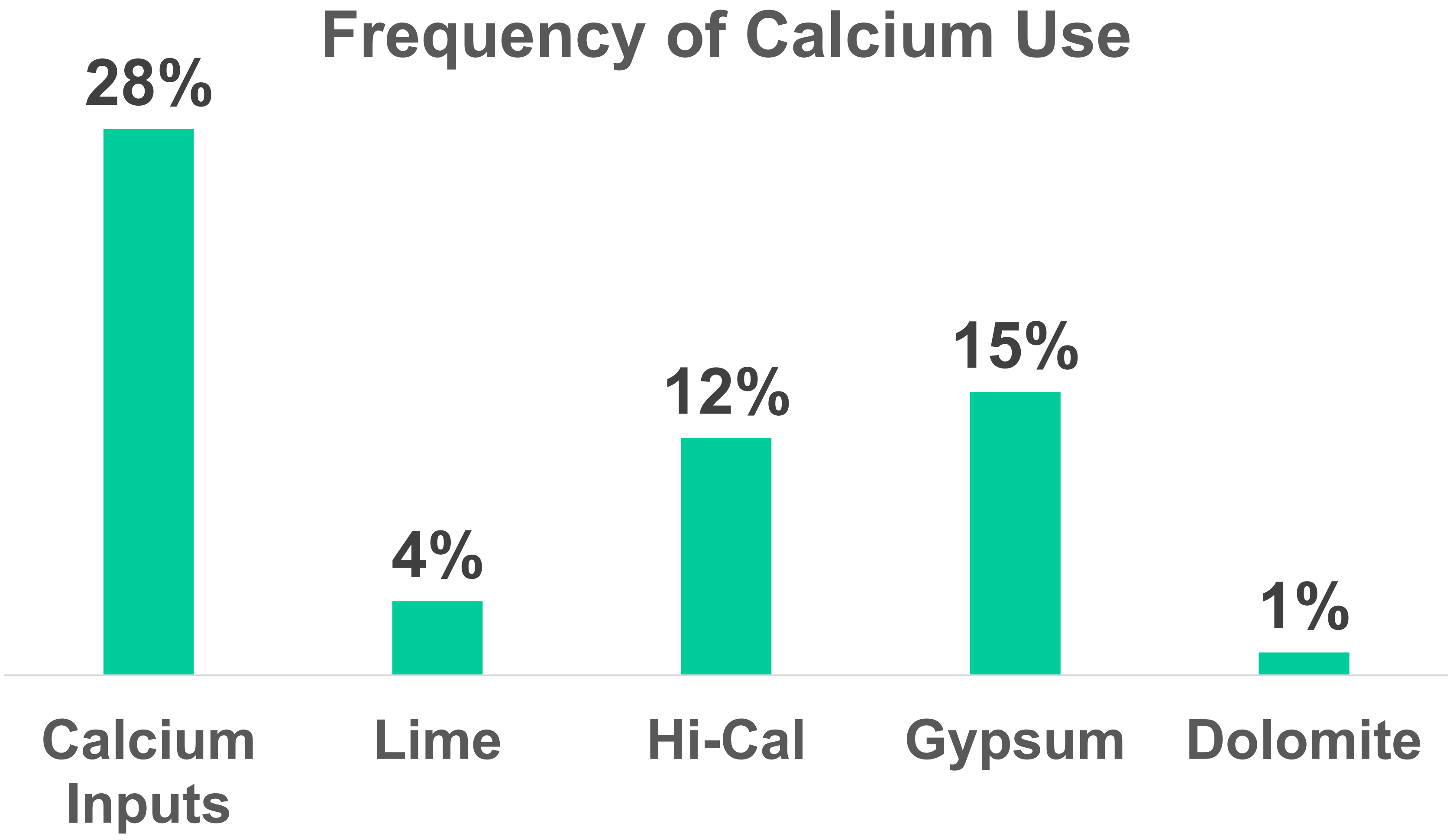
Report

'manure: rate of application'

'manure: units of application'	Mean	N	Std. Deviation
bu	851.7024	42	1423.49707
gallons	12000.0000	1	.
gals	5994.4217	115	3345.43674
lbs	2099.8810	42	2043.50264
loads	16.1571	7	20.54279
missing	6001.7500	2	8482.80650
tons	5.1238	364	6.15734
yds	11.6667	3	15.88500
Total	1457.1904	576	2932.01023



Frequency of Input Use
91%
41%
36%
12%
42%
8%
25%
21%
14%
28%
Manure
Cattle Manure
Chicken Manure
Compost
NPK
Starter Fertilizers
Micronutrients
Microbials
Foliar Sprays
Calcium Inputs


Frequency of Calcium Use
28%
4%
12%
15%
1%
Calcium Inputs
Lime
Hi-Cal
Gypsum
Dolomite

Both Grain Corn and Silage Corn	Calcium Appliers	No-Calcium Applications
Fertilizers and Soil Amendments	**$198**	$129
Fieldwork	**$96**	$94
Seeds	**$102**	$97
Land Rent	**$155**	$152
Total Expenses	**$551**	$472
Total Revenues	**$1380**	$1280
Net Returns to Labor and Management	**$828**	$807

For both Grain Corn and Silage Corn	Calcium Appliers	No-Calcium Applications
Manure and Compost	$ 75	**$ 80**
NPK	**$ 36**	$ 23
Calcium	**$ 45**	$ 2
Micronutrients	**$ 12**	$ 8
Microbial Products	**$ 8**	$ 7
Fish and Foliar Products	**$ 7**	$ 5
Others	**$ 17**	$ 8
Total	**$ 199**	$ 130

Distinction between Corn for Grains and Corn for Silage

Summary Statistics

	Corn Grains	Silage
Yield	133 bu	20 tons
Price	$9.44/bu	$69.44/ton
Revenues	$1267	$1404
Estimated Expenses	$497	$495
Net Returns	$770	$909

Does Calcium Make a Difference in Corn Grain Crop?

	With Calcium	No Calcium	Statistically Different?
Yield	142 bu	130 bu	Yes
Revenues	$1360	$1230	Yes
Estimated Expenses	$551	$475	Yes
Net Returns	$809	$755	No

Does Calcium Make a Difference in Corn Silage Crop?

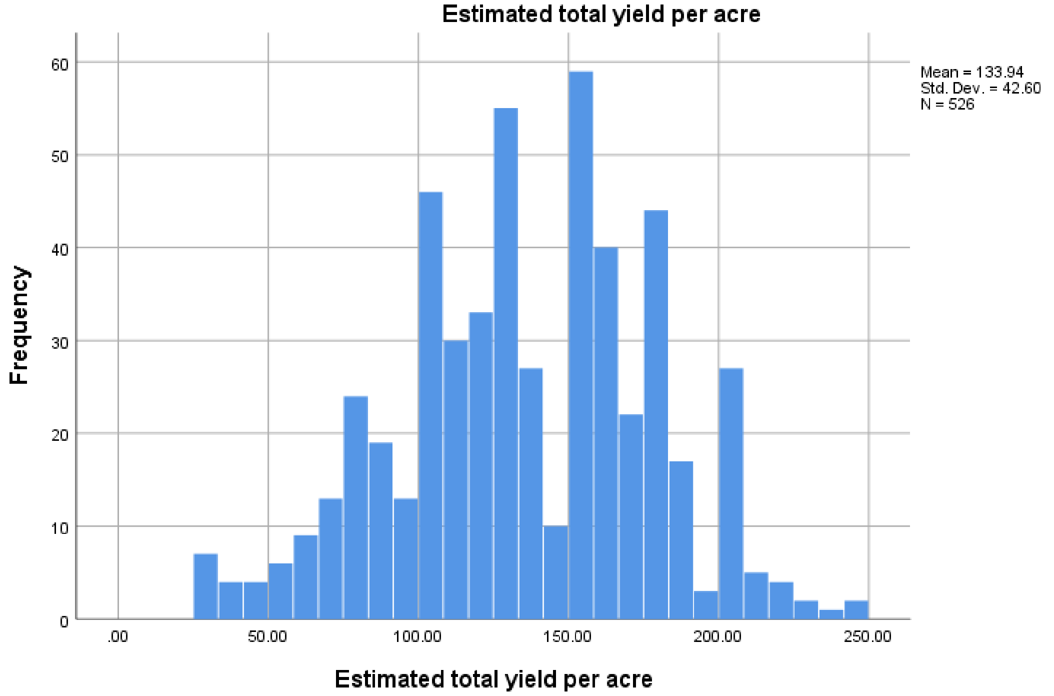
	With Calcium	No Calcium	Statistically Different?
Yield	20.4 tons	19.9 tons	No
Revenues	$1426	$1396	No
Estimated Expenses	$551	$470	Yes
Net Returns	$875	$926	No

- Distributions – not just point estimates!

Yields

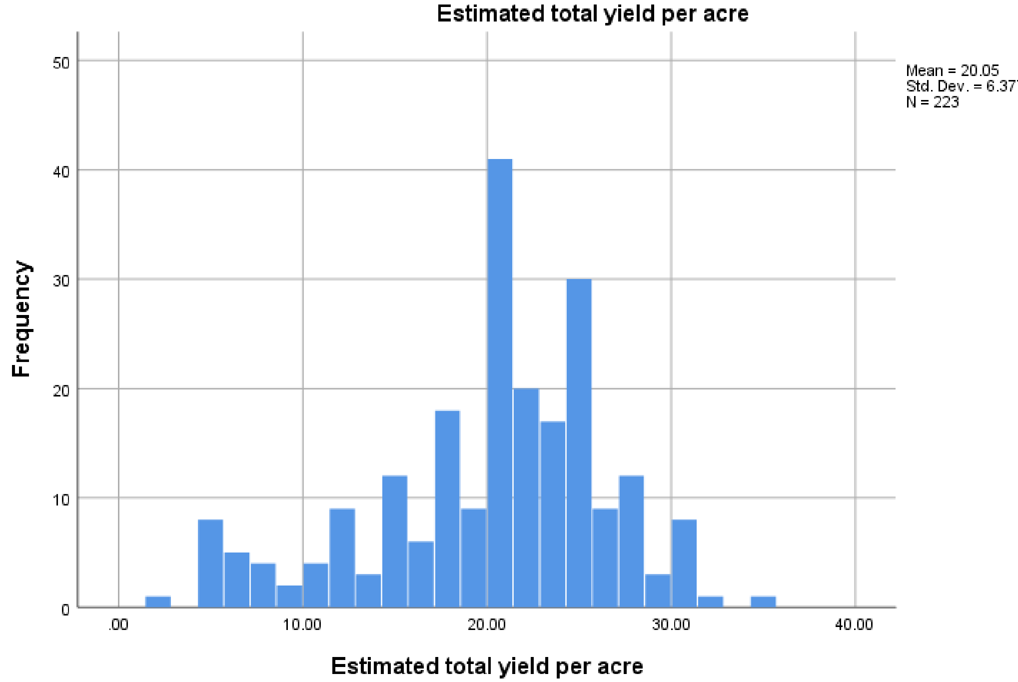
Grains

Average: 134 bu



Silage

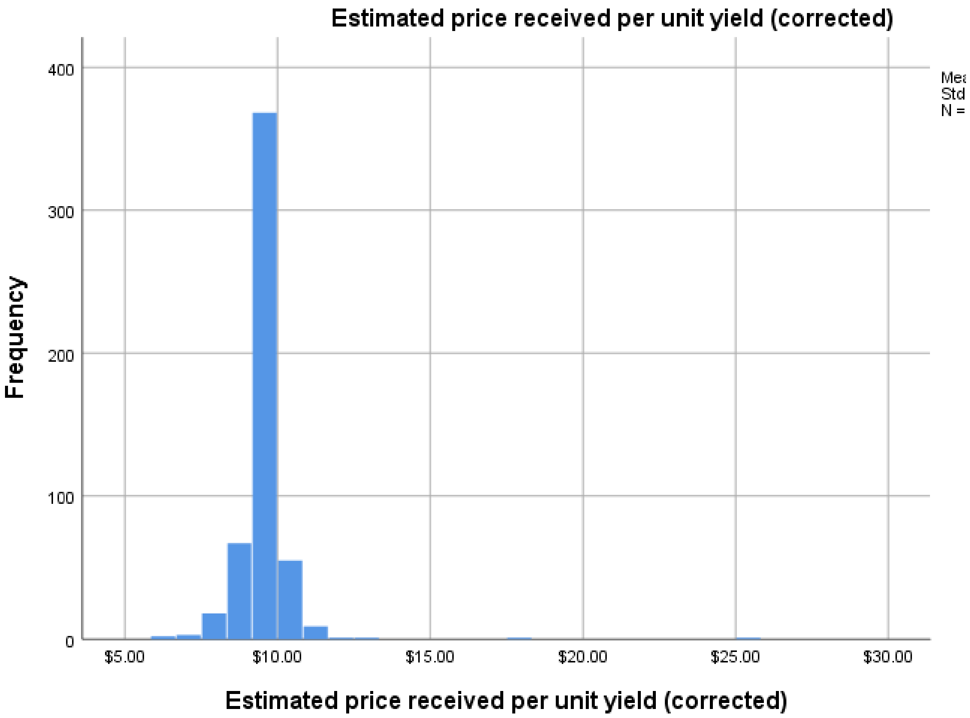
Average: 20 Tons



Grains

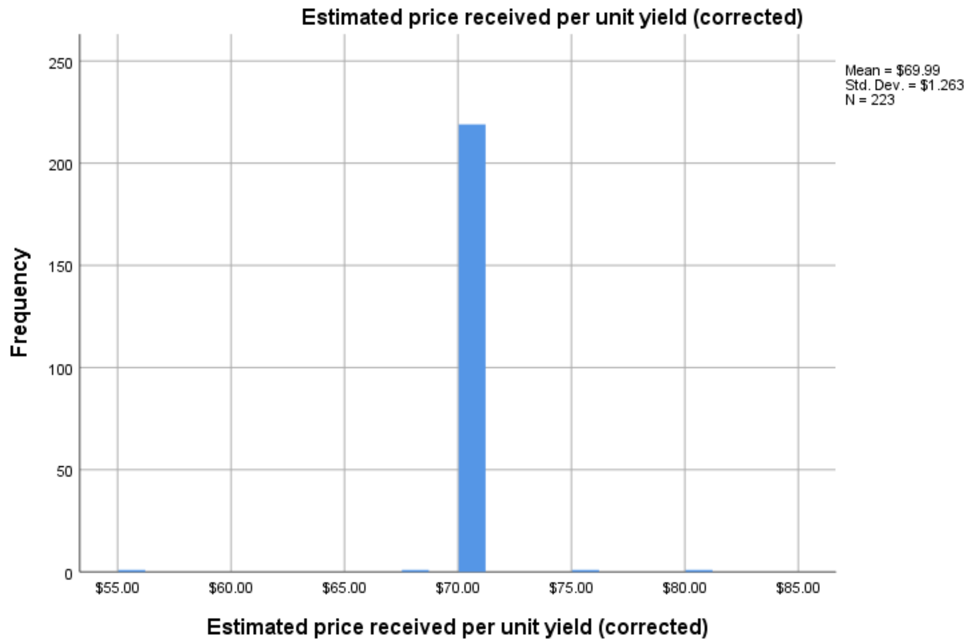
Silage

Average: $9.00



Price

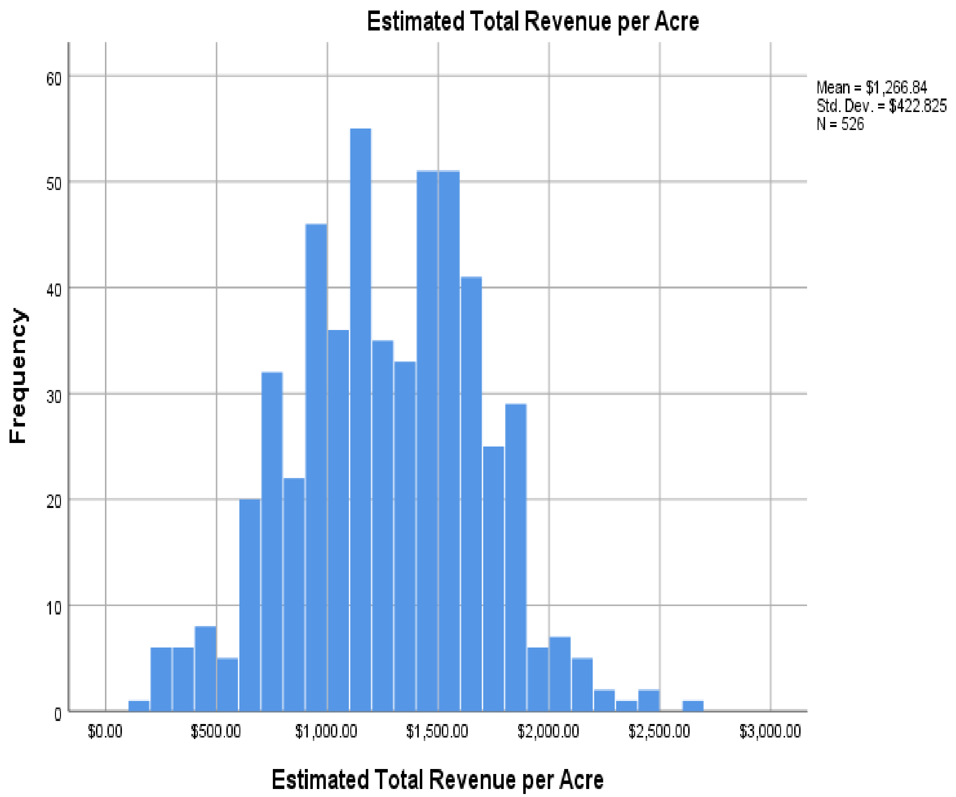
Average: $70.00



Estimated Total Revenue

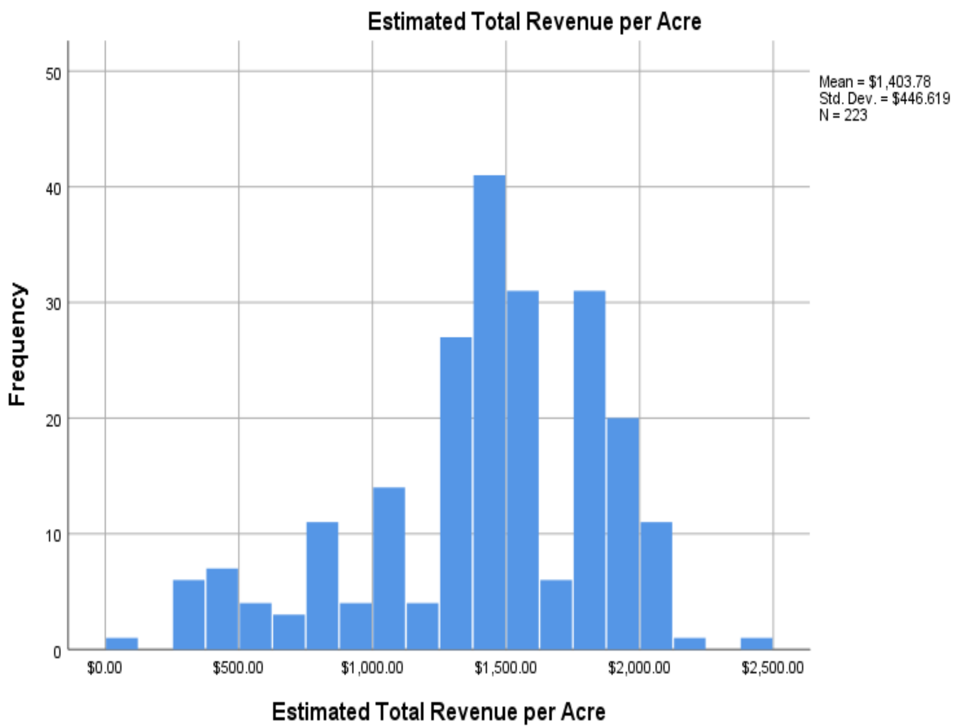
Grains

Average: $1,267



Silage

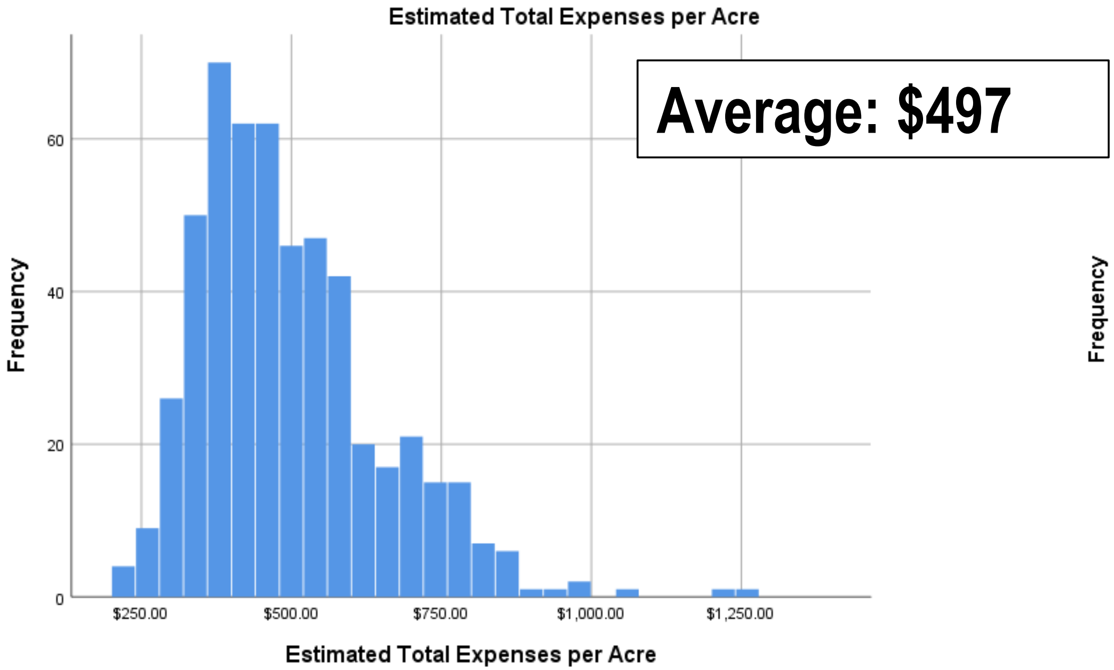
Average: $1,403

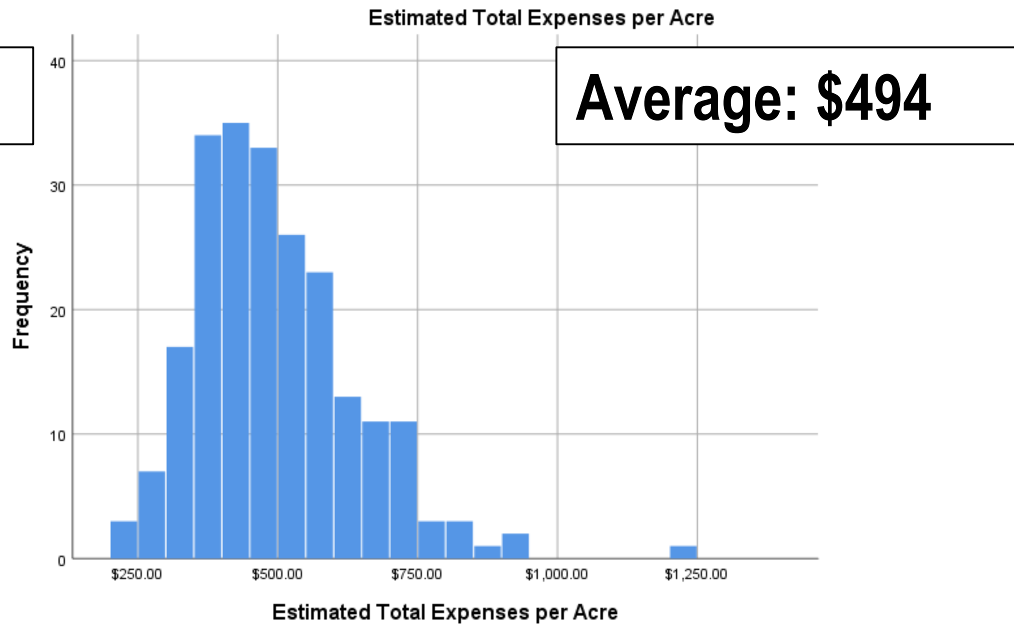


Total Expenses

Grains

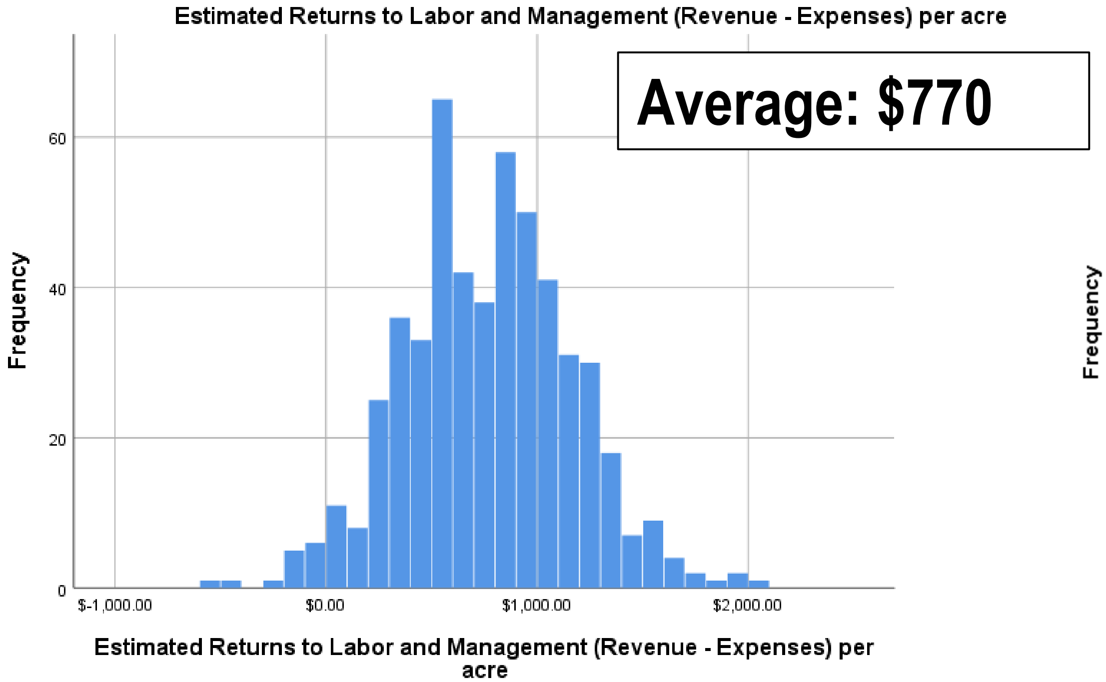
Silage



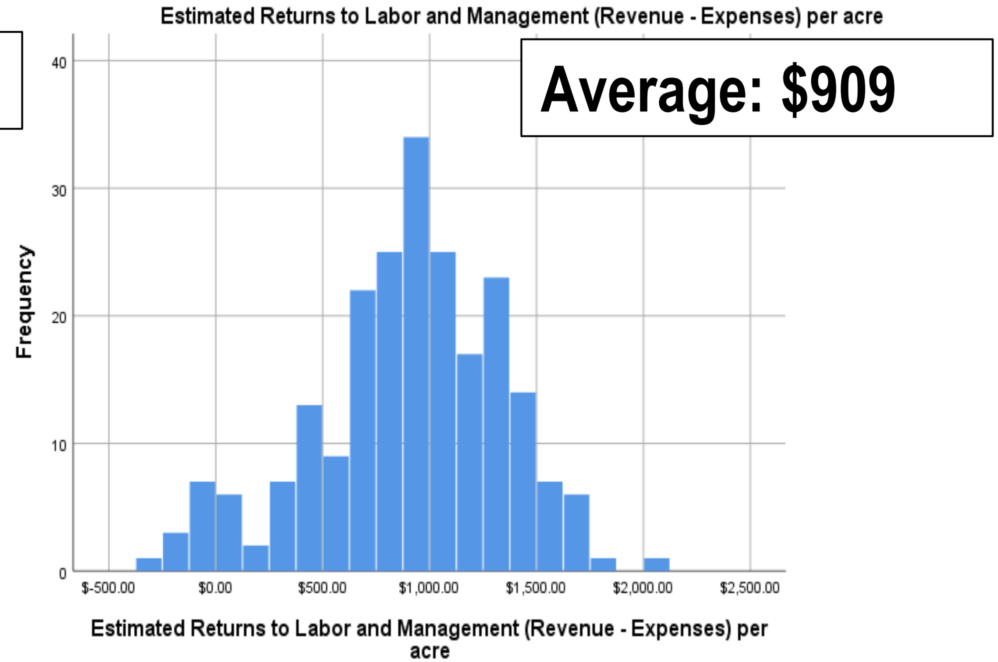


Net Returns to Labor and Management

Grains



Silage



Farmers

- with dairy animals
- or Animal enterprises
- With horse drawn equipment

report higher Net Returns!

Farm Economics: Livestock vs No Livestock

	Presence of Livestock	
	Yes	No
Expenditures on Soil Amendments ($/acre)		
Manure & Compost	$77.19	$84.80
NPK fertilizers	$26.50	$27.15
Calcium products	$14.33	$13.20
Micronutrients	$9.50	$5.91
Microbiologicals	$4.13	$4.79
Fish products and Foliar Applications	$6.08	$5.21
Other expenses	$11.23	$9.24
Total Soil Amendment Expenses (combined)	$148.96	$150.30
Estimated cost/value of fieldwork	$91.25	**$107.17**
Estimated cost of seeds	**$99.90**	$92.60
Estimated cost/value of land (rent)	$151.89	$158.72
TOTAL EXPENSES	$491.99	$508.79
TOTAL REVENUE	**$1,346.38**	$1,165.62
NET RETURNS TO LABOR & MGT	**$854.39**	$656.83

Farm Economics: Farm Type

	By Dominant Farm Enterprise		
Characteristic	Cash Grain	Vegetable	Dairy
Expenditures on Soil Amendments ($/acre)			
Manure & Compost	$84.74	$76.25	$74.38
NPK fertilizers	$25.72	$32.59	$26.51
Calcium products	$15.24	$14.26	$14.57
Micronutrients	*$4.44*	*$7.80*	*$10.92*
Microbiologicals	$4.71	$11.57	$3.67
Fish products and Foliar Applications	$6.10	$7.44	$5.76
Other expenses	$13.92	$12.19	$9.37
Total Soil Amendment Expenses (combined)	$154.88	$162.12	$145.18
Estimated cost/value of fieldwork	$112.12	$91.66	$83.72
Estimated cost of seeds	$94.47	$90.77	$102.51
Estimated cost/value of land (rent)	$154.66	$144.54	$155.02
TOTAL EXPENSES	$516.13	$489.10	$486.44
TOTAL REVENUE	$1,202.19	$1,171.95	$1,398.24
NET RETURNS TO LABOR & MGT	$686.06	$682.85	$911.80

Farm Economics: Type of Equipment

	Type of Equipment		
Characteristic	Horses	Tractors	
Expenditures on Soil Amendments ($/acre)			
Manure & Compost	$71.15	**$91.14**	
NPK fertilizers	$24.30	***$30.71***	
Calcium products	$14.08	$14.21	
Micronutrients	$10.12	$6.49	
Microbiologicals	$4.13	$4.54	
Fish products and Foliar Applications	$5.23	$7.04	
Other expenses	$11.76	$9.29	
otal Soil Amendment Expenses (combined)	$140.76	**$163.42**	
Estimated cost/value of fieldwork	$71.21	**$133.35**	
Estimated cost of seeds	**$100.10**	$95.54	
Estimated cost/value of land (rent)	$156.69	$147.94	
TOTAL EXPENSES	$468.76	**$540.25**	
TOTAL REVENUE	**$1,348.86**	$1,241.82	
NET RETURNS TO LABOR & MGT	**$880.10**	$701.58	

Horses vs. Tractors

Do Tractor vs. Horse Use Make a Difference in Corn Grain farms?

	Horse-drawn	Tractor-drawn	Statistically Different?
Yield	137 bu	130 bu	Yes
Revenues	$1283	$1249	No
Estimated Expenses	$456	$547	Yes
Net Returns	$827	$702	Yes

Do Tractor vs. Horse Use Make a Difference in Corn Silage farms?

	Horse-drawn	Tractor-drawn	Statistically Different?
Yield	21 tons	17 tons	Yes
Revenues	$1457	$1204	Yes
Estimated Expenses	$491	$504	No
Net Returns	$966	$700	Yes

Correlations!

Correlations can capture the

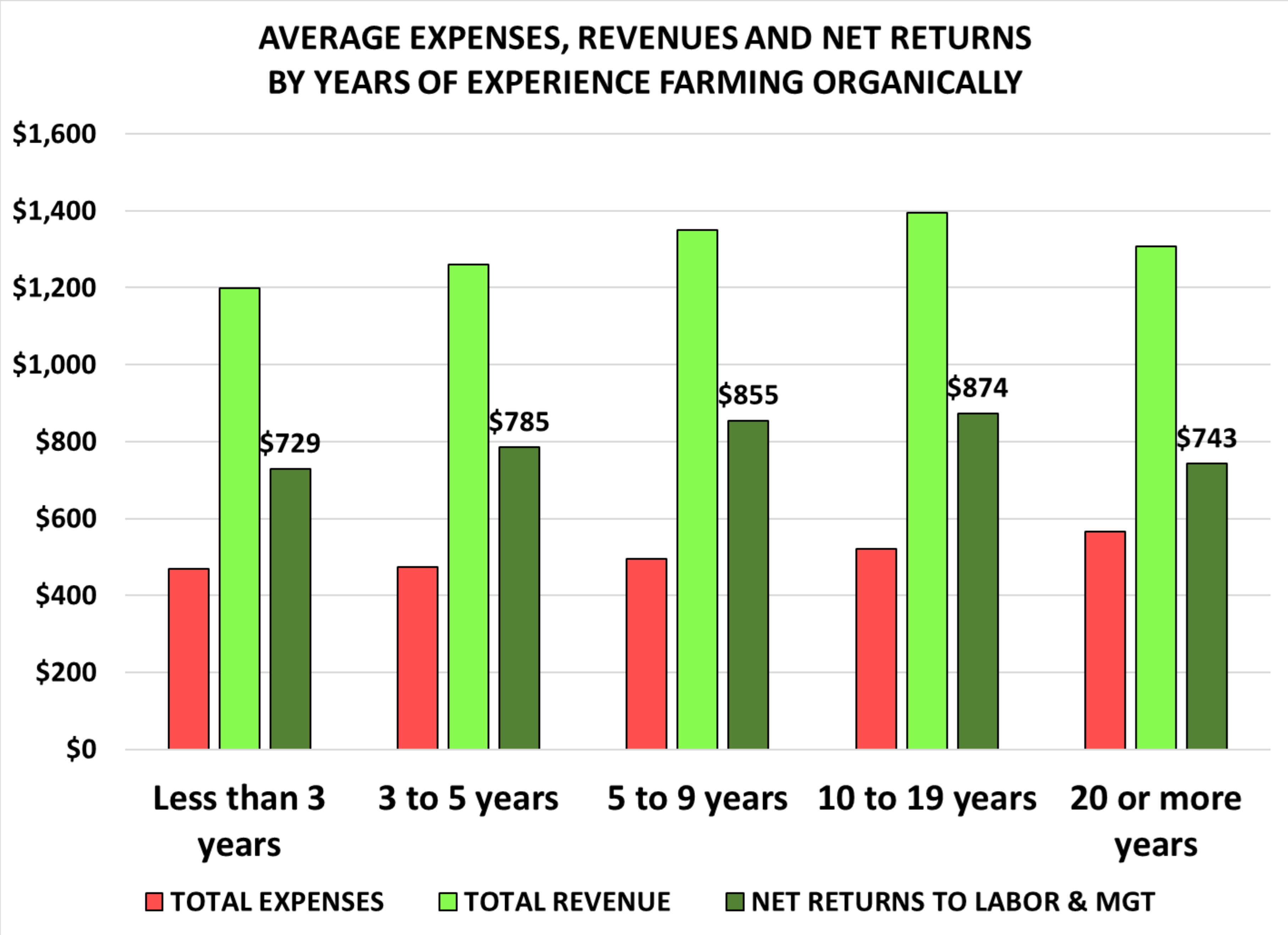
- role of <u>continuous, long-term </u>applications of Calcium

Correlation between Corn Grain Yield and Frequency of	
Any Calcium Applications over 4 years	0.139***
Gypsum Applications over 4 years	0.118***
Hi-Cal Applications over 4 years	0.090**
Dolomite Applications over 4 years	0.021
Lime Applications over 4 years	0
Corn Grain Net Returns and Any Calcium Applications	0.098**

Correlation between Corn Silage Yield and Frequency of	
Any Calcium Applications over 4 years	0.094
Gypsum Applications over 4 years	0.066
Hi-Cal Applications over 4 years	0.099
Dolomite Applications over 4 years	-0.051
Lime Applications over 4 years	-0.047
Corn Silage Net Returns and All Calcium Applications	0.043

Years of Farming

- Slightly matters!


AVERAGE EXPENSES, REVENUES AND NET RETURNS
BY YEARS OF EXPERIENCE FARMING ORGANICALLY
$1,600
$1,400
$1,200
$1,000
$800
$600
$400
$200
$0
$729
$785
$855
$874
$743
Less than 3 years
3 to 5 years
5 to 9 years
10 to 19 years
20 or more years
TOTAL EXPENSES
TOTAL REVENUE
NET RETURNS TO LABOR & MGT

Conclusions

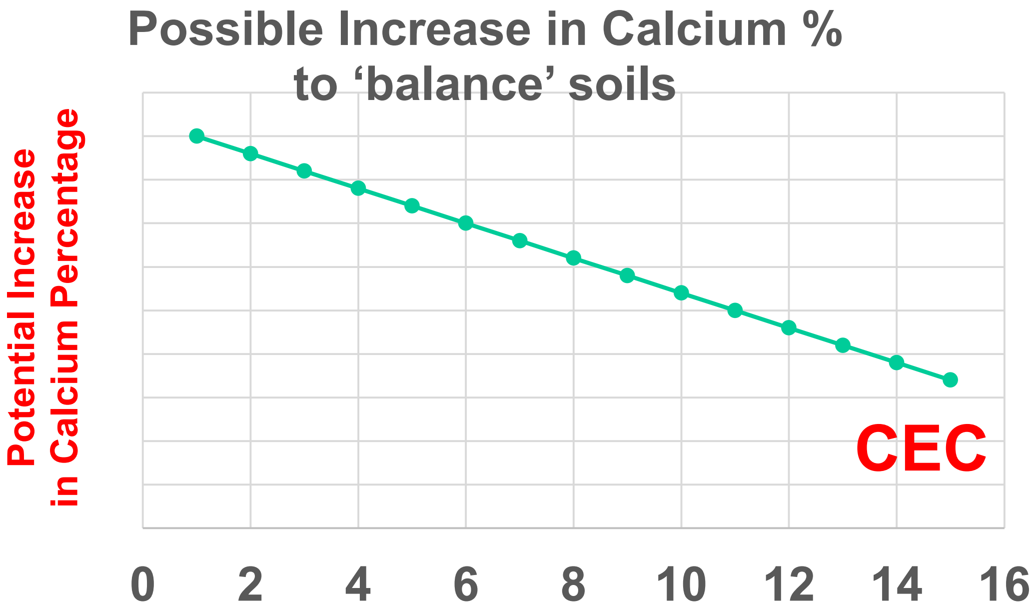
- Some evidence – Applying Calcium helps increase yields in grains
- Farmers need to consider the Costs of Calcium applications!

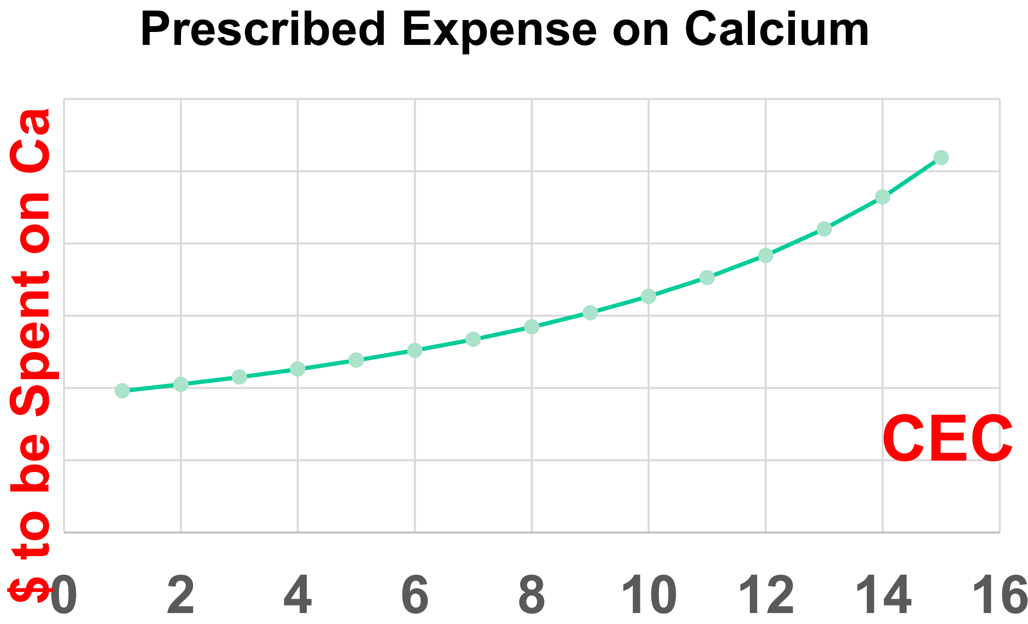
- Statistical difference – yields, estimated expenses
    - No statistical difference in Net Returns to Labor and Management

- Gypsum and Hi-Cal lime applications over a longer durations have effects

Next Steps

How much Calcium should you apply?





Efficiency Analysis – Preliminary Results

Efficient Farms

- 50 out of 526 farms
- Half of them applied Ca during 2014-17
- Half of them did not!
- How do you know if you are efficient?

	Average Yield (bu/ac)	Average Expenses on Fertilizers, Amendments, Seeds, Machinery, Land ($/ac)
Efficient Farms	**160**	**$413**
Other Farms	130	$505

More Results and Summaries Available

- Enterprise types (Dairy vs. Crops vs. Vegetables)
- Role of cover crops
- Horse vs. Tractor comparison
- Efficiency of farm productivity

- A summary report will be mailed to survey participants
- More reports will be made available on our website!
- Please sign up in the sheet to get electronic copies of these reports

Visit our website!

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Soil Balancing Research Team

What Is Soil Balancing?

For most farmers and scientists, soil balancing generally refers to the theory and practice of attaining an optimum ratio of the plant nutrients, calcium (Ca), magnesium (Mg), and potassium (K), in the soil. For many soils, achieving balance requires relatively large inputs of calcium-rich minerals (limestone and/or gypsum), in order to raise Ca to the desired level. A balanced soil is rarely achieved quickly and often requires an investment of resources.

Search

Related News

Notes and Quotes from First Soil Balancing Call-in Conversation

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More Information

Soil Balancing: Worth Another Look

https://offer.osu.edu/soil-balancing

Questions/Thoughts? We would love to hear from you

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Thank you to..

Imputed Expenses

Estimated cost/value of fieldwork	$95	$85
Estimated cost of seeds	$98	$107
Estimated cost/value of land (rent)	$153	$145

Plus Soil Amendment Total= $149

Which is how we get average total expenses

TOTAL EXPENSES $496 $468

Project Team

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OEFFA

stakeholder-designed treatments

The OSU BCSR Project Team*

Investigator	Focus Area
Doug Doohan	Weed Mgmnt./Risk Analysis
Steve Culman	Soil Fertility
Doug Jackson-Smith	Engagement; Case Studies
Matt Kleinhenz	Vegetable Production/Quality
Subbu Kumarappan	Economics
Warren Dick	Soil Biology

THANK-YOU
and
GOOD LUCK!

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QUESTIONS?