Nebraska On-Farm Research Network

Years:	2001-2002, 2004-2014
Title:	Profitability of Incorporating Lime
Crop:	Soybean/Corn Rotation
Study ID:	029053200103M13
Objective:	To determine & document the effect on incorporating lime on the profitability of crop production. Soil pH 5.5.
Treatments:	No tillage, no lime vs. tillage, no lime, vs. no tillage, with lime, vs. tillage w/lime. Lime incorporated April 2001.
Soil Type:	Moody Silty Clay Loam Soil, No-Till
Costs:	Lime - 2.4 T/ac x 14.30/T = $34.32 Prorate for 8 yrs = $4.29/ac/yr Tillage - 2 x Disc @ $7/ac = $14.00 Fall 2011 - Lime 2 T/Ac + Fall vertical till and 2x Spring Disc

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Summary: This long term study was initiated in 2001 to determine the effect lime and tillage had on future corn and soybean yields. The field where this study was conducted consisted of a Moody Silty Clay Loam soil with a soil pH of 5.5 in 2001. 2.4 T/ac ag lime was applied in 2001. Corn and soybean yields were captured each year of the study.

2001: There was no yield interaction between tillage and lime. Soybean yields were increased for the tillage operation as compared to no-till and for the lime application as compared to no lime.

2002: There was no yield interaction between tillage and lime. Corn yields were decreased for the previously tilled treatment versus the no-till treatment; yields were increased for the lime application as compared to no lime application.

2003: No yield was collected.

2004: There was no yield interaction between tillage and lime. There was no corn yield difference between the tilled and no-tilled treatments; yields were increased for the lime treatment as compared to the no-lime treatment.

2005: There was no yield interaction between tillage and lime. There was no soybean yield difference between the tilled and no-tilled treatments; yields were increased for the lime treatment as compared to the no-lime treatment.

2006: There was no significant yield difference for the interaction of tillage and lime, or for tillage and lime independently.

Soil tests were taken by treatment strip in 2006. The results are in the following table.

Treatment	Water pH by depth (in)			
	0-2	2-4	4-6	6-8
No Tillage, No Lime	5.9	5.3	5.6	5.4
No Tillage, Lime	6.6	5.5	5.5	5.7
Tillage, No Lime	5.8	5.3	5.5	5.6
Tillage, Lime	6.6	5.8	5.5	5.7
	Buffer pH by depth (in)			
	0-2	**2-4**	**4-6**	**6-8**
No Tillage, No Lime	6.7	6.5	6.6	6.5
No Tillage, Lime	7.0	6.6	6.5	6.7
Tillage, No Lime	6.4	6.5	6.6	6.6
Tillage, Lime	7.0	6.6	6.5	6.6

2007: There was no yield interaction between tillage and lime. There was a significant difference for lime with the lime treatment having higher soybean yields than the no-lime treatment. NDVI was also collected and there was a significant interaction between lime and tillage. NDVI was increased slightly by tillage where no lime was applied, however lime increased NDVI significantly regardless of tillage.

2008: Corn yields were not increased by lime application.

2009-2011: Soybean and corn yields were not different for lime or tillage treatments.

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Soil samples were again taken in 2011 at a depth of 0-8 inches in only the no-till strips. The results are in the following table.

Treatment	Sample Number	Lab pH	Buffer pH	P_2O_5	K	OM	S
Lime	6529	5.6	6.5	6	270	2.79	11
	6530	5.5	6.5	10	305	3.09	12
	6531	5.9	6.5	13	283	3.09	10
No Lime	6532	5.5	6.5	8	309	3	11
	6533	5.7	6.5	4	217	3	12
	6534	5.6	6.5	8	208	-	-

In 2011 lime was reapplied (2 tons/ac) to the strips previously limed (2.4 tons/ac) in 2001. The tillage treatments from 2001 were also repeated. The lime was incorporated in tilled strips with turbo till in fall 2011 and double disking in spring 2012. Corn and soybean yields were captured each year of the study.

2012: There was no significant corn yield interaction between lime and tillage treatments. There was no yield difference between the lime and no-lime treatments; yields were significantly higher for the no-till versus the tilled treatment.

2013: There was no significant soybean yield interaction between lime and tillage treatments. There was no yield difference between the tilled and no-till treatments; the lime treatment was significantly higher yielding than the no lime treatment.

2014**:** The no-till treatment were significantly higher than for the till treatments. Yields for the no lime treatment were significantly higher than for the lime treatment.

Detailed results from each year follow.

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INDIVIDUAL YEAR RESULTS:

OFRN Operator:

Results: 2001 — Soybeans

Treatment	Yield, bu/ac @ 13%	Moisture %	Test Wt lbs/bu	Cost $/ac
No Tillage, no lime	48	9.7	56.0	---
No Tillage, lime	51	9.9	56.2	4.29
Tillage, no lime	51	10.0	56.2	1.75
Tillage, lime	54	10.1	55.9	6.04

Statistical Analysis: (Prob >F)

Tillage (T)	0.002 ***	0.399 ns	0.746 ns
Lime (L)	0.008 ***	0.544 ns	0.935 ns
TxL	0.778 ns	0.776 ns	0.302 ns

Results: 2002 — Corn (Pioneer 34M94)

Treatment	Yield, bu/ac @ 15.5%	Moisture %	Test Wt lbs/bu	Cost $/ac
No Tillage, no lime	92	17.1	58.4	---
No Tillage, lime	94	16.9	58.2	4.29
Tillage, no lime	83	16.7	58.6	1.75
Tillage, lime	91	16.8	58.6	6.04

Statistical Analysis: (Prob >F)

Tillage (T)	0.009 ***	0.228 ns	0.260 ns
Lime (L)	0.022 **	0.754 ns	0.601 ns
TxL	0.190 ns	0.281 ns	0.703 ns

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Results: 2004	Corn (GH 8906)		
	Yield, bu/ac	Moisture	Cost
Treatment	@ 15%	%	$/ac
No Tillage, no lime	159	15.5	---
No Tillage, lime	167	15.9	4.29
Tillage, no lime	160	15.5	1.75
Tillage, lime	174	15.6	6.04

Statistical Analysis: (Prob >F)		
Tillage (T)	0.382 ns	0.334 ns
Lime (L)	0.018 **	0.037 **
TxL	0.424 ns	0.204 ns

Results: 2005	Soybeans (Latham 967)		
	Yield, bu/ac	Moisture	Cost
Treatment	@ 13%	%	$/ac
No Tillage, no lime	45	11.0	---
No Tillage, lime	47	11.4	4.29
Tillage, no lime	46	11.6	1.75
Tillage, lime	48	11.2	6.04

Statistical Analysis: (Prob >F)		
Tillage (T)	0.465 ns	0.341 ns
Lime (L)	0.006 ***	0.907 ns
TxL	0.680 ns	0.148 ns

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Results: 2006	Corn (Dekalb 6716)		
	Yield, bu/ac	Moisture	Cost
Treatment	@ 15.5%	%	$/ac
No Tillage, no lime	123	16.2	---
No Tillage, lime	125	16.2	4.29
Tillage, no lime	123	16.3	1.75
Tillage, lime	124	16.3	6.04

Statistical Analysis: (Prob >F)

Tillage (T)	0.951 ns	0.313 ns
Lime (L)	0.444 ns	0.696 ns
TxL	0.914 ns	0.859 ns

Planted: 4/28/06 Harvested: 10/18/06

Soil Tests:	3/15/06			
Water pH		Depth, inches		
Treatment	0-2	2-4	4-6	6-8
No Tillage, no lime	5.9	5.3	5.6	5.4
No Tillage, lime	6.6	5.5	5.5	5.7
Tillage, no lime	5.8	5.3	5.5	5.6
Tillage, lime	6.6	5.8	5.5	5.7
Buffer pH				
No Tillage, no lime	6.7	6.5	6.6	6.5
No Tillage, lime	7.0	6.6	6.5	6.7
Tillage, no lime	6.4	6.5	6.6	6.6
Tillage, lime	7.0	6.6	6.5	6.6

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Results: 2007

Soybeans (Latham 967)

Treatment	Yield, bu/ac @ 13%	Moisture %	NDVI	Cost $/ac
No Tillage, no lime	56	9.3	0.08	---
No Tillage, lime	60	9.2	0.28	4.29
Tillage, no lime	57	9.3	0.17	1.75
Tillage, lime	60	9.3	0.27	6.04

Statistical Analysis: (Prob >F)

Tillage (T)	0.524 ns	0.762 ns	0.057 *
Lime (L)	0.0007 ***	0.497 ns	<0.0001 ***
TxL	0.224 ns	0.786 ns	0.028 **

Planted: 4/30/07 Harvested: 9/22/07

Results: 2008

Corn (Hybrid)

Treatment	Yield, bu/ac @ 15.5%	Moisture %	Cost $/ac
No Tillage, no lime	129	15.1	--
No Tillage, lime	133	14.8	4.29
Tillage, no lime	131	15.1	1.75
Tillage, lime	129	14.7	6.04

Statistical Analysis: (Prob >F)

Tillage (T)	0.524 ns	0.973 ns
Lime (L)	0.535 ns	0.313 ns
TxL	0.021 **	0.973 ns

Planted: 5/5/08 Harvested: 10/30/08

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Results: 2009	Soybeans (Pioneer 93M43)		
	Yield, bu/ac	Moisture	Cost
Treatment	@ 13%	%	$/ac
No Tillage, no lime	63	9.9	---
No Tillage, lime	65	10.2	---
Tillage, no lime	65	10.1	---
Tillage, lime	65	10.8	---

Statistical Analysis: (Prob >F)		
Tillage (T)	0.231 ns	0.327 ns
Lime (L)	0.606 ns	0.300 ns
TxL	0.285 ns	0.626 ns

Planted: 4/24/09 Harvested: 10/11/09

Results: 2010	Corn	(DK 62-29)
	Yield, bu/ac	Moisture
Treatment	@ 15.5%	%
No Tillage, no lime	159	15.7
No Tillage, lime	160	15.7
Tillage, no lime	158	15.8
Tillage, lime	160	15.6

Statistical Analysis: (Prob >F)		
Tillage (T)	0.641 ns	0.915 ns
Lime (L)	0.558 ns	0.347 ns
TxL	0.765 ns	0.311 ns

Planted: 4/18/10 Harvested: 9/27/10

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Results: 2011 Soybeans (Pioneer 93M11)

Treatment	Yield, bu/ac @ 13%	Moisture %	Cost $/ac
No Tillage, no lime	56	8.8	---
No Tillage, lime	56	8.8	---
Tillage, no lime	56	8.9	---
Tillage, lime	58	8.9	---

Planted: 5/3/2011 Harvested: 10/1/2011

Results: 2011 Soybeans (Pioneer 93M11)

Statistical Analysis: (Prob >/T/)

Yield	Tillage	Tillage-Lime	No Tillage-No Lime
Tillage-Lime	0.8141 ns	---	---
No Tillage-No Lime	0.9777 ns	0.826 ns	---
No Tillage-Lime	0.1604 ns	0.2091 ns	0.1453 ns

Moisture	Tillage	Tillage-Lime	No Tillage-No Lime
Tillage-Lime	0.9306 ns	---	---
No Tillage-No Lime	0.5412 ns	0.4608 ns	
No Tillage-Lime	0.6794 ns	0.5965 ns	0.8319 ns

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Soil Tests: May 2011 Depth 0-8 inches pH
samples are 0-8" depth, and only taken in the notill strips

Treatment	Strip ID	Lab_pH	Buff_pH	P205	K	OM	S
Lime	6529	5.6	6.5	6	270	2.79	11
	6530	5.5	6.5	10	305	3.09	12
	6531	5.9	6.5	13	283	3.09	10
No Lime	6532	5..5	6.5	8	309	3	11
	6533	5.7	6.5	4	217	3	12
	6534	5.6	6.5	8	208	-	-

Information: 2012 Lime &Tillage

Planted: 4/22/12
Hybrid - GoldenHarvest 8969 @ 28k
Gal/A 32% UAN 28
Gal/A 10-34-0 5.7
Preplant Herbicides
Balance Flexx 4.7oz/A
Aatrex 4L .3 gal/A
2,4-D LVE (6) .67 pt/A
Lime Cost (Lime plot only, applied fall 2011)
Lime delivered at $19.6/ton
Lime application at $6.32/ton
Application rate was 2 tons/A, single rate

Harvested: 9/4/12

Post Herbicides
Laudis 3 oz/A
Cornerstone .25 gallon/A
Ammonium sulfate 2.6 lb/A

Lime was incorporated in tilled strips with Turbo till fall 2011, and double disking Spring 2012.

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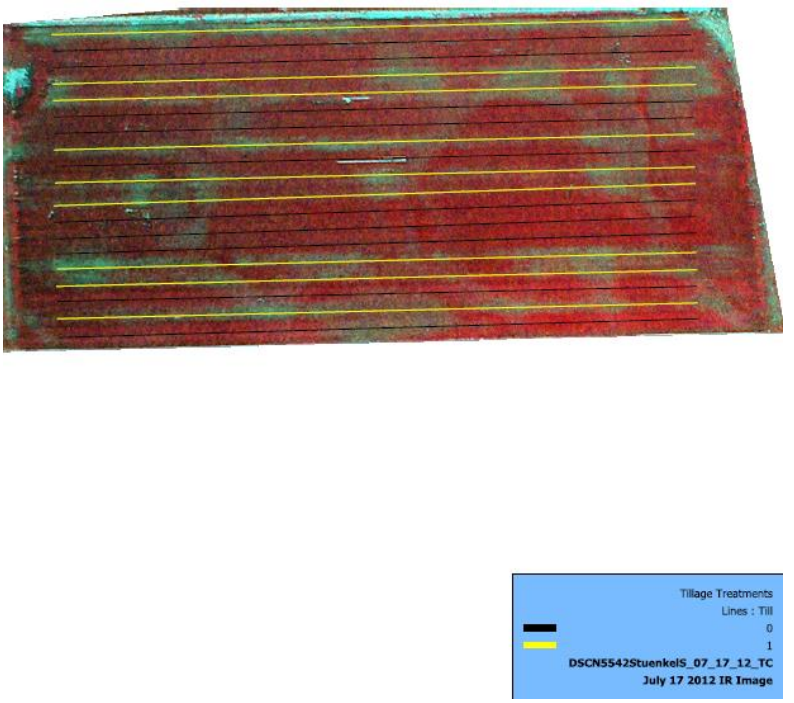

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Results: 2012	Corn-Yield		
	Lime &Tillage		
	Tilled	Check	
YIELD	48.1	81.2	
Cost/Acre	$20	---	
Prob>/T/ <0.0001***	B	A	
	Lime	Check	
YIELD	66.6	62.7	
Cost/Acre	$25.92	---	
Prob>/T/ 0.3148 ns	A	A	
TILLAGE * LIME	Yield	Group	Cost/Acre
T0 * L0	81.5	A	---
T0 * L1	80.8	A	$25.92
T1 * L1	52.3	B	$45.92
T1 * L0	43.9	B	$20

Prob>/T/ 0.2429 ns

Note: Lime applied Fall 2011, pH Lime-5.5-5.9 / Check 5.5-5.7

Results: 2012	Corn-Moisture		
	Lime &Tillage		
	Tilled	Check	
MOISTURE	10.6	12.9	
Cost/Acre	$20	---	
Prob>/T/ 0.0002***	B	A	
	Lime	Check	
MOISTURE	11.7	11.8	
Cost/Acre	$25.92	---	
Prob>/T/ 0.7279 ns	A	A	
TILLAGE * LIME	Moisture	Group	Cost/Acre
T0 * L0	13.5	A	---
T0 * L1	12.4	AB	$25.92
T1 * L1	11.0	BC	$45.92
T1 * L0	10.2	C	$20

Prob>/T/ 0.0451**

Note: Lime applied fall 2011, pH Lime-5.5-5.9 / Check 5.5-5.7

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Results: 2013 Soybeans – Lime and Tillage Matrix

	Yield	Moisture
Tilled – Yes	52.8 A	9.63 B
Tilled – No	52.7 A	10.05 A
Prob>/T/	ns	0.0777*
Limed – Yes	54.3 A	9.7 A
Limed – No	51.1 B	10.0 A
Prob>/T/	0.0229**	ns
Tilled and Limed	55.0 A	9.6 A
Limed Only	53.6 A	9.8 A
Check	51.7 A	10.3 A
Tilled Only	50.6 A	9.7 A
Prob>/T/	ns	ns

Moody Silty Clay Loam Upland, 18" row spacing,

Pioneer 93M11 No-till at 140,000 planted on 5/9/2013, Harvested on 10/1/13.

Note: Tillage performed fall 2011/spring 2013, therefore no tillage costs associated with 2013.

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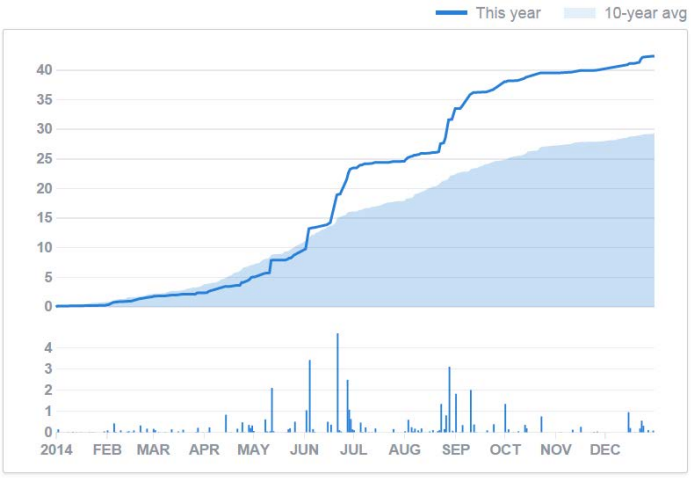
2014 Results:

Study ID: 029053201402
County: Dodge
Soil Type: Moody – Silty Clay Loam
Planting Date: 5/4/2014
Harvest Date: unknown
Population: 28,000
Row Spacing: 36”
Hybrid: Golden Harvest G16K01
Reps: 5
Previous Crop: Soybeans
Tillage: No-till
Herbicides: **Pre:** 4 oz Balance Flexx + 4 oz Atrazine 4L + 1 pt Parallel Plus - 4/5/14 **Post:** 4 oz Capreno + 1 qt Cornerstone Plus + ½ pt Atrazine 4L – 6/11/14
Insecticides/Fungicides: Cruiser 250 seed treatment

Fertilizer: UAN 32% 30gal – Mid April, MAP 6gal + Zinc Sulfate 7lb at planting in-furrow.
Note: Hailed at V5, (6/4/14)
Irrigation: Not irrigated.
Rainfall:



This study was analyzed to check for interactions between tillage and liming. There was no interaction therefore the factors of lime and tillage were analyzed separately. The tillage event occurred in 2011 only, therefore no tillage costs are factored in. Lime costs were prorated for 8 years.

Tillage:

	Yield† (bu/acre)	Moisture (%)	Net Return ‡
No-Till	160 A*	17.4 A	$559.30
Till	156 B	17.4 A	$531.75
P-Value	*0.0300*	*0.6743*	--

†Bushels per acre corrected to 15.5% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.

	Yield† (bu/acre)	Moisture (%)	Net Return ‡
No Lime	161 A	17.5 A	$563.50
Lime	154 B	17.3 B	$535.76
P-Value	*0.0010*	*0.0159*	--

†Bushels per acre corrected to 15.5% moisture.
*Values with the same letter are not significantly different at a 90% confidence level.
‡Net return based on $3.50/bu corn, and $3.24/ac/yr prorated lime costs for 8 years.

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