Soil Health Economics: A Farmer's Perspective

March 14, 2017

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Farming Since 1869
RULON
ENTERPRISES

Our Cropping System:

PRODUCTIVE & SUSTAINABLE

-4th Generation family farm

-North Central Indiana

-100% No-Till since 1989

-95% CB Rotation, 5% CAC

-12 years cover crops

-Liquid Hog manure 320 a/yr (No-Till)

-1 acre grid management w/ full VRT of inputs

-Conservation is the best economic model

-We are accountable for what leaves our farm

We are a Legacy Farm


BUT! "MUST TILL FOR YIELD"
BUT! "MUST TILL FOR YIELD"
SOIL OXIDATION IS NOT SUSTAINABLE


SUSTAINABLE REQUIRES
CARBON CAPTURE
TECHNOLOGY

What healthy soil returns to us:

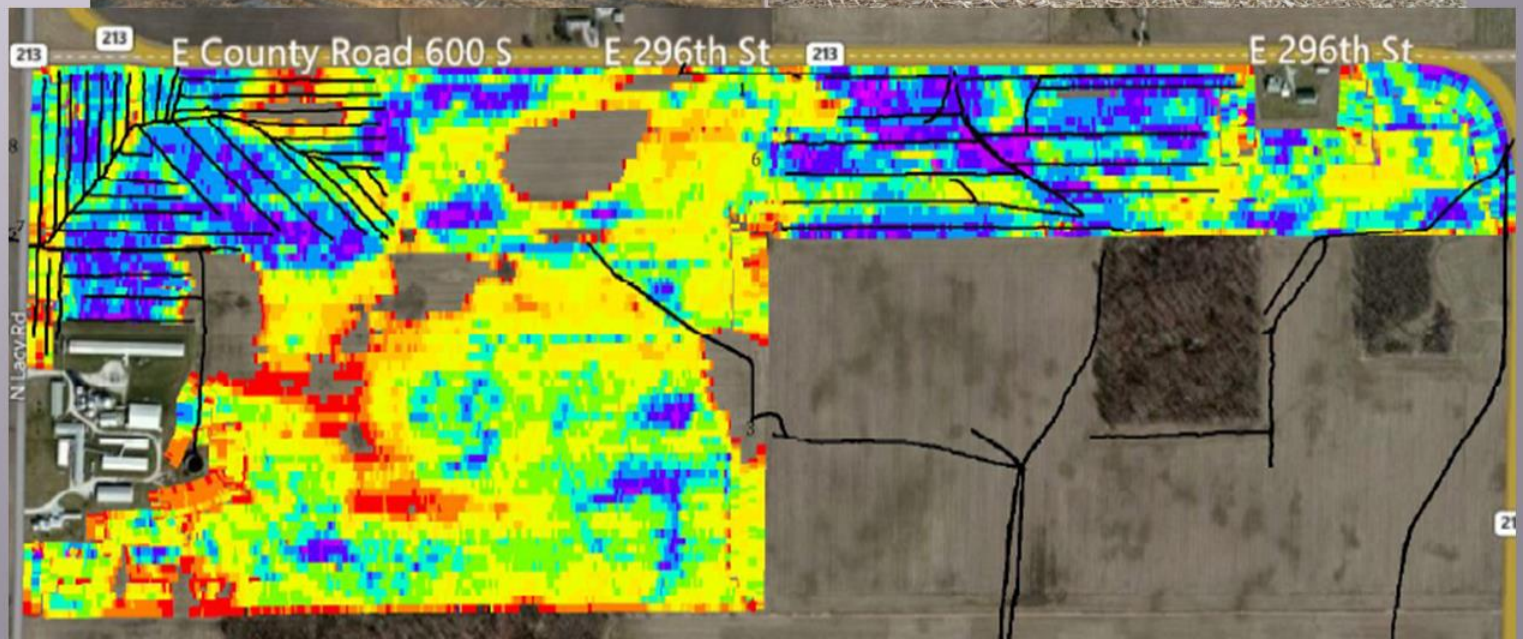
- Increased Yield
- Increased Biology (Big and Small)
- Nutrient Efficiency and Cycling
- Drought Tolerance/decreased soil temp/evaporation
- Increased water infiltration/water holding
- Improved Plant Health (reduced disease and insects)
- Improved Structure=Improved Trafficability (Timing)
- Improved Economics/Agronomics

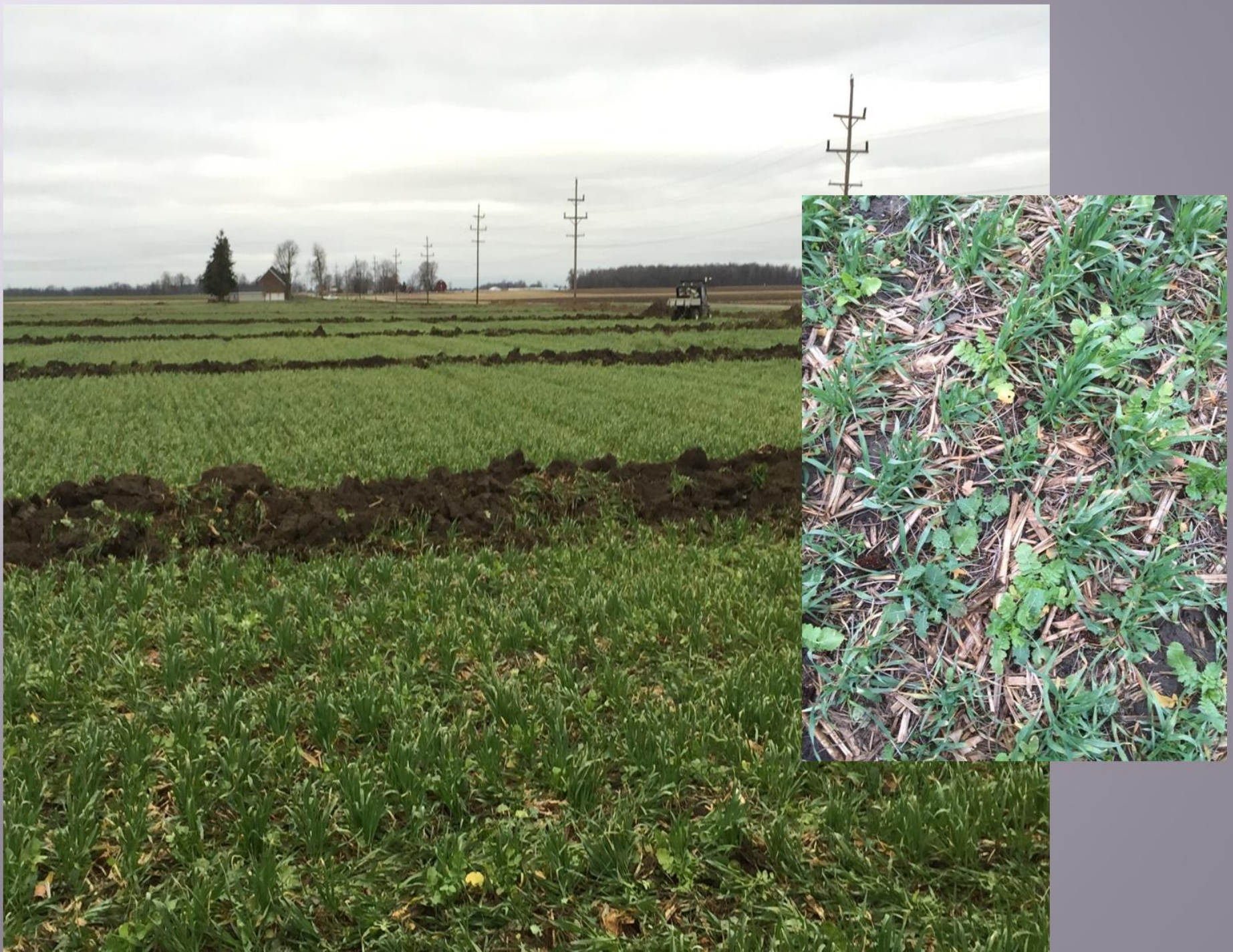
What we do to manage soil Quality:

- Continuous No-Till – not rotational
  - Eliminate catastrophic tillage events
  - Allow soil to build structure and biology

What we do to manage soil Quality:

- Drainage – Foundational to No-till and soil quality





What we do to manage soil Quality:

- 1 Acre grid Fertility
- Hi-Cal Lime/Gypsum/pH/P/K/Mg/OM
- Balanced Soil is More Stable and Resilient

What we do to manage soil Quality:

- Spread Residue and Minimize Compaction

What we do to manage soil Quality:

- Low Disturbance N-Applicator/Manure

What we do to manage soil Quality:

- Correct Planter Set UP For No-Till with Covers

What we do to manage soil Quality:

- Cover Crops
- Manage for long term soil health-FAST

Cover Crops on Our Farm

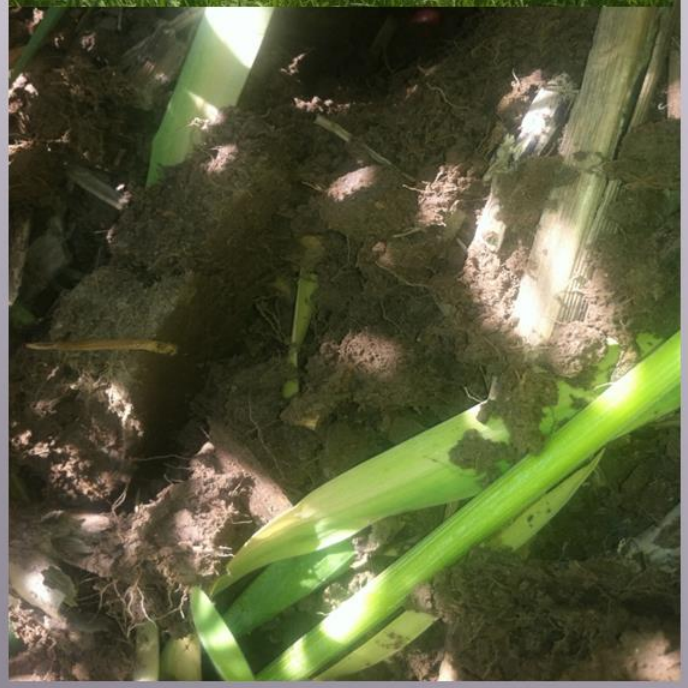
- Remove compaction without tillage (Soil repair)
- Transition from tillage to no-till
- Rotational Advantage
- Take no-till and soil quality/Biology to the next level
- Trap nitrogen from manure/carryover/soybeans
- Erosion Control
- Break disease cycle in CAC
- Cycle expensive nutrients
- Build Organic Matter/Structure
- Economics/Agronomics
- Grandpa used cover crops and he was pretty smart

Cover Crop Choices on Our Farm

- *Cereal (winter) Rye, Annual Rye Grass*
- *Oats, Radish, Clover, Rape, Vetch*
- *Austrian Winter Peas, Mixes*
- *For others see the SARE cover-crop handbook*

www.**sare.org**/publications/**covercrops**/**covercrops**.pdf

Planting Conditions With Cover Crops



35#
Cereal Rye

2016

30# Oats
2# Radish
2# Rape
4# Crimson
. Clover

Planting Dates (Central Indiana)

Summer (Aug 10)	Lots of Choices
September 15	Austrian Peas
October 1	Oats/Radish/Clover
October 21	Annual Rye Grass
November 10	Cereal Rye

Check out Midwest Cover Crop Council

Cover Crop Selection Tool

http://www.mccc.msu.edu/selectorINTRO.html

Planting Methods





- Aerial/Surface
- Air Cart/harrow
- No-Till Drill
- Precision Planter
- CONSIDER:
  - Seed size (Hopper size)
  - Planting date (Timing)
  - Moisture required to germinate
  - Fall growth needs
  - Seeding rates and cost
  - Mixes
  - Coatings
  - Inoculants





Mixes

- Root types
- Growth rate
- Planting date
- Feeder/Scavenger/Storage
- Legume/Grass/Brassica
- Build OM
- Boost cash crop
- Save on inputs
- Improve winter survival
- Termination method/timing

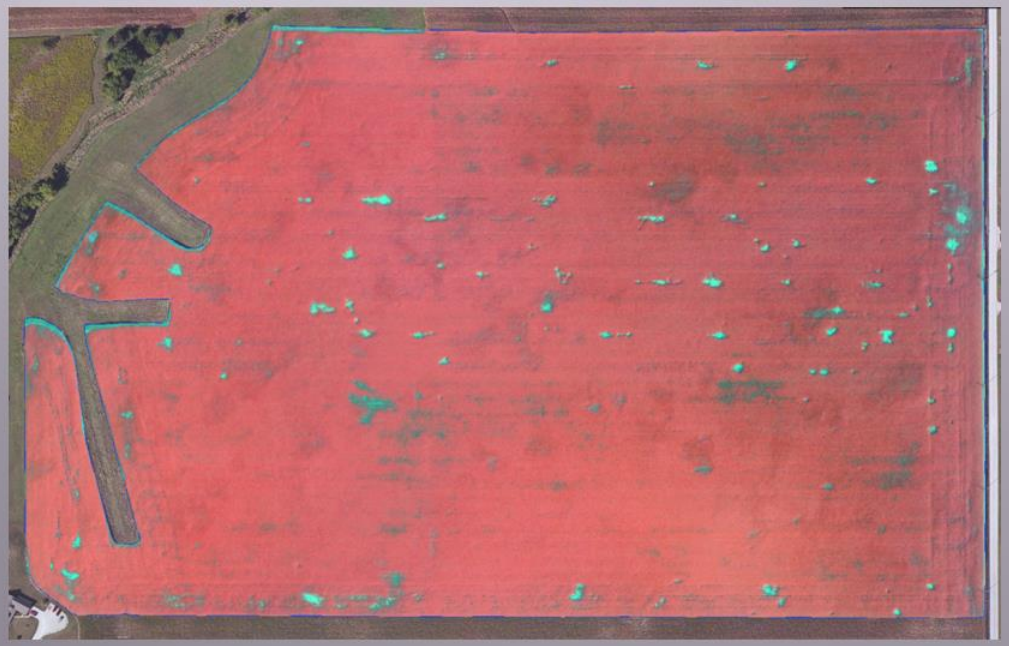
Other things to worry about

- Quality Seed Source/Supply
- Bulk blending/delivery
- Spring germination of fall seeding
- Aerial misapplication
- Seeding rates
- Chemical Programs
  - Residuals from cash crop
  - Termination of cover crop
- Test Strips
- Tile lines (Roots?)
- Voles

What do roots look like in our tiles?

Vole Holes? Who else has them?

Crop Type	lbs Applied
Annual Ryegrass	(18#)
Cereal Ryegrass	(35#)
Oats/Radish Mix	(32# & 2.5#)



Considerably less vole holes in the Oats/Radish mix strips.

WHAT DO COVER CROPS COST?

Average Cover Crop Costs		
SEED COSTS	**Cost/Acre**	
Oats (32#) + Radish (2.5#)	$16.38	
Oats (24#) + Radish (2.5#) + Clover (6#)	$18.40	
Annual Rye Grass (18#)	$14.04	
Cereal Rye Grass - Plant (35#)	$10.49	
Cereal Rye Grass - Aerial (40#)	$12.05	
Avg Seed Cost	$ 14.27	
Planting Costs for Season	**Quantity**	**Rate**
Aerial Seeding Cost	1,475	$13.93
Tractor Hours	140	$35.00
Labor	210	$15.00
Fuel	720	$3.50
Planter Repairs/wear	2,052	$5.00
Planting Cost/Acre =		**$11.73**
Total Cost/Acre Planted = $26.00		

RULON ENTERPRISES

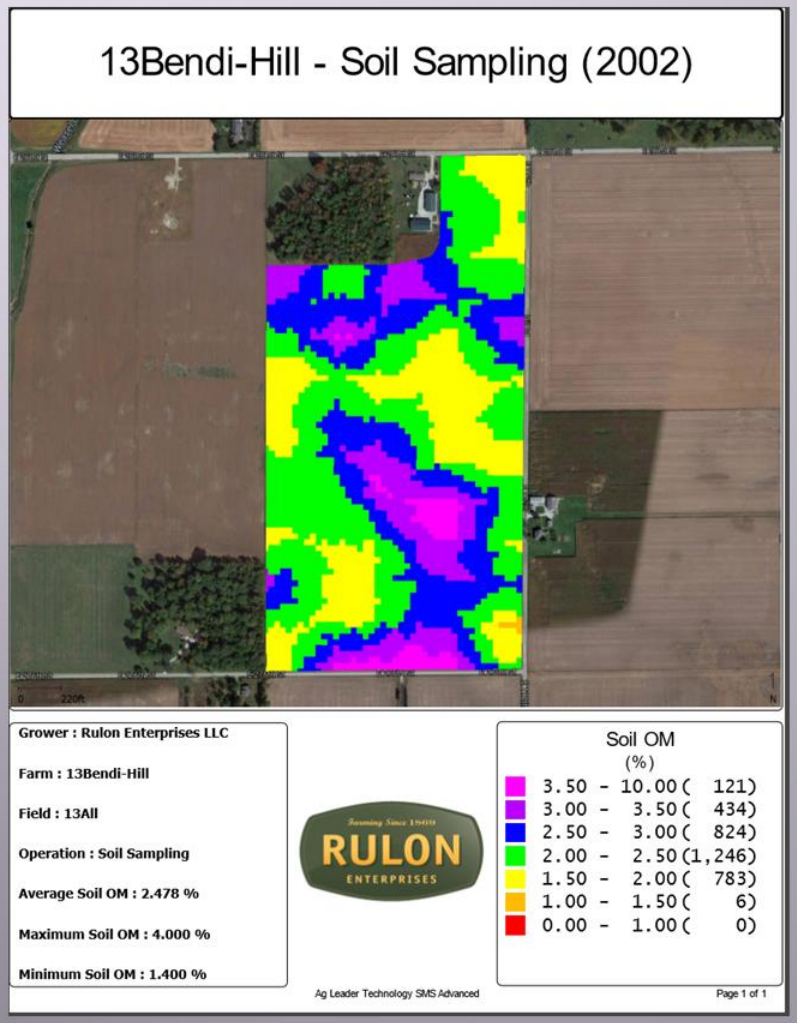
WHAT ARE THE ECONOMIC BENEFITS OF COVER CROPS?

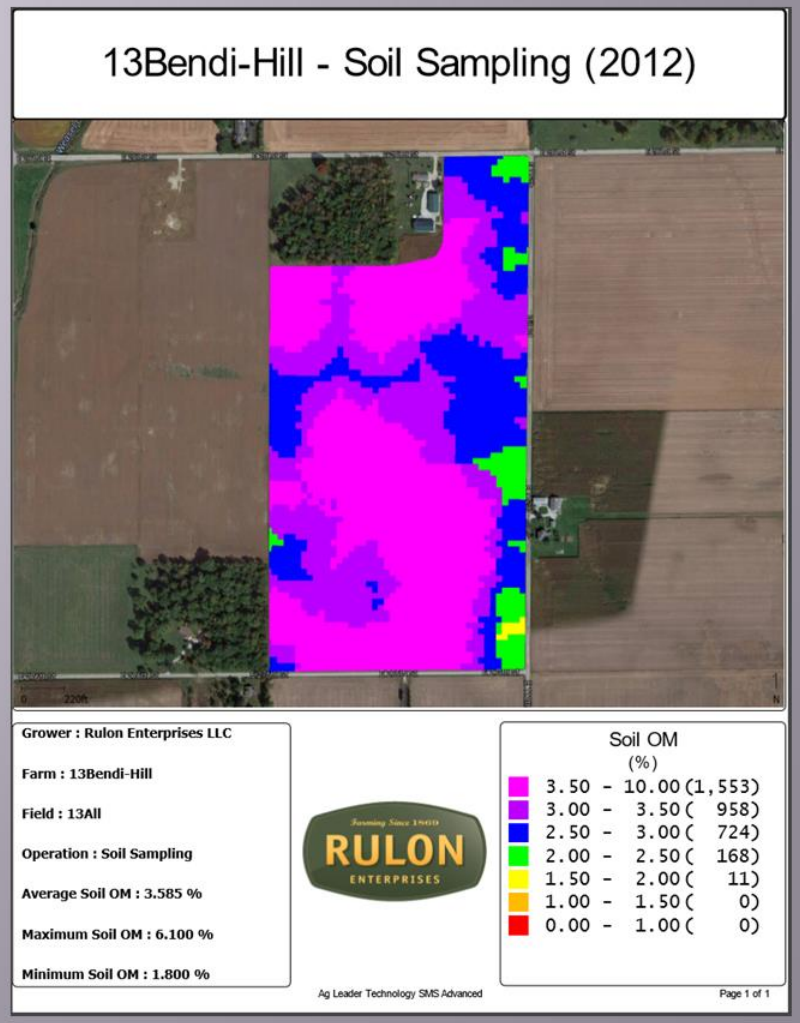
	COVER CROP BENEFITS			
BENEFITS ANALYSIS				
		Per acre	Acres	Total Benefit
Fertilizer Saved-P & K	(Soil Test+Tile Discharge Data)	$16.23	3527	$57,243.21
Fertilizer Savings - N	(40#/A invested in OM From legumes+Biomass)	$0.00	3667	$0.00
Corn Yield Increase	(3yr 9 Tests CC Plot 7.1bu@$5)	$35.50	2052	$72,846.00
Soybean Yield Increase	(Strip Test Minimum 2bu@$12)	$24.00	1475	$35,400.00
Drought/Stress Tolerance	(2004-2014 Actual 16% every 4th=6.9bu@$5)	$34.50	3527	$121,681.50
Biology Improvement	(Cycling+Resilience)	$2.00	3527	$7,054.00
Soil Quality	(OM Increase 2xOver No Cover))	$4.00	3527	$14,108.00
Erosion Reduction	(Land Value 2t/Acre @ $4/t)	$8.00	3527	$28,216.00
CSP Program	(Conservation Program Dollars)	$10.91	3667	$40,006.97
		Total Cover Crop Benefit =		$376,555.68
		Total Invested ($26/A)		$91,702.00
		Net Economic Benefit =		$284,853.68
ROI=311%	Net Benefit/Acre Planted =		$	80.76

RULON ENTERPRISES

Organic Matter 2002 vs. 2012 = + 1.1%

2.47 (1.4 to 4.0) **3.58 (1.8 to 6.1)**



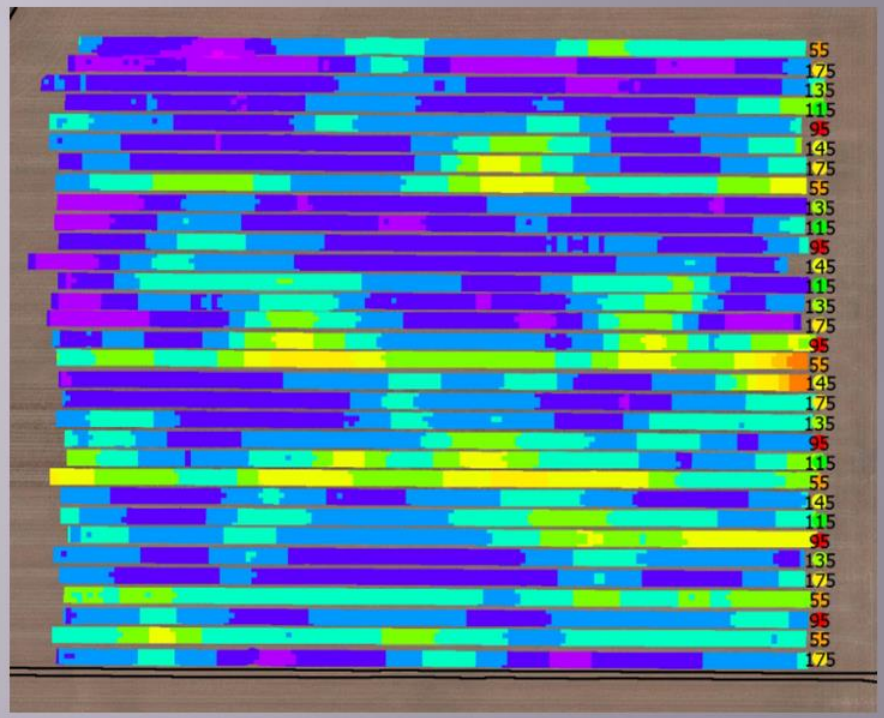


2015 CCSI Cover Crop/N Rate Harvest Data

Cover Crop vs N Rate Study 2015

Nitrogen Rate	Cover	Rep1	Rep2	Avg	Rank	AVG For N Rate
55	Oats/Radish	150.66	169.4	160.03	1	142.27
	Cereal Rye	155.65	146.48	151.07	2	
	Annual Rye	137.05	125.82	131.44	3	
	No Cover		126.55	126.55	4	
95	Cereal Rye	164.89	187.1	176.00	1	165.42
	Oats/Radish	154.48	180.07	167.28	2	
	Annual Rye		162.26	162.26	3	
	No Cover	143.78	168.5	156.14	4	
115	Cereal Rye	171.9	195.26	183.58	1	172.06
	Oats/Radish	163.82	185.32	174.57	2	
	Annual Rye	174.9	171.35	173.13	3	
	No Cover	159.83	154.12	156.98	4	
135	Cereal Rye	184.35	196.58	190.47	1	184.08
	Oats/Radish	184.37	192.86	188.62	2	
	No Cover	182.17	175.5	178.84	3	
	Annual Rye	173.53	183.25	178.39	4	
175	Oats/Radish	187.12	203.39	195.26	1	187.35
	Annual Rye	186.29	187.65	186.97	2	
	No Cover	184.7	183.69	184.20	3	
	Cereal Rye	184.94	181	182.97	4	

Other N Credits	Total N Applied
30# from planter	55 + 80 = 135#
50# Soybeans	95 + 80 = 175#
	115 + 80 = 195#
	135 + 80 = 215#
	175 + 80 = 255#



Cover Crop Yield + 12.8 bu/ac

Final Yield Average:

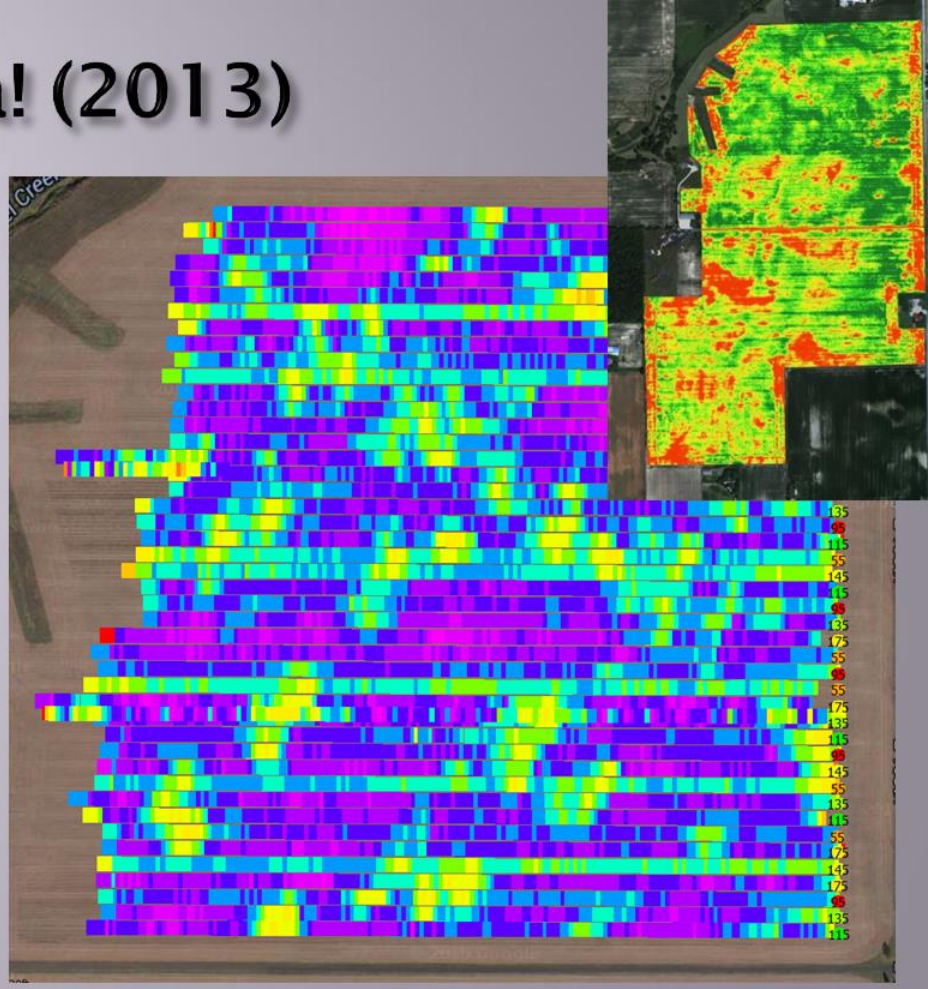
Oats/Radish = 177.1 bu/ac
Cereal Rye = 176.8 bu/ac
Annual Rye = 166.9 bu/ac
No Cover = 164.3 bu/ac

More Data! (2013)

Cover Crop vs N Rate Study 2013

Nitrogen Rate	Cover	Rep1	Rep2	Avg	Rank	AVG For N Rate
55	Oats/Radish		153	153	1	149.56
	Annual Rye	148.9	155.6	152.25	2	
	No Cover	148.8	150.4	149.6	3	
	Cereal Rye	139	147.8	143.4	4	
95	Oats/Radish		203.7	203.7	1	183.4
	Annual Rye	180.8	178.8	179.8	2	
	Cereal Rye	172.6	180.6	176.6	3	
	No Cover	173.3	173.7	173.5	4	
115	Oats/Radish	193.7	187.2	190.45	1	184.05
	Cereal Rye	192.5	175.7	184.1	2	
	Annual Rye	181.7	183.2	182.45	3	
	No Cover	168.5	189.9	179.2	4	
135	Oats/Radish	204.8	193.1	198.95	1	189.81
	Cereal Rye	194.6	189.1	191.85	2	
	Annual Rye	181.6	191.7	186.65	3	
	No Cover	178.1	185.5	181.8	4	
175	Oats/Radish	208.4	194.4	201.4	1	190.9
	Annual Rye	190.3	190.5	190.4	2	
	Cereal Rye	182.8	193.1	187.95	3	
	No Cover	173.3	194.4	183.85	4	

Actual N Applied	Total N Rate
30# N on planter	55 + 80 = 135#
50# Bean Credit	95 + 80 = 175#
	115 + 80 = 195#
	135 + 80 = 215#
	175 + 80 = 255#



Cover Crop Yield + 7.1 bu/ac

Final Yield Corn/Oats+Radish = 190.5
Final Yield Corn/Rye = 187.6
Final Yield Corn/No Cover = 183.4

2012, 2014, 2016 CCSI Plot Soybean Harvest Data Summary

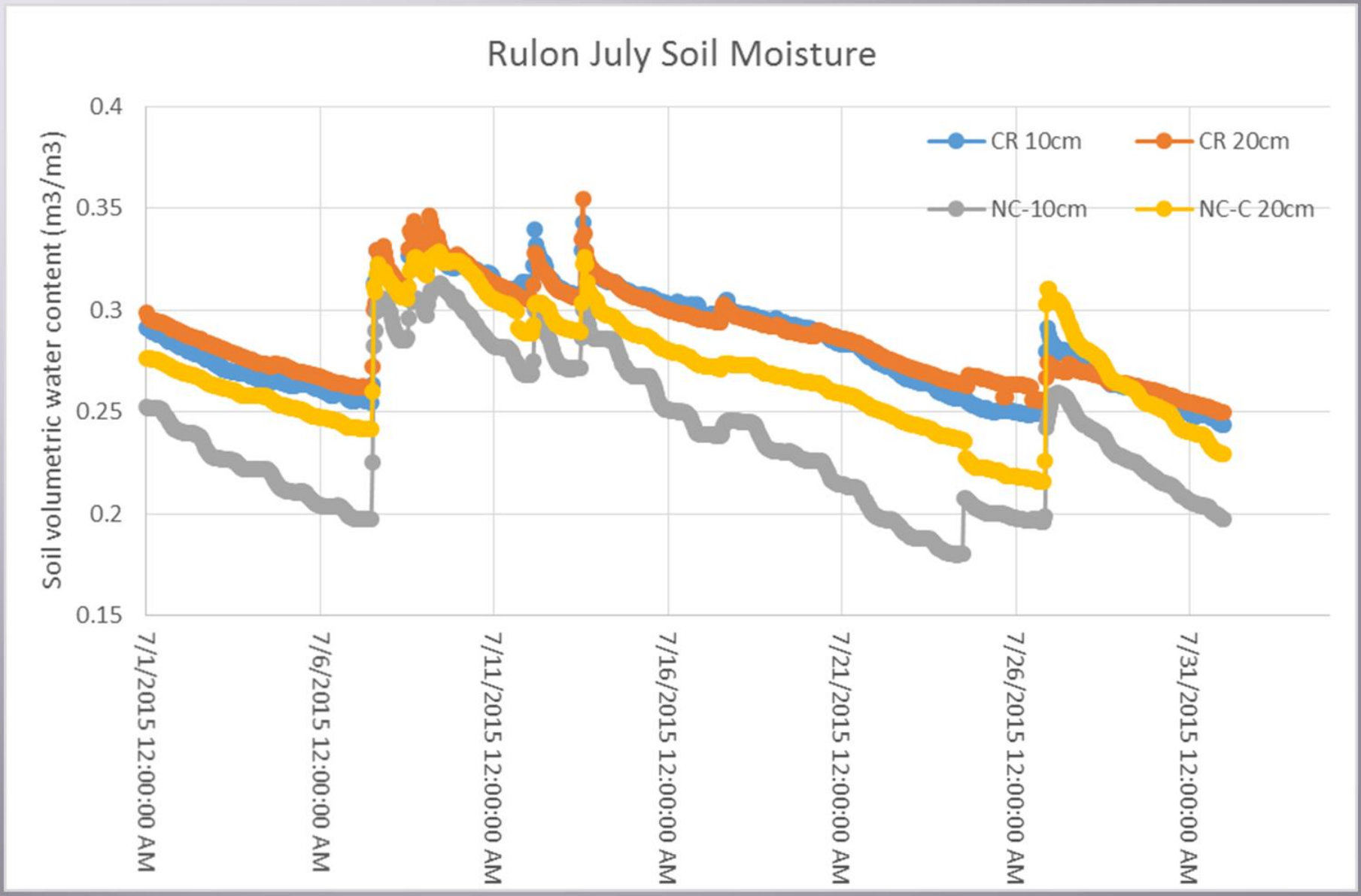
Cover Crop vs N Rate Study - Bean Average Yields

Year	Cover	Rep1	Rep2	Avg	Rank	Field Average
2012	Annual Rye	-	63.4	**63.4**	1	60.20
	Cereal Rye	-	59.8	59.8	2	
	Oats/Radish	-	59.5	59.5	3	
	No Cover	-	58.1	58.1	4	
2014	Oats/Radish	76.3	72.7	**74.5**	1	73.43
	Cereal Rye	72.8	75.4	74.1	2	
	Annual Rye	72.3	74.8	73.55	3	
	No Cover	73.5	69.6	71.55	4	
2016	Oats/Radish	68.4	67.8	**68.1**	1	63.93
	Cereal Rye	66	62.9	64.5	2	
	Annual Rye	64.7	61.3	63.0	3	
	No Cover	64.3	56	60.2	4	

*Rep #1 in 2012 was harvested by 2 different combines and data was too inaccurate to summarize.

Cover Crop Yield + Up To 7.9 bu/ac Over No Cover in Long term test

2012 Annual Rye	= +5.3	bu/ac
2014 Oats/Radish	= +2.95	bu/ac
2016 Oats/Radish	= +7.9	bu/ac
Three Year Avg	= +5.4	bu/ac



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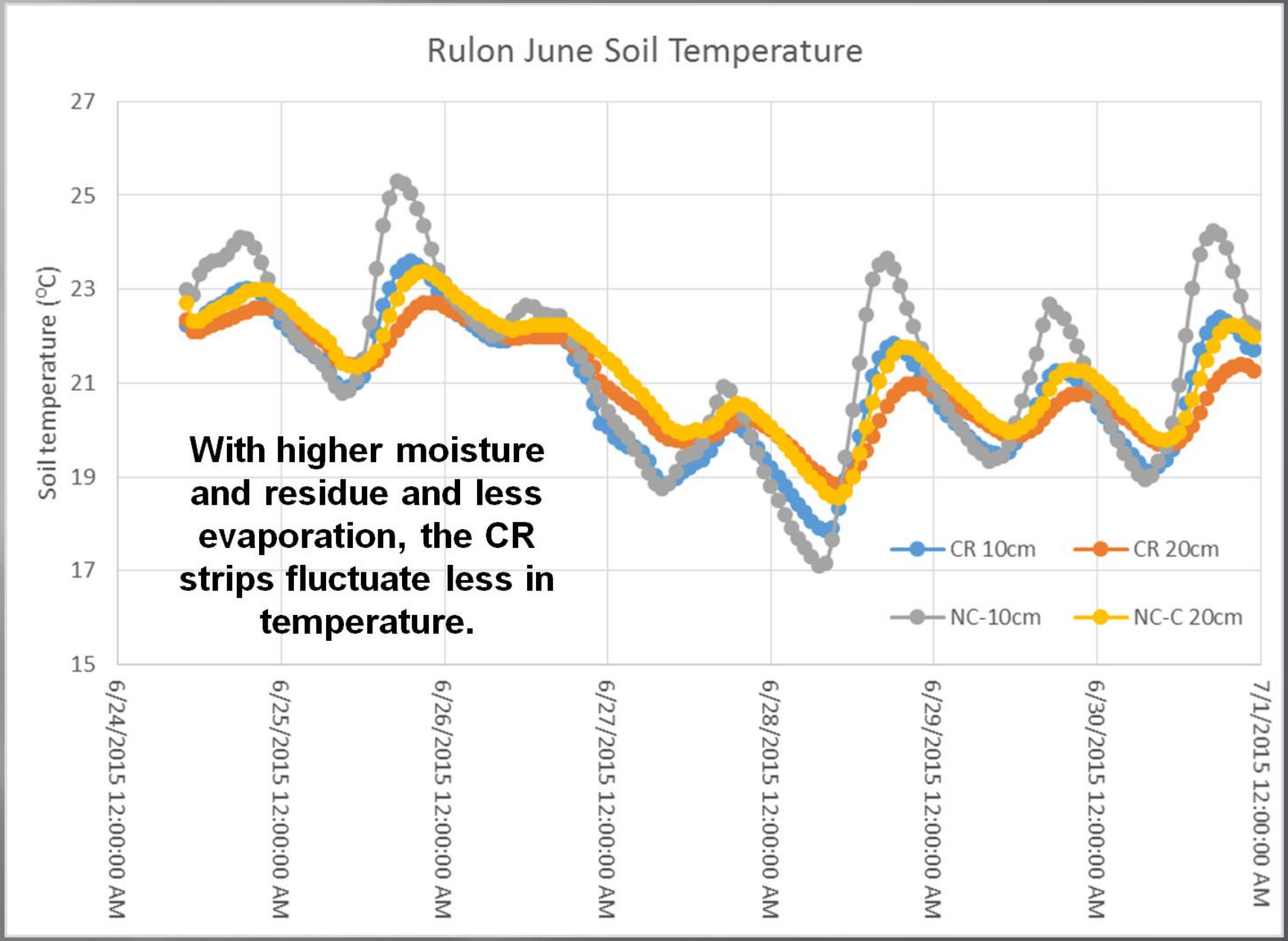

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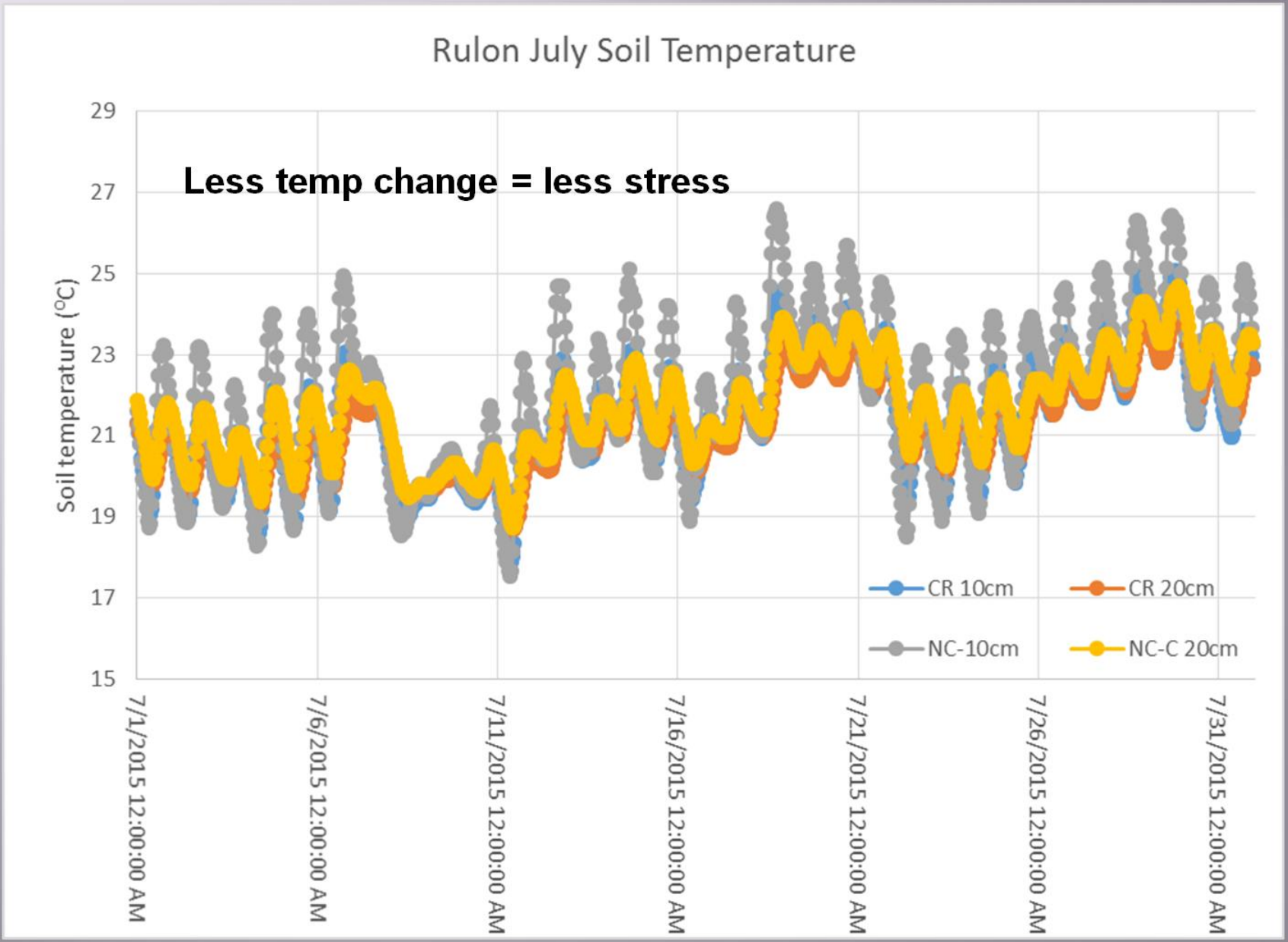

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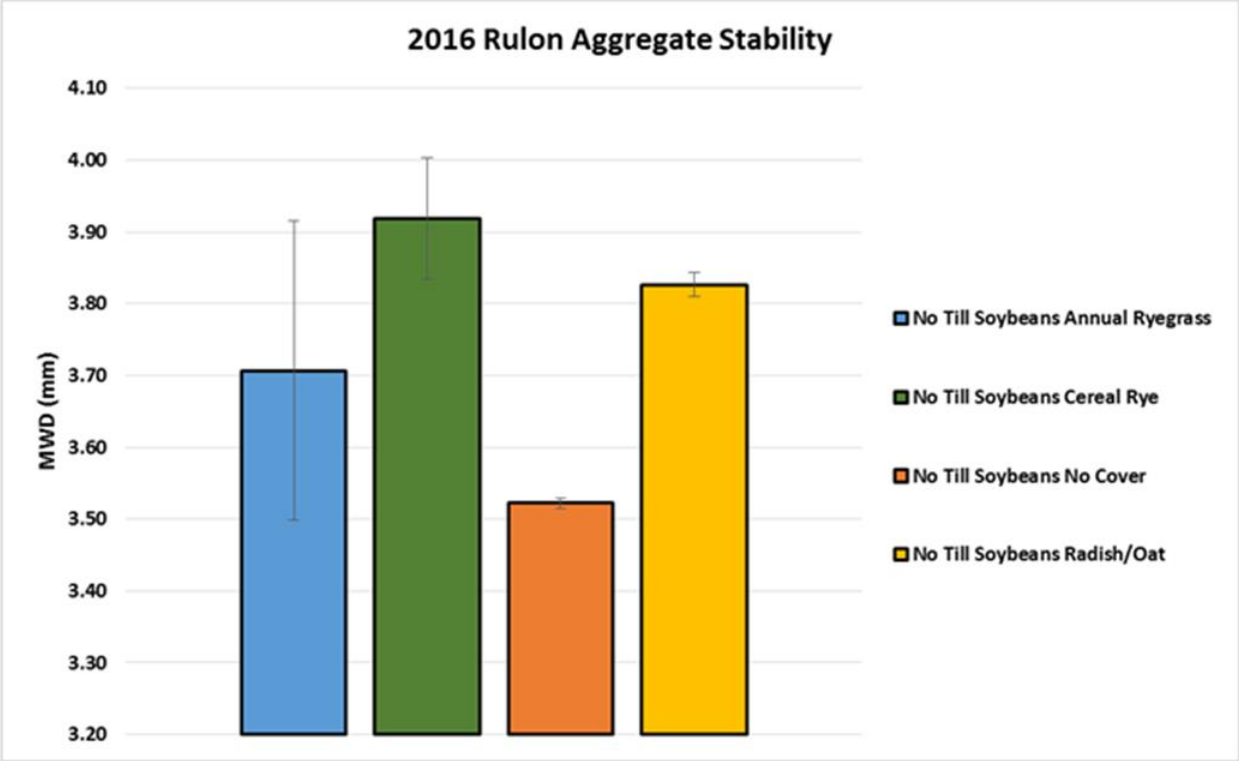

Date	Management	Cash Crop	Cover Crop	Plot#	MWD	Treatment MWD	Standard Deviation	Standard Error
2016	No Till	Soybeans	Annual Ryegrass	RR3	3.50	3.71	0.29	0.21
				RR7	3.91			
2016	No Till	Soybeans	Cereal Rye	RR2	3.83	3.92	0.12	0.08
				RR6	4.00			
2016	No Till	Soybeans	No Cover	RR4	3.52	3.52	0.01	0.01
				RR8	3.53			
2016	No Till	Soybeans	Radish/Oat	RR1	3.81	3.83	0.02	0.02
				RR5	3.84			

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WHAT ARE THE ECONOMIC BENEFITS OF COVER CROPS?

Rainfall in Inches

APR	MAY	JUN	JUL	AUG	TOTAL
4.09	3.72	4.04	2.74	5.34	19.93

Central Indiana PFR

BECK'S Soybean After Cover Crop Study - 2014

PLANTED: April 24, 2014
HARVESTED: September 30, 2014
POPULATION: 130,000 seeds/A.
ROWS: Four 30" Rows
REPLICATIONS: Three (averaged)

PREVIOUS CROP: Various Cover Crops/Corn
TILLAGE: No-Till
HERBICIDE: Burndown: 1 qt. Roundup PowerMAX®
Pre: 4 oz. Authority® XL, 1 qt. Roundup PowerMAX
Post: 1 qt. Roundup PowerMAX
INSECTICIDE: Escalate™

PURPOSE:

Many farmers have been experimenting with cover crops to determine their ability to scavenge nitrogen, improve soil tilth and reduce compaction. The goal of this study is to evaluate how the use of cover crops before a soybean rotation affects yield and returns of that crop. Two cover crops (Beck's Cereal Rye and Beck's Bean Builder Mix) were planted in the fall preceding the soybean crop. The Beck's Bean Builder Mix was burned down before planting, and Beck's Cereal Rye was burned down after planting. Both cover crops were seeded on September 24, 2013.

Brand & Treatment		Percent Moisture	Bushels† Per Acre	Bu./A. Difference	Net^ Return	Return on° Investment
BECK 278R4™*						
Control		11.3	57.5	---	$644.00	---
40 lb. Beck's Cereal Rye		11.5	63.0	+5.5	$685.20	+$41.20
24 lb. Beck's Bean Builder Mix		11.6	54.9	-2.6	$577.68	-$66.32
	AVERAGE	11.5	58.5	+1.5	$635.63	-$12.56
BECK 328R2™*						
Control		10.9	57.9	---	$648.48	---
40 lb. Beck's Cereal Rye		10.8	67.6	+9.7	$736.72	+$88.24
24 lb. Beck's Bean Builder Mix		10.8	60.7	+2.8	$642.64	-$5.84
	AVERAGE	10.8	62.1	+6.3	$675.95	+$41.20
BECK 358R4™*						
Control		11.3	63.8	---	$714.56	---
40 lb. Beck's Cereal Rye		11.2	67.5	+3.7	$735.60	+$21.04
24 lb. Beck's Bean Builder Mix		10.8	57.5	-6.3	$606.80	-$107.76
	AVERAGE	11.1	62.9	-1.3	$685.65	-$43.36
COVER CROP SUMMARY						
Control		11.2	59.7	---	$669.14	---
40 lb. Beck's Cereal Rye		11.2	66.0	+6.3	$733.70	+$64.56
24 lb. Beck's Bean Builder Mix		11.1	57.7	-2.0	$608.92	-$60.22
	AVERAGE	11.2	61.1	+2.2	$670.59	+$2.17

†Bu./A. corrected to 13% moisture. ^Net return is gross income (Bu./A. x $11.20/Bu.) minus treatment cost. °Return on investment is Bu./A. difference x $11.20/Bu. minus treatment cost and application cost, if applicable. $0.36/lb. Beck's Cereal Rye, $1.30/lb. Beck's Bean Builder Mix and $6.00/A. application cost.

SUMMARY:

The two different cover crop treatments provided mixed results. The use of Beck's Cereal Rye resulted in yield increases across all varietes, with a 6.3 Bu./A. average advantage over the control. The Beck's Bean Builder Mix, on the other hand, was less successful. A positive yield response was only recorded in one variety and a 2 Bu./A. yield loss was realized overall. Return on investment was affected similarly. Beck's Cereal Rye provided a $64.56/A. average return, while the use of the Beck's Bean Builder Mix resulted in a $60.22/A. loss. It will be interesting to see how the two crops work to reduce soil compaction, improve tilth and control erosion over time. Losses may be recouped in the future if overall soil health is improved to promote yield increases in later growing seasons.

Visit **www.beckshybrids.com/pfrvideos** to view more information about Beck's new Flo-Rite Seed Firmers.

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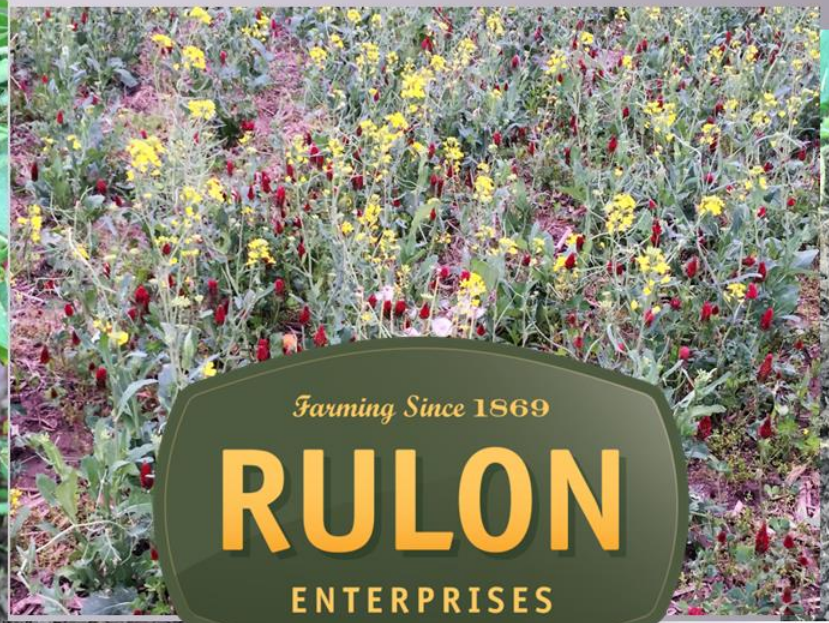
Cereal Rye = + 6.3 Bu/Ac

In Conclusion…

- There are many potential benefits to cover crops
- Match the cover crop to your goals
- It's not cheap or easy and may not show immediate returns
- No-Till is not easy, Cover crops may be able to help with some of the challenges
- Soil Quality Should Be the GOAL
- WE CAN NOT AFFORD NOT TO USE COVER CROPS!!!

Thank You!!



Farming Since 1869

RULON

ENTERPRISES

Soil Health Economics
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Comparing the Systems

The "Real" Economics of No-Till

Activity or Input	Unit		Conventional		Long-Term No-Till	
Soil Test	$/Acre		2.50		2.50	($10.00 every 4th year - 1 ACRE GRIDS)
Chisel Plow	$/Acre		16.00		0.20	(No-till=Zone Build 5% of acres every 4th year)
Spray Fall Weed Control	$/Acre		0.00		1.25	($5.00 every 4th year)
Fall Weed Chem Cost	$/Acre		0.00		1.17	(22oz R-up+24D=$4.70 every 4th year)
Cover Crop Cost-All	$/Acre		0.00		7.00	($14/acre on 50% of Acres)
Apply Dry Fertilizer	$/Acre		6.00		7.00	(VRT Apply - 1 Acre Grid Data)
0-11-45	Lbs/Acre/Year	150	46.90			(Standard Fertility Program)
11-52-0	Lbs/Acre/Year			41	13.53	(Actual usage per year in LT No-Till)
0-0-60	Lbs/Acre/Year			65	20.15	(Actual usage per year in LT No-Till)
Apply Anhydrous	$/Acre		12.50		14.50	($2.00 to pay for Exactrix/no-till bar)
82-0-0	Lbs/Acre	225	92.81	156	64.35	(LT No-Till increases OM = Increased N avail)
	act N=	185	128			(Lower Rate Requires Exactrix Precision App.)
Apply Preplant Chemicals	$/Acre		5.00		5.00	
Preplant Chem Cost	$/Acre	2.1qt BICEP	15.23		15.93	(11oz R-up + 24D + 1.8qt BICEP= $15.93)
Field Cultivate 1.3 times	$/Acre		15.02		0.75	Level spots in no-till
Plant Corn	$/Acre		16.14		18.14	($2.00 to pay for expensive no-till planter)
Corn Seed - RR + CB	$/Acre		127.50		127.50	(Drop 34,000 seeds)
28-0-0	Lbs/Acre	100	18.00	180	32.40	(Conv=9.2 gal; no-till=16.5 gal)
	act N=	28	50			
Fungicide/ Insecticide Cost	$/Acre		22.50		6.48	More control from beneficials - less chemicals needed
Replant Corn Fuel/Depr	$/Acre		0.36		0.18	(4% avg conv - 2% no-till - LT OM increase)
Apply Post Chemicals	$/Acre		5.00		5.00	
Post Chem Cost	$/Acre		6.22		6.22	(22oz R-up+1# Attrex+Array+AMS= $6.22)
Spray & Mow Fencerows	$/Acre		0.75		1.25	($.50 to dig trees in no-till)
Harvest Corn	$/Acre		36.40		35.40	($.20/bushel) (No-till $1 fuel savings)
Hauling Corn	$/Acre		14.80		14.80	($.08/bushel)
Drying Corn	$/Acre		17.58		17.58	($.095/bushel)
Storing Corn	$/Acre		24.98		24.98	($.135/bu= Int-.08: Shrink-.02: Depr/Repairs- .035)
Net Land Rent Cost	$/Acre		300.00		280.00	NRCS Water Quality Incentive Payments $20/ac
SOYBEAN YIELD VALUE	$/Acre		0.00		-18.00	LT No-Till 3 bu better bean yield than conv ($12/bu/2yea
TOTAL COST =			**802.19**		**705.26**	
				Difference	**-96.93**	**19.386 bushels at $5.00**
AVERAGE YIELD =			**185.00**		**185.00**	**There is no yield drag in LT No-Till**
AVERAGE COST PER BUSHEL =			**$ 4.34**		**$ 3.81**	