

Infrared Sensors, Row Clutches, Auto-Steer - Precision Practices That Pay.

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January 9, 2013



Tim Norris & Ag Info Tech, LLC.

- I am not an engineer, scientist, or a researcher, I am a Precision Ag Service Provider and farmer at heart.
- Grow corn & soybeans in Gambier, Ohio.
- 17 years of experience with Precision Ag.
- I want to share my real world experience with you, but again these results are not from a scientific study.



Ag Info Tech's Approach to Selling Precision Ag

- Ag Info Tech loves new technologies, but only if they provide a payback to the grower.
- Too many people will sell the latest technology gadget to a grower. Not very many of them explain the true payback.



Ag Info Tech's Approach to Selling Precision Ag

- Ag Info Tech tries to educate our growers on the technology that we sell and provide them with a projected payback using their numbers on their farming operations.
- We believe that an educated customer is the best customer.



What does it mean to provide a payback?

- Providing a payback is measured by several ways.
 - Will it provide a positive financial return?
 - Will it benefit the environment?
 - Will it give you a competitive advantage in attracting landowners?





What does it mean to provide payback?

- Providing a payback is measured by several ways.
 - Will it allow you to perform a task better?
 - Will it allow you to do something you can't do currently?
 - Will this technology be used elsewhere?



What Technologies Are We Going to Look at Today?

- On The Go Infrared Sensors
- Automatic Swath Control
- Automated Steering Systems



On the Go Variable Rate Infrared Sensors

- How do they work?
- How do we use them?
- What paybacks can they provide?



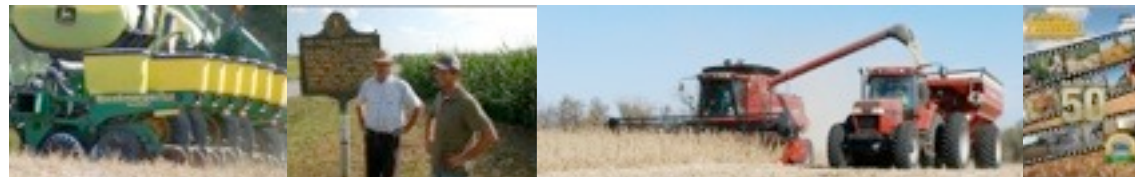
How do these sensors work?

- They send infrared light down on the crop in real time.
- The healthier the crop is the more of the light is absorbed.
- The sensors measure the amount of the light that is reflected back, not absorbed and puts a number to that.



How do these sensors work?

- They also send out a different form of infrared light that measures the Bio Mass of the plant.
- The combination of these numbers gives us an NDVI reading.
- They then compare the NDVI reading to corn in an N Rich Strip compared to the NDVI in the non N rich Strip.



How do these sensors work?

- Using land grant universities algorithms and some general guidelines set up by the operator we come up with a nitrogen recommendation.
- These sensors read the crop at 100 times per second.
- Once per second it will change our target rate.



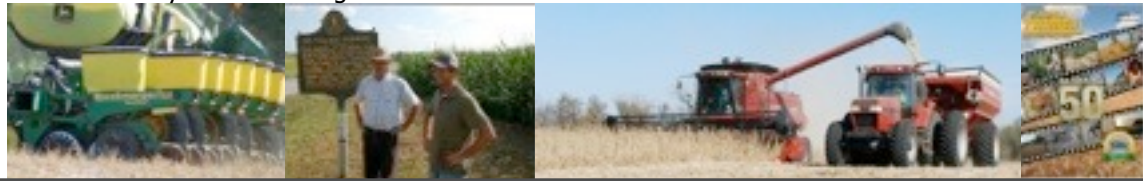
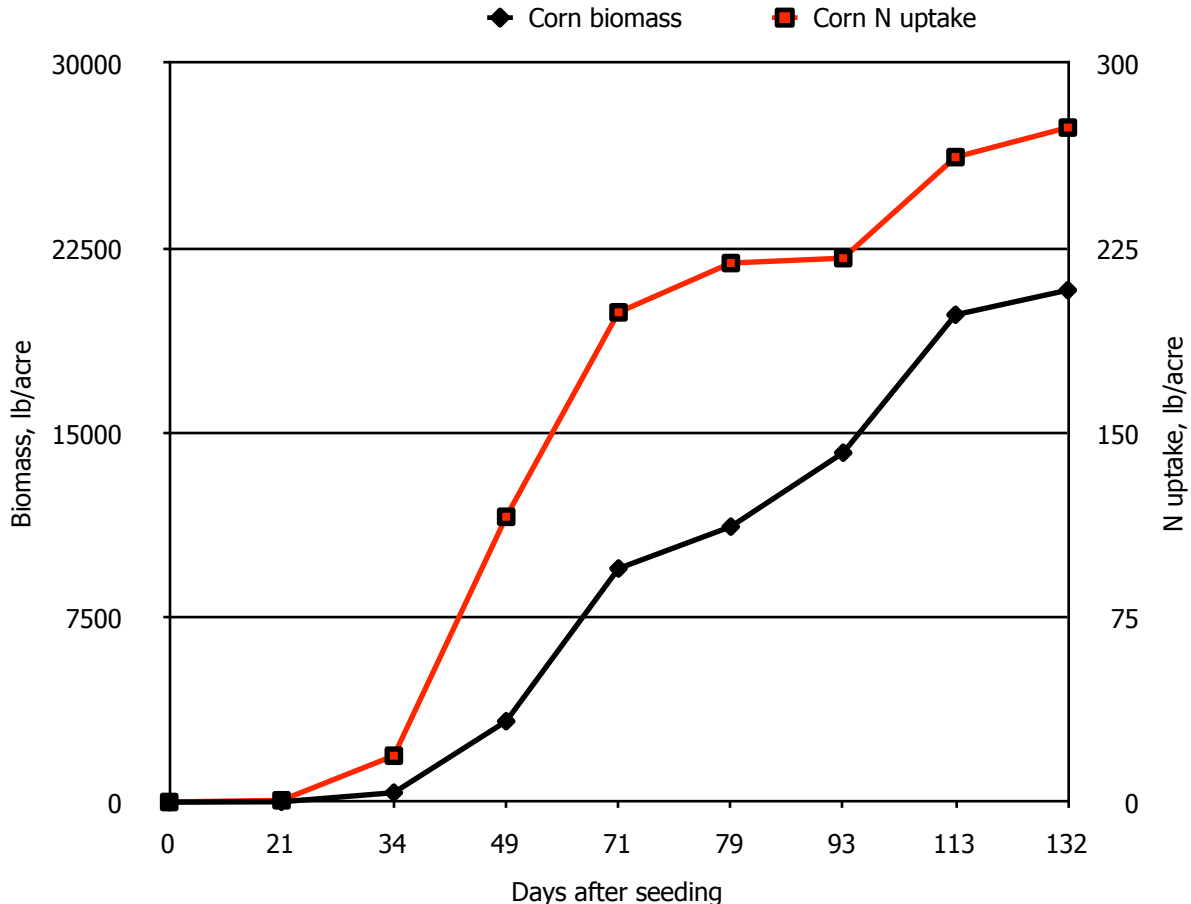
Will On the Go Infrared Sensors Provide a Payback?

- First we need to start with a few questions.
- What is the right time for nitrogen to be applied to a corn crop?
- Is there variability in the amount of nitrogen available?
- Does it make sense to put all of our N down at planting?





Nitrogen Uptake by the Corn Plant



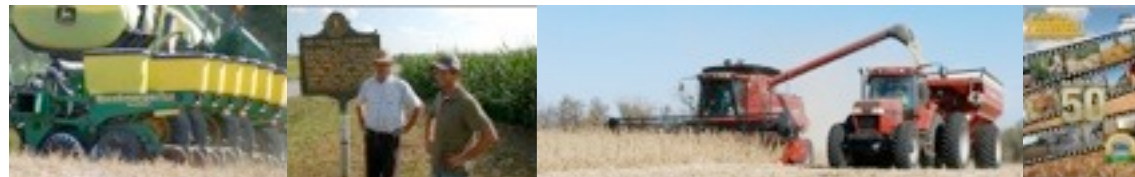
Nitrogen Use

- 1 Month from planting May 20th it has used 20 Units of N.
- 2 Months from planting June 20th it has used 150 units of N, roughly half of its N needs.
- 3 Months out it July 20th it has used 230 units.
- 4 Months out Aug 20th it has used 280 units of N.



Is there variability in the amount of nitrogen available?

- To answer this lets look at a field on my farm.



N Before Planting?

- MAP is variable rate spread with rates from Zero to 400 lbs. 0 to 44 lbs. of N
- Organic Matter is 1.2% to 3.5%. Organic N is 24 – 70 lbs.
- Corn following soybeans extra 20 lbs. of N.
- Total N before planting is 44 to 134 lbs. to the acre.



So we Know we have a minimum of 44 lbs. of N at planting.

- We saw that 100 lbs. of N will get us to approximately 45 days from planting without stressing the plant.
- Putting all of our nitrogen down early leaving it subject to denitrification or leaching is not a sound environmental practice or a sound investment.
- Would you leave your combine sit outside 2 months before its needed so that it is there just in case?
- No! it does not make sense to put all of our N down at planting.



So what do I apply at planting?

- I typically put 20 Gals. 28% as a carrier for the herbicide. 60 units of N.
 - Not stabilized and it is spread on top of the ground
Weed & Feed.
- Total N before side dress is 104 to 194 lbs. to the acre.
- So I have enough N to get me past 45 days to 75 day period.



So that means we need to side dress! It's the Right thing to do!

- How much nitrogen should we put down at side dress?
- Remember the variability of N in My Field?
- 104 to 194 units of N available.
- What does the crop need? 260 units give or take.
- So if we add 20 gals. At an early side dress we will have some parts of the field with all of their nitrogen needs and others that are 90 units short.
- I typically do this 30 to 45 days after planting.



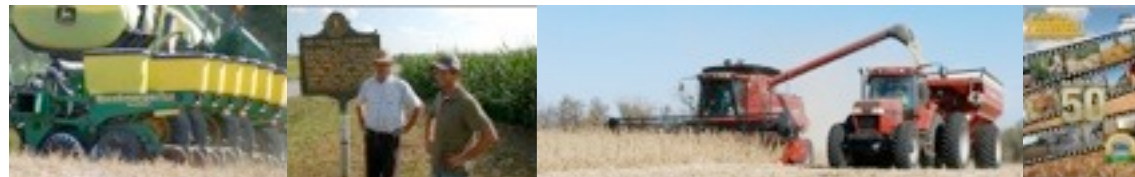
We still need to answer these questions

- How much denitrification has occurred?
- Is the more organic N there then we are thinking?
- So what is the correct rate?
- What would 10 Gals extra of 28% cost me?
- \$400 @ ton, it would be \$21.13 acre.
- How much yield would I loose if I were 10 gals short?
- Do you want to rely on a crap shoot?



How have we tried to handle this in the past?

- Side dressed 30 to 40 gals. and hoped for the best.



People have wanted to vary nitrogen since Precision Ag Started?

- We have created yield goals in different zones.
- We have mapped the N from MAP or DAP applications.
- We have OM maps
- We can give 50% credit of the OM and MAP or DAP Nitrogen and subtract it from the target N based off yield goals.



What is a key piece missing from this method?

- Denitrification!
- And we only feel comfortable in taking 50% credit for N OM and N from Phos. Fertilizers.
- We were never able to show a consistent benefit to applying nitrogen this way.
- And varying the rate to just vary the rate was not the right thing to do.



So that brings us to the sensors.

- The potential of these sensors excites me.
- We need a good way to vary our Nitrogen rates and use it in a more efficient manor.
- Lets look at some results



2010 Test's

- Used Green Seeker on our 28% applicator.
- 28% figured at \$340.00 ton
- Corn figured at \$6.00 bu.
- 20 28% sprayed as carrier for pre emerge.
- Applied V5 – V6, tool bar limitation.
- 20 Gal. Minimum and a 40 Gal. Maximum
- We greatly limited the sensors ability to change rates.



My tractor & coultter injector




FAA





Farm 1

	Yield	ave 28%	Yield over	Gal over	Net \$
30 Normal Practice	209.3	30	0.0-		\$ -
20 Gal Straight Rate	207.1	20	-2.2(10.0)		\$ 4.94
25 Gal Straight Rate	208.2	25	-1.1(5.0)		\$ 2.47
VRA High Rate best	205.5	25.48	-3.8(4.5)		\$(14.60)
 VRA OSU High in low	216.8	28.75	7.5(1.3)		\$ 47.27

Average results for 2010 compared to 30 gal. straight rate

- .75 gal less 28%
- \$1.35 per acre savings
- 5.31 Bu. Per care advantage
- \$31.86 advantage from yield
- \$33.21 dollars per acre advantage
- Could have been more if we would have let the sensor go to 0 and up to 50!



Lessons Learned in 2010

- Trust the sensors, **slightly** stressed corn can respond positively to the extra nitrogen.
- The best corn in the field does not always need additional Nitrogen.
- Window for application is too narrow for a typical toolbar applicator.



2011 Test Parameters

- 28% Nitrogen @ \$340 ton
- Corn @ \$6.00 bu.
- Applied in a band with Ag Leader OptRx and Direct Command Case Sprayer
- Applications were performed in the V6-V8 growth stages.
- 25 Gal 28% down at planting



Sold an OptRx on a Case High Clearance Sprayer



2011 Results

- On Farm Test A
 - Straight Rate 34.45 Gal. = 203.10 bu./acre
 - OptRx 25.93 Ave Rate = 213.42 bu./acre
 - Saved 8.52 gals. 28% for a savings of \$15.42
 - Yielded 10.32 bu. More, an increase of \$61.92
 - **Total Return Per Acre \$77.34**

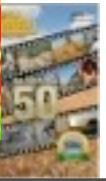
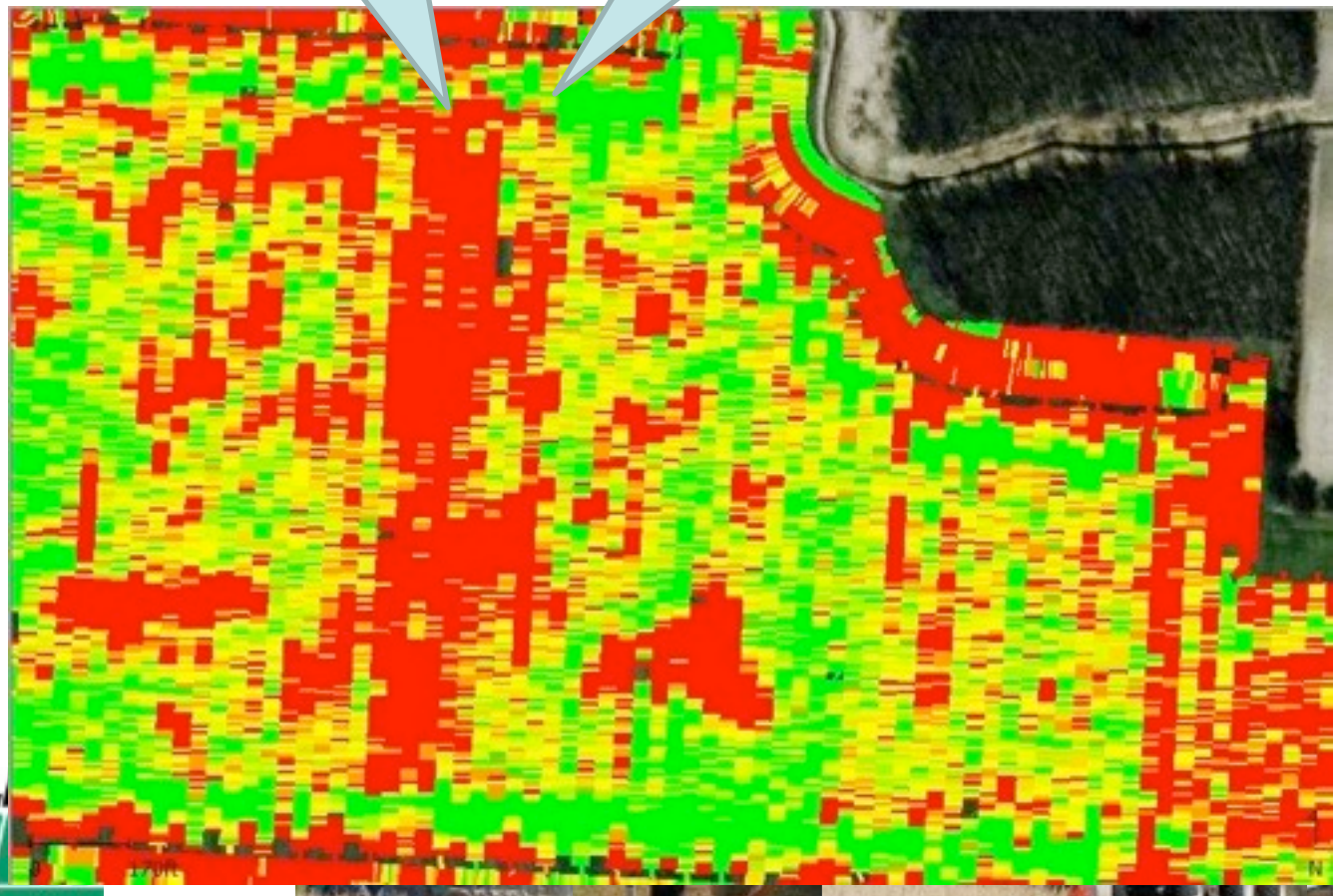




Yield Map Red Low

Straight Rate
35 GPA Here

OptRx
Used Here



2011 Results

- On Farm Test B
 - Straight Rate 24.99 Gal. = 177.24 bu./acre
 - OptRx 27.29 Ave Rate = 193.49 bu./acre
 - Saved -2.3gals. 28% for a savings of -
\$4.16
 - Yielded 16.2 bu. more for an increase of
\$97.20
 - **Total Return Per Acre \$93.04**



2011 Results

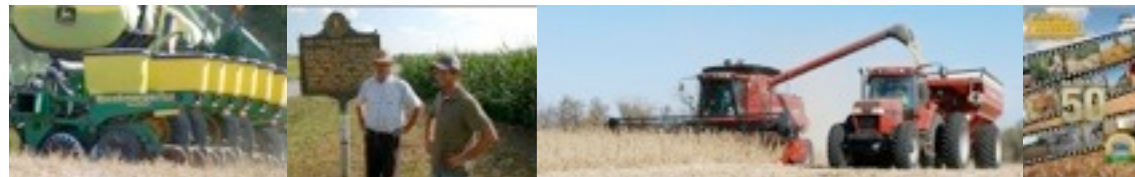
- On Farm Test C
 - Straight Rate 25.04 Gal. = 223.07 bu./acre
 - Straight Rate 29.81 Gal. = 230.02 bu./acre
 - Straight Rate 34.38 Gal. = 233.46 bu./acre
 - OptRx 23.59 Ave Rate = 234.61 bu./acre



2011 Results

- On Farm Test C
 - 28% Savings compared to OptRx 23.59 gal. average rate

Rate	Gal Over OptRx	\$ OptRx Adv.
– 25.04 gal.	1.45 gal.	\$2.62
– 29.81 gal.	6.22 gal.	\$11.25
– 34.38 gal.	10.79 gal.	



Hardscrabble Farms Delaware, Ohio

- Schnipke Farm Test B
 - Yield Advantage of OptRx 234.61 Bu. compared to straight rates

Rate	Yield dif.	\$ OptRx Adv.
– 25.04 gal.	11.54 bu.	\$69.24
– 29.81 gal.	4.59 bu.	\$27.54
– 34.38 gal. 6.90	1.15 bu.	\$



Hardscrabble Farms Delaware, Ohio

- Schnipke Farm Test B
 - Total OptRx Advantage

Rate	\$ OptRx Adv.
– 25.04 gal.	\$71.86
– 29.81 gal.	\$38.79
– 34.38 gal. \$26.42	



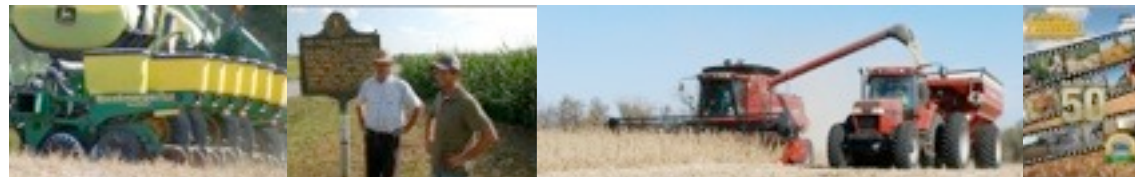
2011 Results

- Average OptRx Advantage for 2011
- \$66.12 per acre.



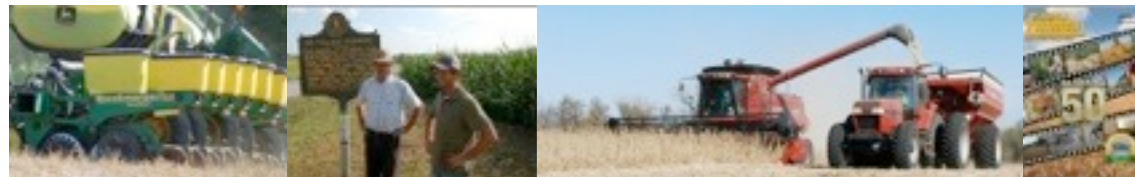
Average of all 2010 & 2011 Tests

- \$49.62 Per Acre Advantage!
- This is high compared to Ag Leader and Trimble's testing.
- But these were both wet springs and denitrification was present.
- I warned that results may vary especially in a dry year.



2012 Test

- Currently have 6 of these systems out on farms and 1 at Town & Country Co-op.
- We had several thousand acres that they were used on in 2012
- 2012 was dry.



2012 Test

- Some crops did not receive any rain after the Nitrogen was put on for the N rich strip.
- N Rich strips looked the same to the sensors as non N rich strips.
- We had to lie to the sensors to get them to work.



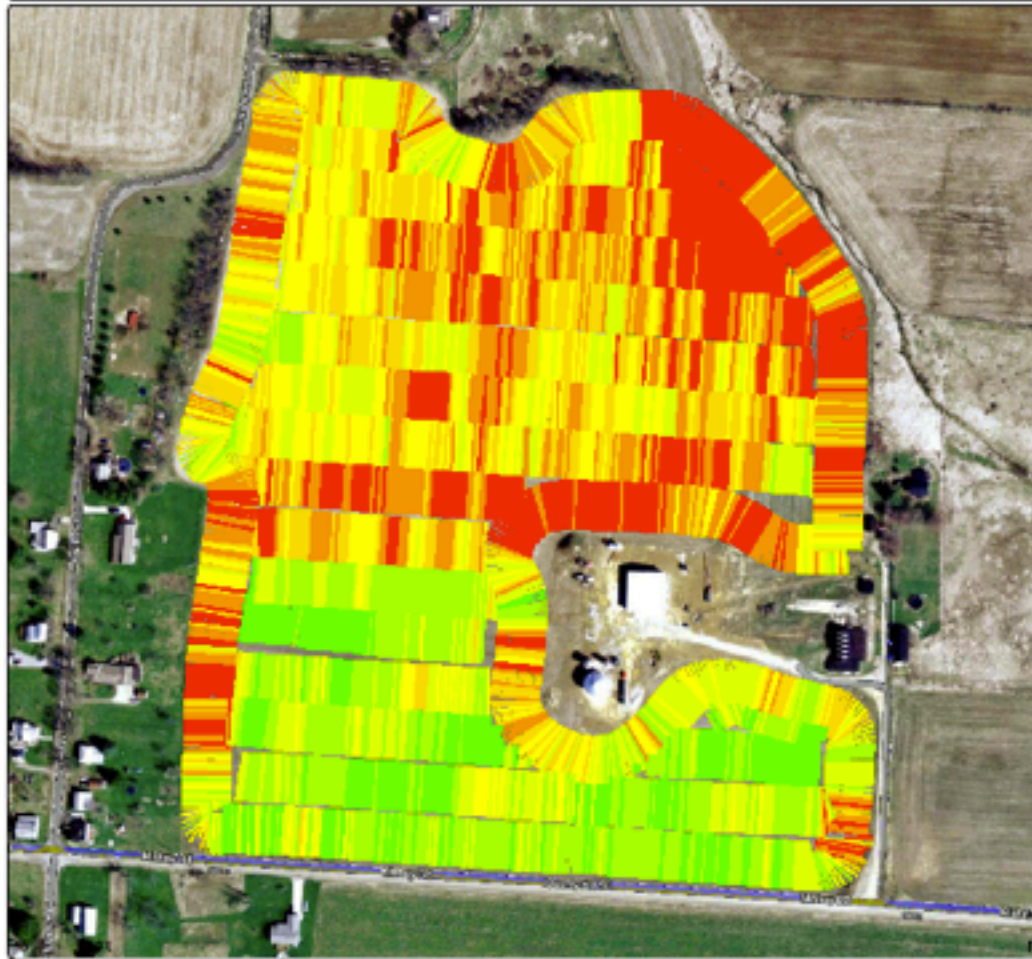


Lets look at some interesting examples of the OptRx in 2012



OptRx finding Hog Manure

Fertilizing (Liquid) 2012 By new garage (28% UAN)

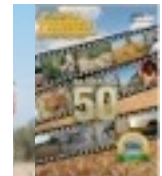


NDRE	
0.41 - 0.53	(2.522 ac)
0.39 - 0.41	(5.047 ac)
0.36 - 0.39	(5.108 ac)
0.34 - 0.36	(5.247 ac)
0.33 - 0.34	(5.417 ac)
0.30 - 0.33	(5.616 ac)
0.00 - 0.30	(5.706 ac)

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Ag Leader Technology SMS Advanced

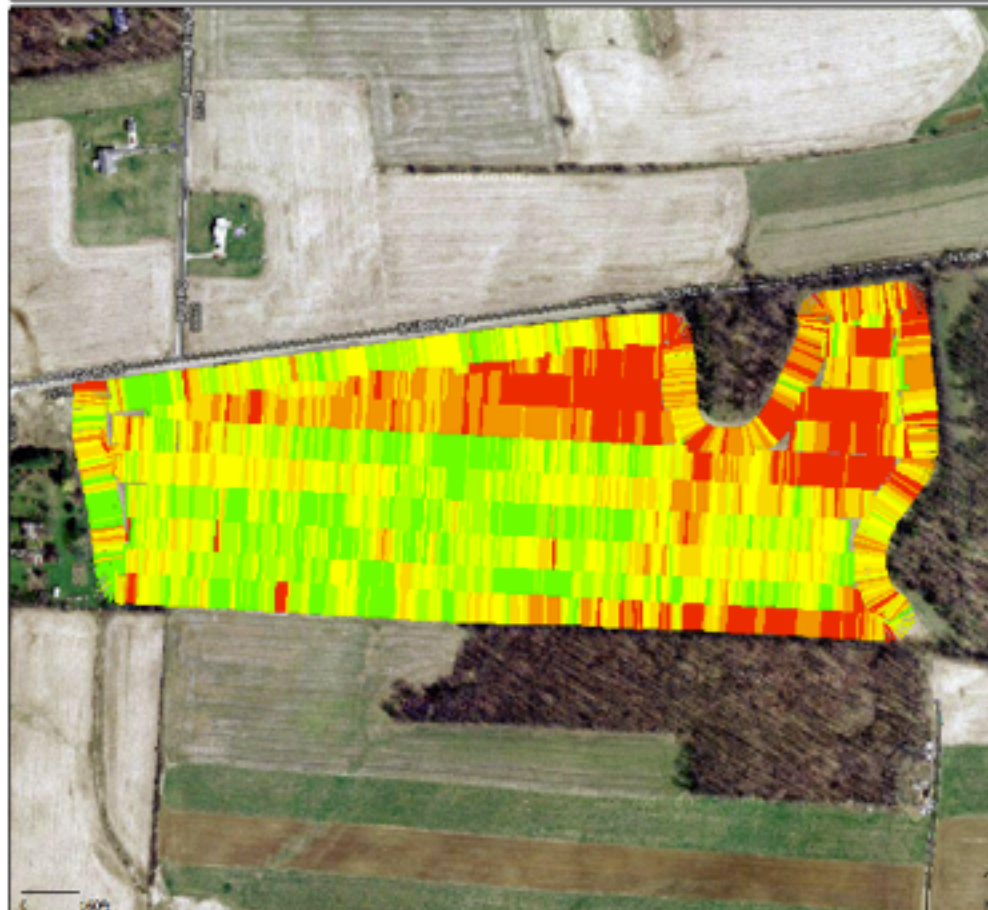
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OptRx finding

Where sprayer ran out of 28%

Fertilizing (Liquid) 2012 - Behind Larry P. (28% UAN)



NDRE	
0.38 - 0.45	(4.424 ac)
0.37 - 0.38	(6.213 ac)
0.36 - 0.37	(6.506 ac)
0.35 - 0.36	(6.050 ac)
0.33 - 0.35	(5.958 ac)
0.31 - 0.33	(5.834 ac)
0.00 - 0.31	(5.549 ac)



2012 Test Parameters

- 28% Nitrogen @ \$400 ton
- Corn @ \$7.00 bu.
- Applied in a band with Ag Leader OptRx and Direct Command Case Sprayer
- Applications were performed in the V6-V8 growth stages.
- 25 Gal 28% down at planting
- Compared to a 30 Gal. Straight Rate





Farmer A

		Gallons /acre	Bu./Acre
Test A	30 Gal.	30.02	132.12
	OptRX	31.4	140.52
Test B	30 Gal.	29.94	130.77
	OptRX	39.27	137.29
Test C	30 Gal.	29.92	142.99
	OptRX	37.21	146.31



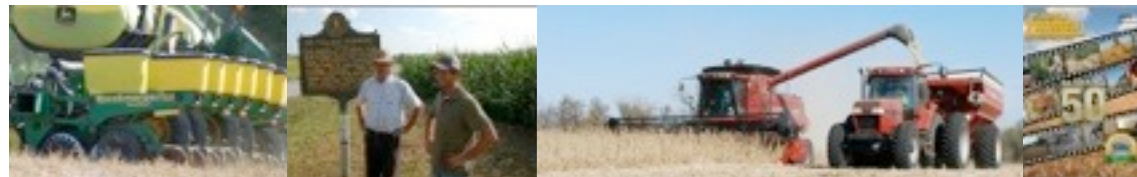


	Nitrogen Savings	\$ Adv. Nitrogen	BPA Yield Adv.	\$ Adv. Yield	Total OptRx \$ Adv.
Test A	-1.38	\$ (2.94)	8.4	\$ 58.80	\$ 55.86
Test B	-9.33	\$ (19.91)	6.52	\$ 45.64	\$ 25.73
Test C	-7.29	\$ (15.56)	3.32	\$ 23.24	\$ 7.68



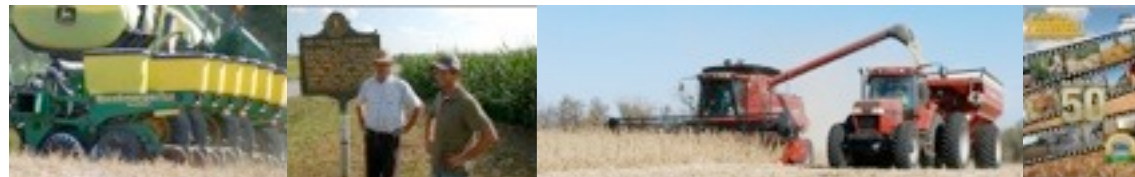
2012 Ave Payback so far!

- We have not ran everyone's data yet but so far for 2012 we have seen an average advantage from the sensors of \$29.37



What are the cost of these systems?

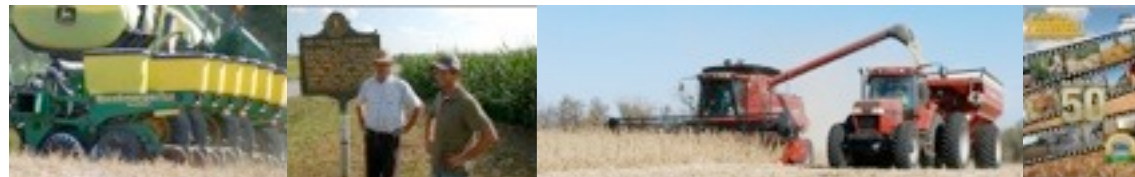
- My 28% applicator using Trimble
 - Rawson Drive \$2,995
 - Field IQ \$1,400
 - FmX – WAAS \$5,995
 - Green Seeker 4 Sensor System \$9,995
 - VRA Unlock for FmX \$ 750
 - Total Cost \$21,135



What are the cost of these systems?

- Ag Leader OptRx on a Sprayer
 - Integra Display \$4,500
 - GPS 1500 \$ 995
 - Direct Command \$2,600
 - OptRx Module Kit \$1,500
 - OptRx 4 Sensor Kit \$12,000

 - Total Cost \$21,595



With a \$21,500 Investment What Is My ROI?

- 500 acres of corn at \$49.62 per acre = \$24,810 annually payback in 1 year.
- 500 acres of corn at a \$20 per acre = \$10,000 annually payback in 2.5 years.
- If you already have a display and GPS you have half the cost.



What Paybacks do on the go sensors provide?

- AIT has proven that they provide a positive financial return on investment to the grower.
- They allow us to redistribute or nitrogen to places where the crop can get the most benefit of it, leaving less N to leach away.
- It allows us to better manage our nitrogen.
- Provides a competitive selling tool to attract land owners.
- And the technology can be used elsewhere.



However, On The Go

- These sensors require a high level of management to make them work properly.
- You need to wait till V6 to be able to use them correctly.
- You should have a “N rich strip” to calibrate in.
- Because of the size of the corn you should have a high clearance machine to apply the nitrogen.
- If you don't want to do these things this technology is most likely not for you!



Auto Steer & Row Clutches

- I am curious
 - How many people have Auto Steer in this room?
 - What about individual row clutches on the planter?



Auto Steer

- Basically two different types of Auto Steer
 - Assisted Steering
 - Integrated Steering
- Several levels of GPS accuracy.
 - WAAS 6-8” Pass to Pass 3-4’ Repeatable
 - RTK 1” Pass to Pass 1” Repeatable



Individual Row Clutches

- These give us the ability to shut off individual rows on the planter.
- The display will shut off the appropriate rows when they are in an area already planted or a no apply zone such as a waterway.



How about the payback of Auto Steer & Row Clutches?

- I developed a spreadsheet that we sit down with growers and look at the payback for these technologies using their numbers from their farming operations.
- We ask some simple questions.



Questions for the payback calculator

- Do you have a display
- What display do you have or intend to purchase?
- How many acres of corn do you plant annually?
- What is your average yield for corn?
- What is your average selling price per bushel of corn?
- What is your average seed corn price per acre?
- How many acres of soybeans do you plant annually?
- What is your average yield for beans?



Questions for the payback calculator

- What is your average selling price per bushel of beans?
- What is your average seed bean price per acre?
- Do you have auto steer?
- What kind of auto steer do you own or want to purchase?
- What level of GPS do you have or intend to purchase?
- Is your tractor auto steer ready?
- What brand is your tractor?
- Cost of operation for planting?



Questions for the payback calculator

- Does your planter have individual row clutches already?
- How many rows is your planter
- You percentage of overlap from driving too close?
- Percentage of overlap on point rows do you have?
- What percentage of yield loss do you feel you have from double planting corn?





Grower A

Items To Purchase			
Display	Ag Leader Integra	\$	4,500.00
Auto Steer	Paradyne	\$	8,800.00
Auto Steer Vehicle Platform Kit		\$	3,995.00
GPS Accuracy Upgrade	GNNS	\$	6,750.00
Clutch Control	Seed Command	\$	2,400.00
Row Clutches for Planter	12Sure Stop	\$	4,930.00
Total Investment This is a rough estimate based on average equipment prices, need an actual quote for your			\$ 31,375.00





Grower A

Corn Planting		500 acres		2.0% steering overlap		6.0% planter overlap
Seed Savings from Auto Steer				\$ 1.80 acre	\$	900.00 annual savings
Auto Steer Equip., Labor, Fuel Savings				\$ 0.28 acre	\$	140.00 annual savings
Seed Savings from Auto Swath Control				\$ 5.40 acre	\$	2,700.00 annual savings
Yield Increase from not Double Planting	\$			17.85 acre	\$	8,925.00 annual savings
Total Savings From Corn				\$ 25.33 acre	\$	12,665.00 annual savings





Grower A

Soybean Planting	0 acres	2.0% steering overlap	6.0% planter overlap
Seed Savings from Auto Steer		\$ 1.30 acre	\$ - annual savings
Auto Steer Equip., Labor, Fuel Savings		\$ 0.28 acre	\$ - annual savings
Seed Savings from Auto Swath Control		\$ 3.90 acre	\$ - annual savings
Total Savings From Soybeans		\$ 5.48 acre	\$ - annual savings
Total Savings			\$ 12,665.00 annual savings
Yeas to ROI			2.48 Years Till Paid For

Actual results will vary. Keep in mind this is just planting results and you can use this tractor for other jobs!





Grower B

Items To Purchase				
Displacement	Trimble FmX		\$	5,995.00
Auto Steer	Auto Pilot		\$	5,000.00
Auto Steer Vehicle Platform Kit			\$	3,995.00
GPS Accuracy Upgrade	GNNS		\$	8,000.00
Clutch Control	Field IQ		\$	2,165.00
Row Clutches for Planter	32Tru Count		\$	14,595.00

Total Investment This is a rough estimate based on average equipment prices, need an actual quote for your **\$39,750.00**





Grower B

Corn Planting		750 acres		2.0% steering overlap		6.0% planter overlap
Seed Savings from Auto Steer	\$		1.80 acre	\$	1,350.00	annual savings
Auto Steer Equip., Labor, Fuel Savings	\$		0.28 acre	\$	210.00	annual savings
Seed Savings from Auto Swath Control	\$		5.40 acre	\$	4,050.00	annual savings
Yield Increase from not Double Planting	\$		17.85 acre	\$	13,387.50	annual savings
Total Savings From Corn			\$ 25.33 acre	\$	18,997.50	annual savings





Grower B

Soybean Planting	750 acres	2.0% steering overlap	6.0% planter overlap
Seed Savings from Auto Steer	\$	1.30 acre	\$ 975.00 annual savings
Auto Steer Equip., Labor, Fuel Savings	\$	0.28 acre	\$ 210.00 annual savings
Seed Savings from Auto Swath Control	\$	3.90 acre	\$ 2,925.00 annual savings
Total Savings From Soybeans	\$	5.48 acre	\$ 4,110.00 annual savings
Total Savings			\$ 23,107.50 annual savings
Yeas to ROI			Years Till Paid 1.72 For

Actual results will vary. Keep in mind this is just planting results and you can use this tractor for other jobs!



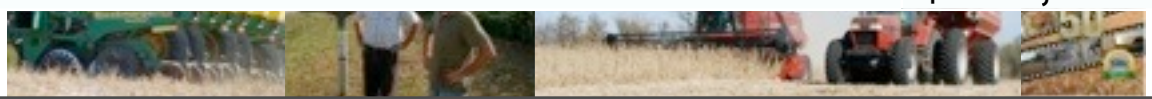
Grower C

Ag Info Tech

Planting Payback Calculator

Items To Purchase			
Displa			\$
v	Trimble FmX	5 995	00
			\$
Auto Steer	Auto Pilot	5 000	00
Auto Steer Vehicle Platform			\$
Kit		3 995	00
			\$
GPS Accuracy			\$
Upgrade	GNNS	8,000.00	
			\$
Clutch Control	Field IQ	2 165	00
			\$
Row Clutches for			\$
Planter	24 Tru Count	9,895.00	

Total Investment This is a rough estimate based on average equipment prices, need an actual quote for your **\$ 35,050.00**





Grower C

Corn Planting		2000 acres		3.0% steering overlap		4.0% planter overlap
Seed Savings from Auto Steer	\$		2.70 acre	\$	5,400.00	annual savings
Auto Steer Equip., Labor, Fuel Savings	\$		0.42 acre	\$	840.00	annual savings
Seed Savings from Auto Swath Control	\$		3.60 acre	\$	7,200.00	annual savings
Yield Increase from not Double Planting	\$		9.52 acre	\$	19,040.00	annual savings
Total Savings From Corn			\$ 16.24 acre		\$ 32,480.00	annual savings





Grower C

Soybean Planting	0 acres	3.0% steering overlap	4.0% planter overlap
Seed Savings from Auto Steer	\$	1.95 acre	\$ - annual savings
Auto Steer Equip., Labor, Fuel Savings	\$	0.42 acre	\$ - annual savings
Seed Savings from Auto Swath Control	\$	2.60 acre	\$ - annual savings
Total Savings From Soybeans	\$	4.97 acre	\$ - annual savings
Total Savings			\$ 32,480.00 annual savings
Yeas to ROI			Years Till Paid 1.08 For

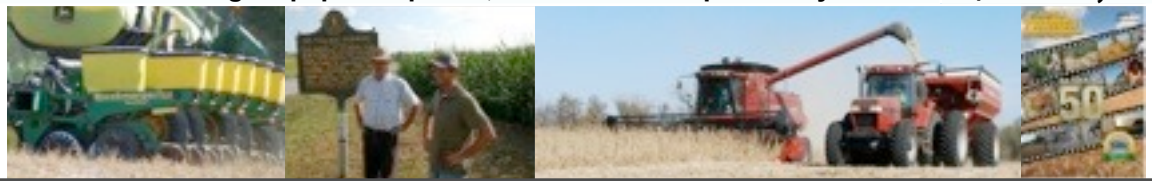




Grower D

Items To Purchase			
Display	Trimble FmX	\$	5,995.00
Auto Steer	Auto Pilot	\$	-
Auto Steer Vehicle Platform Kit		\$	-
GPS Accuracy Upgrade	Omnistar	\$	-
Clutch Control	Field IQ	\$	2,165.00
Row Clutches for Planter	8Tru Count	\$	3,595.00

Total Investment This is a rough estimate based on average equipment prices, need an actual quote for your **\$ 11,755.00**





Grower D

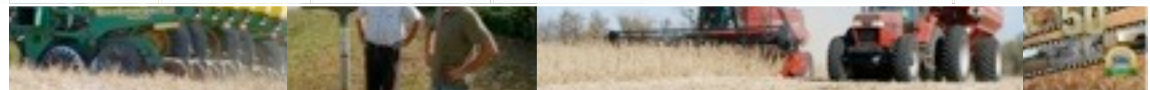
Corn Planting		250 acres		0.0% steering overlap		6.0% planter overlap
Seed Savings from Auto Steer	\$		-acre	\$		- annual savings
Auto Steer Equip., Labor, Fuel Savings	\$		-acre	\$		- annual savings
Seed Savings from Auto Swath Control	\$		5.40 acre	\$	1,350.00	annual savings
Yield Increase from not Double Planting	\$		21.42 acre	\$	5,355.00	annual savings
Total Savings From Corn			\$ 26.82 acre	\$	6,705.00	annual savings





Grower D

Soybean Planting		250 acres		0.0% steering overlap		6.0% planter overlap
Seed Savings from Auto Steer		\$		-acre	\$	- annual savings
Auto Steer Equip., Labor, Fuel Savings		\$		-acre	\$	- annual savings
Seed Savings from Auto Swath Control		\$		3.90 acre	\$	975.00 annual savings
Total Savings From Soybeans		\$		3.90 acre	\$	975.00 annual savings
Total Savings					\$	7,680.00 annual savings
Yeas to ROI						Years Till Paid 1.53 For



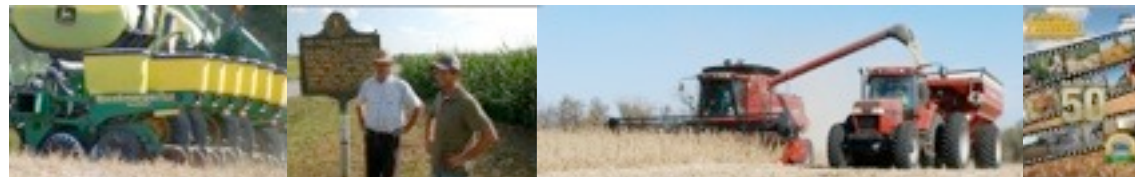
Auto Steer & Auto Swath

- We have proven clutches and auto steer will pay in a planting operation alone.
- The technology can be used for fertilizer & pesticide applications.
- Its good for the environment by not double applying.
- Less stress on the operator.
- Less stress on the family of the operator.



Auto Steer & Auto Swath

- Speeds up planting by not having to slow down or stop at the end of the field.
- Allows you to plant later at night.
- RTK can be used for controlled traffic and for residue management.



Residue management on my farm with RTK



Tim Norris – CEO Ag Info Tech, LLC.

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