Evaluating Best Management Practice Effectiveness

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Nutrient Efficiency and Management Conference February 15,2012 Morton, MN



Today's Topics

- Results from:
 - -Hwy 90 Drainage Demonstration
 - –Nutrient Management Initiative
 Program
 - -Verndale Wellhead Protection Demonstration Project



Hwy 90 Drainage Demonstration Water Quality and Nutrient Management Demonstration



Hwy 90 Drainage Project Goals

- Evaluate "Best Management Practices" effectiveness
- Evaluate water quality at field-scale
 - Environmental Influences
 - Compare to larger watershed
 - Evaluate long term trends
 - Evaluate economic outcomes for producers
- Education outreach



Hwy 90 Design

N-2

N-1

S-2

S-1



80' Spacing Optimum Production (Fall N)

80' Spacing U of M Guidance Spring Applied N

50' Spacing U of M Guidance Spring Applied N

50' Spacing Optimum
Production (Fall N)

Monitoring Equipment



Hwy 90 Nutrient Applications

Watershed	2007 Corn	2008 Corn	2009 SB	2010 Corn	2011 ѕв	2012 Corn
N-2 Aggressive	185-151-39 (variable rate) Fall NH3 No N- Serve	193-151-39 (variable rate) Fall NH3 w/N- Serve	None	150-105-90-19 Fall NH3 (100#) Spring AMS/Urea(26#) P & K 90-90 (uniform)	None	173-94-90-23 Fall NH3 145#/A w/N- Serve (uniform)
N-1 BMP Spring N U of M Rate	160-65-2 Spring Urea (uniform)	160-61-2 Spring Urea (uniform)	None	122-100-0-19 Spring NH3 (75#) Spring AMS/Urea(26#) P&K 85-0 (variable)	None	173-04-90-23 Fall NH3 145#/A w/N- Serve
S-2 BMP Spring N U of M Rate	160-61-2 Spring Urea (uniform)	160-68-2 Spring Urea (uniform)	None	122-00-0-19 Spring NH3 (75#) Spring AMS/Urea(26#) P&K 75-0 (variable)	None	173-94-90-23 Fall NH3 145#/A w/N- Serve (uniform)
S-1 Aggressive	185-149-39 (variable rate) Fall	193-149-39 (variable	None	150-105-90-19 Fall NH3 (100#) Spring	None	173-94-90-23 Fall NH3 145#/A w/N-

						30-yr.			
	2007	2008	2009	2010	2011	Avg.			
January	0.77	0.38			Snow &	1.4			
February	2.42	0.44			4.5	.95			
March	3.32	1.54	0.96	0.38	6.34	2.5			
April	0.91	2.77	1.65	1.74	2.25	3.2			
Мау	2.38	3.6	1.32	2.14	3.11	4			
June	2.82	3.59	3.58	8.41	4.18	4.2			
July	4.84	3.72	2.09	4.57	4.79	4.5			
August	8.32	2.14	1.42	4.01	0.84	4.6			
September	3.7	1.95	0.46	8.68	0.82	3.2			
October	3.76	2.03	4.93	0.91	0.71	2.5			
November	0.09	1.96	1.38	1.00	0.12	2.3			
December	0	1.8	0.43	0.48	1.19	1.4			
Total	33.33	25.92	18.22	32.32	28.85	34.7			
	Below normal precipitation								
	Above normal precipitation								

Inches of Drainage by Watershed



Highway 90 Drainage 2011



Rainfall and Drainage



June 25, 2010 Rain Event



Nitrate-N FWMC



Nitrate-N Yield (Pounds of N Lost per Acre)



Pounds of N Lost per Inch of Drainage



Hwy 90 Total Phosphorous FWMC



Total Phosphorous Yield (Pounds per Acre)



Phosphorous Soil Test Results



Hwy 90 Corn Yields



Hwy 90 Drainage--Net Return Comparison



Recommended BMP Aggressive

Drainage Conclusions

Normally 4-5 major drainage events per year

- Drainage flow normally ceases in early July
- Drainage flow influenced by crop stage, soil moisture, & intensity
- 75% of total runoff occurs over short period
 - 35 days in 2007, 34 days in 2008, 48 days in 2009,
 25 days in 2010 & 30 days in 2011
- Majority of overall drainage has occurred after spring snowmelt-March, and June rain events.



Summary Hwy 90 Nitrate Losses

- 2.1 to 2.5 pounds of N are lost per inch of drainage.
- Nitrate concentrations were reduced by an average of 2 mg/L when spring applied at a reduced rate.
- N losses reduced by an average of 4.6 lbs. when spring applied at a 30 lb. reduced rate.



Summary Hwy 90 P Losses

- An additional 77# per acre of P were applied to the aggressive/max production watersheds compared to the BMP comparison plots.
- Higher P application comparisons resulted in an average increase of .09 mg/L (FWMC) or additional losses of .21 pounds of P per acre.



Economic Considerations

- Corn production years
 - resulted in an average loss of 19 bushels per acre using BMP practices.
 - using actual nutrient input costs and an average corn market price resulted in an average loss of \$54 per acre.
- Today's Prices -19 bushel loss equals \$114 per acre. (\$6.01 Crop Insurance Price)





On-Farm Evaluation of Nitrogen and Phosphorous Nutrient Management



Relationship between Grain Corn Production, Acreage, and N Fertilizer Inputs



2011 Nutrient Management Initiative Locations



Nutrient Management Initiative—Design

- Either nitrogen or phosphorous site
- 2 Rates replicated 3X
- Minimize variables other than N or P
 <u>No</u> manure or alfalfa history
- Current soil test required
 - –<u>High</u> and <u>very high</u> testing phosphorous fields





Nutrient Management Initiative—Design

- Nitrogen Guidance—
- Treatment A (low rate)
 - 100-140# per Acre corn following soybeans
 - 140-180# per Acre corn following corn
- Treatment B (high rate)
 <u>Maintain at least 30# rate separation</u>
- Strip size—<u>minimum</u> of 40' wide by <u>minimum</u> of 600' long—can be larger

 Low N rate check=150-200' length
- Harvest—1 combine swath per strip
- Weigh wagon or yield monitor



ORCS Natural Resources Conservation Service Treatment A & Treatment B must maintain a minimum 30# rate difference

Treatment A

Treatment B

Treatment B

Treatment A

Treatment B

Treatment A

Minimum N Check Strips

ORCS Natural Resources Conservation Service



Enrollment & Producer Agreement

- Farmer signs an EQIP contract with local USDA-NRCS Ag Center (\$1340 payment)
- Farmer completes Producer Agreement
 - Contact information, crop consultant & anticipated applications
 - Insure the sites are established correctly

Natural Resources Conservation Service

 Farmer must work with a certified crop adviser validates cropping and harvest info.
 (\$400 payment incentive)



Reporting Information

- Farmer/Crop Consultant Responsibility
 - Cropping Information July 1st
 - Harvest Information November 15th
- MDA Responsibilities
 - Checklist sent to NRCS county office confirming requirements met (mid December)
 - Farmer and Crop Consultant receives individual site results (late December)
 - Overall results tabulated and copies sent out to farmers, crop consultants, & NRCS staff (early to mid January)

ORCS Natural Resources Conservation Service



.	2011 Nutrient Management Initiative Results								MIN OF A	NESOTA DEPARTMENT GRICULTURE
	Nitrogen Rate Com					parison				
County	Waseca		Previous Crop		Soybeans		Soil	Test Information		
Tilloga	VV00dVIIIe Eall Chical & Spring		HIStory	New Site			clay	ioam		
I liage S	Diant	Fail Cr	nsei & Spring	Population			,	0.IVI.%		4
No	Fig/2011 20		34 400				pii Duffor pH		0.3 6 7	
Pesticide:	Boundun ± Callisto_Atrozing			<u>ل 34,400</u>	Denaid DKC52-59			PhosBray nom		1/
Rate	32 oz ± 2 5 oz±1#							Phos Olsen ppm		 0
Harvest Date		10/11/2011	Comments:		1			Pottasium ppm		113
		Treatment A-	-(low rate)*(1))		Total Plant Food			r Acre	
Nutrient	Cost per		Application	Timing/	Applied on		P2O5 total	K2O total		
Source	ton	Rate lbs./Acre	Date	Placement	N Check	N total lbs./A	lbs./A	lbs./A	Sulfur	Zinc
82-0-0	\$528.00	152	05/04/11	Pre-Plant Bnd	No	125	Ω	0	0	0
10-34-0	\$385.00	5 dallons	05/06/11	Starter	Yes	5.5	19.9	0	0	2.5
11-52-0	\$0.00	360	11/05/10	Fall Brdcst	Yes	13.2	62.4	0	0	0
0-0-60	\$0.00	388	11/05/10	Fall Brdcst	Yes	s 0	0	132	0	0
Nitroge	en Stabilize	r Used?	No		TPF/Acre	143.7	82.3	132	0	2.5
		Treatment B	(high rate)*(2	?)		Total Plant Food P			r Acre	
Nutrient	Cost per		Application	Timing/	Applied on		P2O5 total	K2O total		
Source	ton	Rate lbs./Acre	Date	Placement	N Check	N total lbs./A	lbs./A	lbs./A	Sulfur	Zinc
82-0-0	\$528.00	189	5/4/2011	Pre-Plant Bnd	No	155	0	0	0	0
10-34-0	\$385.00	5 gallons	5/6/2011	Starter	Yes	5.5	19.9	0	0	2.5
11-52-0	\$0.00	360	11/5/2010	Fall Brdcst	Yes	13.2	62.4	0	0	0
0-0-60	\$0.00	388	11/5/2010	Fall Brdcst	Yes	s 0	0	132	0	0
Nitroge	en Stabilize	r Used?	NO		TPF/Acre	173.7	82.3	132	0	2.5
Yield Results							Weig	hing Method	V	eigh Wagon
		Harvested							Stalk	
Strip	Total N	Length in	Row Width	# of Rows	% Moisture	Test Woight	Harvest	Adjusted	Nitrate	Yield
Number		reel	Inches	naivested		rest weight	weight		Results	Averages
Check	18.7	140	30	8	15.0	56.0	626	173.91		Check Ave.
1	174	580	30	8	15.2	57.0	3444	230.40	2176	189.66
2	144	585	30	8	15.3	57.0	3450	228.56	3027	Treatment A
3	174	590	30	8	15.3	56.5	3418	224.52	1329	(low)
4	144	595	30	8	15.5	57.5	3540	230.03	2452	230.60
5	174	600	30	8	15.3	57.0	3606	232.92	1968	Treatment B
6	144	605	30	8	15.2	57.0	3636	233.19	3822	(high)
Check	18.7	160	30	8	15.1	56.0	846	205.40		229.28
Nitrogen Cos	t per lb. of	actual N		0.32	*Bas	sed on farmers	s actual costs	& predominal	nt nitrogen s	ource
Nitrogen to C	orn Price* I	Ratio		0.05	Uni	versity of Mn	. Rate Guide	lines	115	-138
Corn price bas	sed on \$6.22	2 per bushelre	sults from Ma	rshall and Red	Wing MN C	ash Price aver	rage 11/1/10	to 11/1/11		
Additional Co	ost for		30	lbs. of N per a	cre		\$9.60			
Yield Differen	nce from Ad			-1.32	bushels/aci	reor	-\$8.18			
Net Return	from Ad	ditional N p	er acre @ :	\$6.22/bu			(\$17.78)			

Economic Evaluation Report

Sent to Participating Farmer and Crop Consultant





2011 Nutrient Management Results





Yield Advantage from Higher N Comparison



Yield Response from Additional N 106 sites

corn/soybean, 2007-2011

Avg low N rate = 120 lb N/ac, Avg yield 189 bu./ac Avg high N rate = 156 lb N/ac, Avg yield 196 bu/ac



Yield Response from Additional N 53 sites corn/corn, 2007-2011



Economic Advantage from Higher N Comparison



Net Return from Additional N corn/soybean, 2007-2011



Net Return (\$/ac)

Net Return from Additional N corn/corn, 2007-2011



Basal Stalk Nitrate Test-Late Season N Evaluation

Top cut

14 inches above ground

ottom ou

nes above



Test

segment 8 inches

BSNT (Low Apps v.s. High Rates) 2011 soybean/corn 25% 21% **104** Samples 19% 20% 16% 13% 15% 9% 8% 10% 8% 6% 5% 0% **Excessive Optimum** Marginal Low Low Rate Apps High Rate Apps

BSNT (Low Apps v.s. High Apps) 2011 corn/corn





Corn following Corn Fall DAP, Pot, ZN Starter-10-34-0 Side Dress NH3 135 v.s. 165 total N

- 1 1		
neck Ave.		140.70
140.15	5600	191.10
eatment A	5906	197.30
(low)	4283	189.30
192.27	4788	198.70
reatment	5455	196.40
B (high)	5047	192.50
196.17		139.60
196.17		139.60

Everty



Conclusions

- Higher yield does not always mean greater return from additional N
 - SB/C –84% of sites had a yield advantage
 55% of sites had an economic advantage
 - C/C—66% of sites yield advantage
 41% of sites had and economic advantage
- New genetics are becoming much more efficient
 SB/C---.64-.88 pounds of N to produce bushel
 C/C---.89-1.07 pounds of N to produce a bushel
- Organic matter contribution—Check strips many times 70% of overall yield.
- Increased emphasis on water quality. Must be more conscious about nutrient losses.

- Wellhead protection areas, impaired waters, Hypoxia

City of Verndale Wellhead Protection Area Project





Verndale Drinking Water Supply Management Area







Bucket auger holes for lysimeters - 2 ft below trench



Hole at bottom of the trench (4 ft Total)

Trench runs are 2-feet deep





Pushing lysimeter into hole and silica mix



Mixing silica flour & coating ceramic tips

Ready for PVC

Sample lines kept below ground surface – out of way of farmer



NMI strips Long-term lysimeters installed



Verndale WHPA Lysimeter Install

Private Producer Land: N Rate Trials/WQ Monitoring



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Illustration by Ryan Lemickson, MDA



Purging lysimeter water by hand pump ~ i.e. sampling

Staff from MDA, MN Rural Water, and Wadena SWCD took turns sampling all summer and fall.

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Corn Yield Results

Strip Number	Total N	Harvested Length in Feet	Row Width Inches	#ofRows Harvested	% Moisture	Test Weight	Harvest Weight	Adjusted Yield @ 15%	Stalk Nitrate Results	Yield Averages
Check	0	775	30	8	17.3	57.0	3160	154.3	85	Check Ave.
1	189	1220	30	4	17.5	57.0	2552	157.9	3499	155.2
2	159	1220	30	8	17.4	56.5	5302	164.3	3868	Treatment
3	189	1215	30	8	17.7	57.0	5018	155.5	3525	A (low)
4	159	1235	30	8	17.2	56.5	5120	157.1	3755	160.66
5	189	1235	30	8	17.7	56.5	5356	163.3	4989	Treatment
6	159								3136	B (high)
Check	0								170	158.9
Nitrogen Cost per Ib. of actual N 0.53 *Based on farmers					ers actual costs & predominant nitrogen source					
Nitrogen to Corn Price* Ratio			0.08	Univer	University of Mn. Rate Guidelines 144-160					
Additional Cost for				3	0 Ibs. of N per acre					\$15.90
Yield Difference from Additional N				ional N		-1.74	bushe	Is/acre	or	• \$10.80
Net Return from Additional N per acre @ \$6.22/bu(\$26.70)								\$26.70)		

Education Outreach Activities

- Fall Nutrient Newsletter
- Nutrient Conference

•Jackpot Junction Morton—Feb15, 2012

• Direct mailers to crop consultants & farmers

- Press Releases
- News articles
- Meetings
 - Crop Consultants
 - •Farmers
 - Dealers



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