Hub/Spokes Nutrient Management Model, Crop Year 2001

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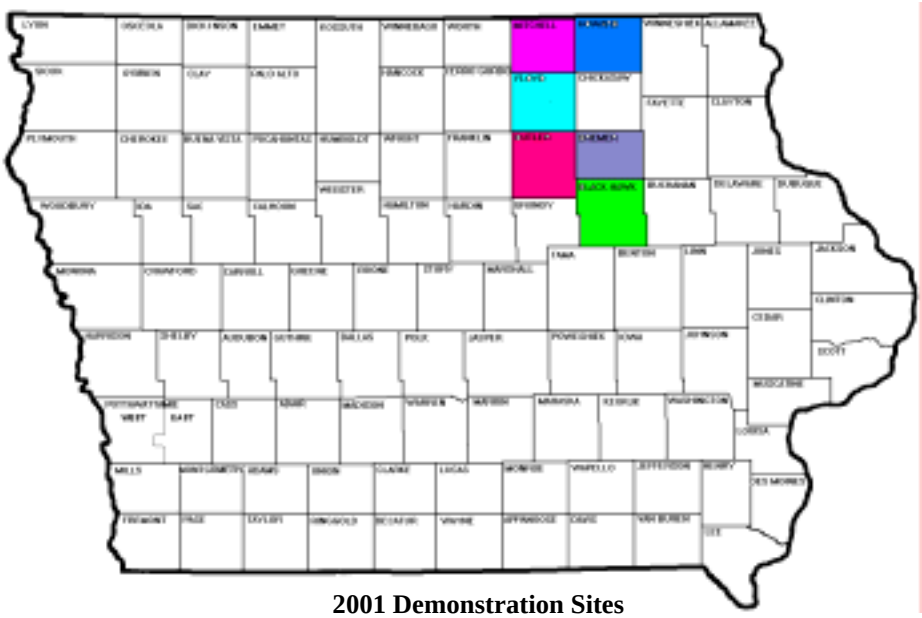
The Iowa State University (ISU) Northeast Research Farm near Nashua (the Hub) has conducted agronomic research related to soil fertility and nutrient management for the past 25 years. It has been considered the premier water quality research site in the Upper Midwest for the past 12 years and has conducted a well-known Precision Agriculture Demonstration Project for the past 5 growing seasons. Current extension recommendations and public policy related to soil fertility and water quality have been developed from these research findings.

The purpose of this project is to organize similar trials with on-farm cooperators (Spokes) as an extension / dissemination strategy. Our initial effort has focused on N utilization from manure and commercial fertilizer sources. Manure analysis, the Late Spring Nitrate Test (LSNT) and the Fall Stalk Nitrate Test (FSNT), GPS/GIS technology, and economic response were used to provide cooperators with appropriate information for nutrient- management decision-making.

The values of the demonstrations are to: 1) increase awareness of and interest in the research work conducted at the Northeast Research Farm; 2) confirm research findings on-farm using cooperator farming systems; 3) introduce cooperators to the various "tools" used to make nutrient management decisions; and 4) demonstrate the economic advantage and environmental impact of various nutrient management practices.

Joyce Dolan, Precision Ag Demonstration Project crop scout, taking samples for Late Spring Nitrate Test.

DEMONSTRATION DESCRIPTIONS AND RESULTS



2001 Demonstration Sites

Twelve separate replicated on-farm demonstrations were completed by 9 cooperators in 6 counties. All plots included replicated treatments randomized for statistical analysis. The Late Spring Nitrate Test (LSNT) was used to determine sidedress N rates and the Fall Stalk Nitrate Test (FSNT) was used to monitor N utilization and losses. Yields were measured and adjusted for moisture. The economic response to various N rates was calculated for all treatments.

1. Mitchell County — Manure/N Rate on C-Sbn Rotation

This cooperator has a large swine confinement operation contracted with the former Murphy Farms of Iowa. He injects manure each fall with an umbilical chord system according to a manure management plan. His goal is to follow a corn/soybean rotation utilizing manure as the primary nutrient source, maintaining P and K soil test readings at current levels and using sidedressed commercial N only as needed. ISU Extension has worked with this cooperator for 4 years, the last two years as part of the Tri-County Water Quality Project.

TRT A = Manure Only
TRT B = Manure + 60# Sidedressed as 28%
TRT C = Manure + 120# Sidedressed as 28%

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		5113	16.5	195.50	$00.00
B	14.8	7780	16.5	198.48	$17.15
C		5625	16.5	196.33	$27.95

LSD = 29.30 Bu/Ac

2. Floyd County — Manure/N Rate on C-Sbn Rotation

This cooperator contracts with Heartland Pork and fall injects swine finisher manure according to a manure management plan. His goal is to follow a corn/soybean rotation utilizing manure as the primary nutrient source, maintaining P and K soil test readings at current levels and using sidedressed commercial N only as needed. This cooperator uses a 28% injector for sidedressing. ISU Extension has worked with this cooperator for two years as part of the Tri-County Water Quality Project.

TRT A = Manure Only
TRT B = Manure + 40# N Sidedressed as injected 28%
TRT C = Manure + 80# N Sidedressed as injected 28%

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		1028	18.3	168.28	$00.00
B	7.3	2943	18.2	171.60	$17.07
C		5613	18.4	167.85	$27.79

LSD = 12.4 Bu/Ac

3. Howard County Manure/N Rate on C-Sbn Rotation

These cooperators have a large swine confinement operation and some open beef feedlots with bedded manure. This is their first year following a manure management plan. Because of short storage they apply manure several times during the year. The preferred method is to inject manure in the fall but they also need to apply in the winter on frozen ground and/or to spring broadcast. Their goal is to follow a corn/soybean rotation utilizing manure as the primary nutrient source, maintaining P and K soil test readings at current levels and using sidedressed commercial N only as needed. Our replicated trial is set up on fall-injected manure and includes a base treatment + starter fertilizer along with the sidedressed treatments. We also did some manure analysis before spring application and also did LSNT on a field with both winter and spring application areas to gather data for future management decision

TRT A = Manure Only
TRT B = Manure + 8# N as 7 – 21 – 7 Starter
TRT C = Manure + 60# N Sidedressed as NH3
TRT D = Manure + 90# N Sidedressed as NH3

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		2483	23.7	152.12	$00.00
B		2898	22.0	154.23	$11.11
C	14	3938	23.8	148.56	$19.48
D		4750	22.8	155.82	$25.87

LSD = 5.14 Bu/Ac

4. Butler County Manure/N Rate on C-Sbn Rotation

This cooperator is a Butler County Soil and Water Conservation District Commissioner who constructed a manure storage tank to collect from open feedlots and confinement buildings. His goal is to follow a corn/soybean rotation utilizing manure as the primary nutrient source, maintaining P and K soil test readings at current levels and using sidedressed commercial N only as needed. He uses a professional crop consultant. This is his first year cooperating with ISU Extension.

TRT A = Manure Only
TRT B = Manure + 70# N Sidedressed as NH3
TRT C = Manure + 130# N Sidedressed as NH3

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		810	20.5	183.09	$00.00
B	13	2185	21.1	187.84	$20.70
C		1868	21	189.75	$30.70

LSD = 8.2 Bu/Ac

5. Bremer County Corn Following Alfalfa Sod

This trial is an attempt to demonstrate the legume credits from a long-term alfalfa stand. The existing stand was killed chemically in the fall, 2000. This is a sandy field and most work with N credit following alfalfa has been done on heavier soils. The LSNT on this plot area would suggest that a full rate of N was needed. Both projects 4. And 5. are also included in the Tri-County Water Quality Project.

TRT A = Alfalfa Sod – No Additional N
TRT B = Alfalfa Sod - 70# N Sidedressed as NH3
TRT C = Alfalfa Sod – 130# N Sidedressed as NH3

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		465	14.3	160.35	$00.00
B	8.3	1333	14.1	160.99	$20.70
C		1158	14.1	162.04	$30.70

LSD = 8.6 Bu/Ac

6. Mitchell County Manure/N Rate and Timing on a C-Sbn Rotation

This cooperator accepted swine manure from a neighboring confinement swine operation and wanted to document its usefulness as a nutrient source. He routinely sidedresses 28% with his cultivator and also is interested in the response to late season 28% application dribbled on with a high boy at tasseling. He is a seed dealer and has followed the success of Francis Childs, the Iowa Master Corn Contest winner who applies N fertilizer several times during the growing season. We will determine the economic response to additional N.

TRT A = Manure Only
TRT B = Manure + 75# N Sidedressed as 28% with a Ridge-till cultivator
TRT C = Manure + 75# N SD at Cultivation + 39# N as 28% injected at tasseling

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		1963	23.2	186.06	$00.00
B	18.8	3703	23.4	189.04	$17.25
C		3785	23.2	187.67	$30.33

LSD = 4.8 Bu/Ac

High clearance prototype used to inject 28% at tasseling at the Mitchell County sites described in Projects 6 and 7.

7. Mitchell County N Application at Tasseling

Some producers and fertilizer dealers have claimed an economic response to N applied at tasseling. In a field which was soybeans in 2000, 30# of N was applied as starter and an additional 105# N sidedressed with the cultivator as 28%. Separated by 16 row check strips, a high-clearance machine was used to inject 28% in 24-row strips at rates of 30#, 40# and 50# N/ acre.

DEMONSTRATION RESULTS					
Plot No	TRT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
101	Check	350	18.0	169.18	$00.00
102	+30#	950	19.8	166.36	$11.10
103	Check	260	20.0	167.06	$00.00
104	+40#	390	19.4	167.56	$13.30
105	Check	330	19.4	173.54	$00.00
106	+50#	790	20.2	172.93	$15.50
AVERAGE	Check	313	19.1	169.93	
"	+ N	710	18.8	168.95	

8. Howard County Winter Applied Manure C-C Rotation

This cooperator has a large confinement swine operation, is an active member of the Iowa Pork Producers and has served on several committees looking at environmental and nutrient management issues. His goal is to follow a corn/soybean rotation utilizing manure as the primary nutrient source, maintaining P and K soil test readings at current levels and using sidedressed commercial N only as needed. He applies manure several times a year and our project compares a block of winter-applied manure on frozen ground with a spring broadcast block.

TRT A = Manure Only
TRT B = Manure + 50# N Sidedressed as NH3
TRT C = Manure + 86# N Sidedressed as NH3

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		7388	24.4	173.45	$00.00
B	36.5	7198	24.0	172.18	$14.65
C		7128	24.2	165.18	$22.32

LSD =17.2 Bu/Ac

9. Howard County Spring Applied Manure C-C Rotation

TRT A = Manure Only
TRT B = Manure + 50# N Sidedressed as NH3
TRT C = Manure + 86# N Sidedressed as NH3

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		6553	25.1	170.10	$00.00
B	28.8	5770	25.1	171.64	$14.65
C		6698	24.8	167.01	$22.32

LSD = 15.8 Bu/Ac

10. Black Hawk County Commercial N Rate on C-Sbn Rotation N Rate on C-C Rotation

This plot was located at the Hawkeye Community College Campus. The cooperator has a variety of manure (confinement swine/open feedlot and bedded beef and sheep manure), uses a corn/ soybean rotation and the intent of this project was to demonstrate the economic response to reduced rates of N. This project supplements classroom instruction in the Agriculture and Agri-Business Programs at Hawkeye Community College.

TRT A = Manure + 90# N Spring Applied as NH3
TRT B = Manure + 90# N Spring Applied as NH3 + 60# N Sidedressed as NH3
TRT C = Manure + 90# N Spring Applied as NH3 + 90# N Sidedressed as NH3

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		2133	21.3	188.95	$00.00
B	23.3	4185	20.7	188.28	$19.49
C		4330	21.0	191.16	$26.36

LSD = 3.7 Bu/Ac

11. Floyd County Commercial N Rate on C-Sbn Rotation

This plot was located at the Floyd County Fairgrounds. The cooperator uses a corn/soybean rotation and the intent of this project was to demonstrate the economic response to reduced rates of N. A professional crop consultant also assists with this project. This was also the site of an ISU research project looking at the relationship between N rates and carbon sequestration. This project supplements classroom instruction in the Vo Ag Program at Charles City.

TRT A = 90# N Spring Applied as 28%
TRT B = 90# N Spring Applied as 28% + 60# N Sidedressed as NH3
TRT C = 90# N Spring Applied as 28% + 90# N Sidedressed as NH

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		1773	20.3	152.23	$00.00
B	16	4328	20.3	155.87	$21.70
C		5240	20.5	158.53	$29.20

LSD = 9.5 Bu/Ac

12. Howard County Commercial N Rate on C-Sbn Rotation

This plot was located at the Howard County Experimental Farm. The cooperator uses a corn/soybean rotation and the intent of this project was to demonstrate the economic response to reduced rates of N. This trial also included a base treatment + starter fertilizer treatment. This cooperator uses a 28% injector for sidedressing. This plot supplements classroom instruction in the Vo Ag Program at Riceville High School.

TRT A = 90# N Spring Applied as Urea
TRT B = 90# N Spring Applied as Urea + 11# N as 10-34-0 Starter
TRT C = 90# N Spring Applied as Urea + 60# N SD/Incorporated as 28%
TRT D = 90# N Spring Applied as Urea + 90# N SD/Incorporated as 28%

DEMONSTRATION RESULTS

TRT	LSNT	FSNT	Corn Moisture %	Bu/Ac	Added Fert.
A		58	22.3	135.65	$00.00
B		28	22.1	143.93	$3.08
C	14	1135	22.7	146.48	$25.55
D		1953	22.6	148.32	$35.15

LSD = 5.7 Bu/Ac

MANURE ANALYSIS RESULTS

An important aspect of manure management plans is to know the analysis of the manure being applied. The analysis varies with a number of factors which include species, age of the animal, storage and agitation. The following manure analysis was provided by the cooperator or determined by manure analysis tests conducted as part of the project.

Manure Application Equipment

COUNTY	TYPE	# NUTRIENT / 1000 GALLON		
		N	P	K
FLOYD	SWINE FINISHING	44	21	38
MITCHELL	SWINE FINISHING (SLURRY STORE)	34	38	21
FLOYD	SWINE FINISHING	50	52	43
BUTLER	MIXED LIVESTOCK (OUTSIDE CONCRETE PIT)	25	18	23
HOWARD	SWINE FINISHING	78	49	37
HOWARD	SWINE FINISHING	85	100	45
MITCHELL	SWINE FINISHING	78	83	52

LATE SPRING NITRATE TEST (LSNT) RESULTS

The Late Spring Nitrate Test (LSNT) was used to set sidedress rates for all projects. Average values from 4 replications are reported in the individual plot data. This table indicates the variation in readings across each project. The yields from each project and the Fall Stalk Nitrate Test Results (FSNT) can be used to confirm the reliability of the sidedress recommendations from the LSNT.

COUNTY	PROJECT#	N SOURCE	LSNT (PPM)			
			RPL1	RPL2	RPL3	RPL4
FLOYD	PREC.AG.	SPRING MANURE	AVERAGE OF 9 RPLS = 11			
		SPRING NH3	AVERAGE OF 9 RPLS = 25			
MITCHELL	1	FALL MANURE	15	12	14	18
FLOYD	2	FALL MANURE	7	8	7	7
BUTLER	4	FALL MANURE	13	19	9	11
BREMER	5	ALFALFA	9	8	8	8
FLOYD	11	90#N AS 28%	17	18	13	16
HOWARD	12	90#N AS UREA	12	15	15	14
HOWARD	3	FALL MANURE	18	11	17	10
		FALL MANURE	COMPOSITE SAMPLE = 15			
		SPRING MANURE	COMPOSITE SAMPLE = 38			
HOWARD	8	WINTER MANURE	30	41	38	37
	9	SPRING MANURE	39	23	28	25
BLACK HAWK	10	SPR.MANURE + 90#NH3	21	24	24	24
MITCHELL	6	FALL MANURE	16	20	16	23

COOPERATOR OBSERVATIONS

Project cooperators made the following observations:

a. On-farm results (Spokes) were generally consistent with research farm results (Hub).
b. Actual manure analysis data varied from common book values.
c. Actual N and P application rates exceeded planned amounts.
d. Optimal corn yields can be achieved with manure or alfalfa credits alone.

e. Reduced commercial N rates (50-60# less than the cooperators normal rate) produced optimal corn yields.
f. The LSNT results require interpretation based on application methods, materials, timing and weather conditions.
g. Differences in FSNT results were generally consistent with yield differences.

OUTREACH ACTIVITIES

Information from the project and cooperator sites were included in the educational efforts and outreach activities:

1. The Bigalk to Bohemia Water Project Field Tour in Howard County held June 14th with 20 local farmers in attendance.
2. The Annual Howard County Crop Tour, which included stops at 2 cooperator sites on July 12th , attracted 38 participants.
3. The Manure Analysis results and the LSNT data from the project were topics of discussion at the Special Tour for Ag Professionals held July 20th at the Northeast Research Farm near Nashua. 48 Ag Professionals participated.
4. The Manure Analysis results, the LSNT data and one cooperator site were included in the July 21st bus tour sponsored by the Tri-County Water Quality Project. 36 people were included on the tour hosted by the Charles City FFA.
5. A tabletop display on the first 4 years of the Precision Ag Project was developed and used at the 25th Anniversary Field Day at the Northeast Research Farm on June 26th. The booth was manned by Joyce Dolan, crop scout, and Virgil Schmitt, the Extension Crops Specialist from Tipton who was one of four crops specialists trained to teach Precision Ag. An estimated 450 - 500 people attended the field day.
6. The Precision Ag Project will be the cover story/featured article for the July issue of Wallaces Farmer. Bill Lotz, Joyce Dolan, Ken Pecinovsky and George Cummins provided input.
7. A cooperator meeting was held December 19th at the Northeast Research Farm to share individual project results and observations and to identify unanswered questions.
8. Report of findings from all demonstration sites will be published in different publications such as Tri-County Water Quality newsletter, Integrated Crop Management newsletter, and area print media. These results will also be included on the IFLM project website.
9. Project cooperators will be included in an ISU Documentation of Change study of all IFLM participants. The survey process will begin in late December.
10. Ag students at Riceville High School, Charles City High School and Hawkeye Community College were cooperators and took an active role in sampling, data collection and interpretation.
11. An expanded Hubs and Spokes Project involving N Rates X Tillage Systems has been funded for 2002. Fall field work has been completed at the Hub and with two on-farm cooperators. Interviews with candidates for the project coordinator position have been scheduled. Additional cooperators will be identified before spring. The project is expected to build on this year's success.