SCREC - 98/3
Cooperative Extension
Institute of Agriculture and Natural Resources

1997

WATER QUALITY

Mid-Nebraska Demonstration Project

Field Demonstrations of Best Management Practices to Protect Groundwater Quality

University of Nebraska Cooperative Extension
Natural Resources Conservation Service

Issued in furtherance of Cooperative Extension work,
Acts of May 8 and June 30, 1914, in cooperation with the
U.S. Department of Agriculture.
Kenneth R. Bolen, Director of Cooperative Extension,
University of Nebraska, Institute of Agriculture and Natural Resources.

Under the leadership of the Natural Resources Conservation Service and the University of Nebraska Cooperative Extension, the following agencies have provided financial and personnel assistance to make this project possible:

- Upper Big Blue Natural Resources District
- Tri-Basin Natural Resources District
- Little Blue Natural Resources District
- Lower Republican Natural Resources District
- Blue River Association of Groundwater Conservation Districts
- UNL Conservation and Survey Division
- USDA Agricultural Research Service
- USDA Farm Service Agency
- Nebraska Department of Environmental Quality

PROJECT PERSONNEL

Project Coordinators

Ed Barnes, Cooperative Extension
Mick Reynolds, Cooperative Extension
Buddy Steinshouer, Natural Resources Conservation Service

Project Communications Associate

Kim Peterson, Cooperative Extension

Project Secretary

Tammy Weatherly, Cooperative Extension

Project Leaders

Richard Ferguson, Cooperative Extension
Brian Benham, Cooperative Extension
Ken Noonan, Natural Resources Conservation Service

Project Office

South Central Research and Extension Center
P.O. Box 66, Clay Center, NE 68933
(402) 762-3535
(402) 762-4422 - fax

94-EWQD-1-9517

Project Committees:

Little Blue Natural Resources District Project Committee

Lower Republican Natural Resources District Project Committee

Tri-Basin Natural Resources District Project Committee

Upper Big Blue Natural Resources District Project Committee

Special Thanks to:

Dean Krull: Platte Valley Nitrogen and Irrigation Management Demonstration Project

Kelly Wertz: Management Systems Evaluation Area

Greg Craig: Little Blue Natural Resources District Project Committee

Ron Wunibald: Lower Republican Natural Resources District Project Committee

John Thorburn: Tri-Basin Natural Resources District Project Committee

Rod De Buhr: Upper Big Blue Natural Resources District Project Committee

Ray Glaser: Senninger Irrigation Inc.

Kevin Breece: Holdrege Natural Resources Conservation Service

Starr Farms: Hastings, Nebraska

Daniel Benes: Nebraska Wheat Growers Association

Doug Walsh: Hybritech Seed International

Dave Wysong: UNL Plant Pathologist

Randy Brown: Kansas State University Crops and Soils Extension Specialist

Doug Jose: UNL Extension Farm Management Specialist

Roger Hammons: Nebraska Crop Improvement Association

Roger Selley: UNL Extension Farm Management Specialist

John Watkins: UNL Plant Pathologist

Scott DeWald: UNL Extension Forester

Steve Moran: Rainwater Basin Joint Venture

Ace Irrigation, Incorporated: Kearney, Nebraska

Keith Ostermeier: Central Nebraska Public Power and Irrigation District

John Anderson: UNL Extension Horticulturist Aide

Glen Slater: UNL Ag Research Technician

Table of Contents

Introduction to Project 4
- Project Description 4
- Project Structure 5
- Best Management Practices 6
- Reference Aids 7

Summary of Results - 1997 9

Project Map 11

Survey Results from 1997 12

Demonstration Plot Data Summaries 14

Individual Plot Data, Alphabetically

Bartlett, Dennis, Clay County ____ 18
Casper, Dean, Kearney County ____ 32
Choquette, Edwin, Franklin County ____ 22
Damrow, Marty, Phelps County ____ 38
Doremus, Dave, York County (corn) ____ 50
Doremus, Dave, York County (soybeans) ____ 52
Eller, Dick, Polk County ____ 44
Engelhardt, Meredith, Webster County ____ 48
Greer, John, Nuckolls County ____ 36
Gustafson, Charles, Hamilton County ____ 58
Hanson, Bill, Phelps County ____ 40
Hinrichs, Joel, Hamilton County ____ 26
Hollertz, Al, Harlan County ____ 28
Johnson, Harold, Kearney County ____ 34
Kaufman, Ed, Adams County ____ 16
Naber, Larry, Seward County ____ 58
Ortgiesen, Butch, Franklin County ____ 24
Richards, Blaine, Fillmore County ____ 58
Schardt, Nathan, Clay County ____ 20
Schluntz, D.M., Inc., Harlan County ____ 30
Smith, Boyd, York County ____ 54
Springer, Darrel, Clay County ____ 19
Stahr, Jerry, York County ____ 56
Voss, Leroy, Thayer County ____ 46
Weber, Tom, Saline County ____ 45
Wiebe, John, Phelps County ____ 42

Individual Plot Data, by County

Adams County	Ed Kaufman	16
Clay County	Dennis Bartlett	18
	Darrel Springer	19
	Nathan Schardt	20
Fillmore County	Blaine Richards	58
Franklin County	Edwin Choquette	22
	Butch Ortgiesen	24
Hamilton County	Joel Hinrichs	26
	Charles Gustafson	58
Harlan County	Al Hollertz	28
	D.M. Schluntz, Inc.	30
Kearney County	Dean Casper	32
	Harold Johnson	34
Nuckolls County	John Greer	36
Phelps County	Marty Damrow	38
	Bill Hanson	40
	John Wiebe	42
Polk County	Dick Eller	44
Saline County	Tom Weber	45
Seward County	Larry Naber	58
Thayer County	Leroy Voss	46
Webster County	Meredith Engelhardt	48
York County	Dave Doremus (corn)	50
	Dave Doremus (soybeans)	52
	Boyd Smith	54
	Jerry Stahr	56

Who to Contact for Information 60

Mid-Nebraska Water Quality Demonstration Project

The Mid-Nebraska Water Quality Demonstration Project (MNWQDP) began in 1990 under the authorization of USDA funds from the 1990 Water Quality Initiative. The project has four objectives:

- Foster adoption of farm management practices that will reduce nutrient and pesticide loading in the soil
- Promote producer adoption of irrigation management practices that provide adequate moisture to grow crops while reducing leaching of agricultural chemicals to groundwater
- Demonstrate that producers can achieve suitable economic returns while utilizing management practices that reduce inputs and chemical leaching to groundwater
- Effectively address critical water quality issues in Nebraska by integrating resources and expertise from agribusinesses, and government and educational institutions.

Project Description

The 17-county area encompassed by the MNWQDP contains over four million acres of cultivated land that has been irrigated for more than 60 years. Continuous corn production is the most common agricultural practice on most of the irrigated acres. Investments made in irrigation capabilities and USDA farm program provisions strongly influence cropping decisions in this area.

The production area includes some of the most productive corn producing acres in Nebraska. While the area accounts for less than 22 percent of the cultivated acres in the state, it produces 35 percent of the total corn acres and it accounts for over 30 percent of the nitrogen fertilizer farmers use.

This production history has left many areas of south central Nebraska with a high

nitrate concentration in the vadose zone (the area between the root zone and the water table). As nitrate reaches the groundwater, community and private wells may become contaminated.

A critical widespread nitrate problem in the groundwater underlying the project area does not currently exist, but the intensive irrigated agricultural practices in south central Nebraska create the potential for water quality problems. As the project began in 1990, evidence from local, state, and federal agency studies showed that groundwater levels were on the rise and a nitrate load does exist in the vadose zone. Most of the nitrate is at depths that deep-rooted crops cannot reach, which lead it to eventually leach into the groundwater.

Project Structure

The project area includes four of Nebraska's natural resources districts (NRDs), the Little Blue, the Lower Republican, the Tri-Basin, and the Upper Big Blue. In 1995, project personnel developed a stronger working relationship with NRD personnel to match project goals with best management practices emphasized in each NRD.

Best Management Practices

The Mid-Nebraska Project team encourages producers to employ 19 best management practices (BMPs) to slow nutrient and pesticide movement from the crop root zone to groundwater. The project focuses on three areas:

Nitrogen BMPs

Nine practices promoted through the Mid-Nebraska Project help reduce nitrate loss to groundwater.

1. **Select a realistic expected yield**
2. **Credit irrigation water nitrate**
3. **Credit legume nitrate**
4. **Credit soil nitrate**
5. **Credit manure, sludge or compost fertilizer nitrate**
6. **Efficiently apply manures, sludges, and compost**
7. **Use nitrification inhibitors**
8. **Split-apply fertilizer**
9. **Plant a fall cover crop**

Irrigation BMPs

The project team encourages six practices to keep irrigation systems operating efficiently with no more water than necessary.

1. **Level land**
2. **Use reuse pits**
3. **Use a water flow meter to measure the amount of water applied**
4. **Schedule irrigation based on crop water use**
5. **Use surge irrigation**
6. **Rotate crops**

Pesticide BMPs

Pesticides are not a major problem in groundwater in south central Nebraska. Atrazine is the only pesticide occasionally found at low levels in wells. These four practices prevent contamination and tighten economic management.

1. **Rotate crops**
2. **Properly mix chemicals**
3. **Practice integrated pest management (IPM)**
4. **Effectively apply chemicals**

Reference Aids

Several publications and software resources are available through local Cooperative Extension Offices to help producers implement the BMPs recommended under the MNWQDP.

Nitrogen Management

Neb Guides

G74-174A	*Fertilizer suggestions for corn (rev. July 1995)*
G77-361	*Using starter fertilizer for corn, grain sorghum and soybeans*
G93-1171A	*Using a chlorophyll meter to improve N management*
G94-1178A	*Fertilizer nitrogen best management practices*
G91-1000	*Guidelines for soil sampling*
G97-1323A	*Best management practices to reduce atrazine runoff from corn fields in south central Nebraska*

Other Extension Publications/Software

SOIL TEST,	*Version 4.93: fertilizer recommendation software*
EC94-737D	*Calibrating anhydrous ammonia applicators*
EC93-126D	*Procedures for field demonstrations of nitrogen management practices*
EC89-117	*Fertilizing crops with animal manure*
NF97-323	*BMPs to reduce atrazine runoff from irrigated corn in south central Nebraska*

Irrigation Management

Neb Guides and NebFacts

NF93-118	*Fine tuning furrow irrigation systems*
NF93-140	*Water management for irrigation in Nebraska*
NF94-176	*Surge irrigation*
NF94-177	*Nebraska surge irrigation trials*
NF94-178	*Surge irrigation field layouts*
NF94-179	*Surge irrigation management*
NF96-290	*Irrigation management practices in Nebraska*
G78-392	*Selecting and using irrigation propeller meters*
G78-393	*Water measurement calculations*
G82-602-A	*Predicting the last irrigation for corn, grain sorghum, and soybeans*
G85-753	*Irrigation scheduling using crop water use data*
G91-1021	*Managing furrow irrigation systems*

G93-1157-A	*Testing irrigation water*
G96-1299-A	*Agricultural management practices to reduce atrazine in surface water*
G84-690	*Estimating soil moisture by appearance and feel*

Other Extension Publications/Software

CP13	*Furrow Irrigation Toolkit (software evaluating and fine-tuning furrow irrigation systems*
EC91-735	*The impact of nitrogen and irrigation management and vadose zone conditions on groundwater contamination by nitrate-nitrogen*
EC89-723	*Irrigation scheduling using soil moisture blocks in silty soils*
EC97-782A	*Water quality criteria for irrigation*

Pest Management

Neb Guides

G75-217	*European corn borer*
G77-382	*Right crop stage for herbicide use*
G79-471	*Choice of corn hybrids*
G81-613	*Ear attacking insects of corn*
G86-774	*Western corn rootworm soil insecticide treatment based on beetle numbers*
G87-839	*Corn rootworm control*
G89-904	*Corn insects - quick reference*
G91-1031	*How to hire a crop consultant*
G92-1108-A	*Evaluating corn rootworm soil insecticide performance*
G93-1182-A	*Best management practices for agricultural pesticides to protect water resources*

Other Extension Publications/Software

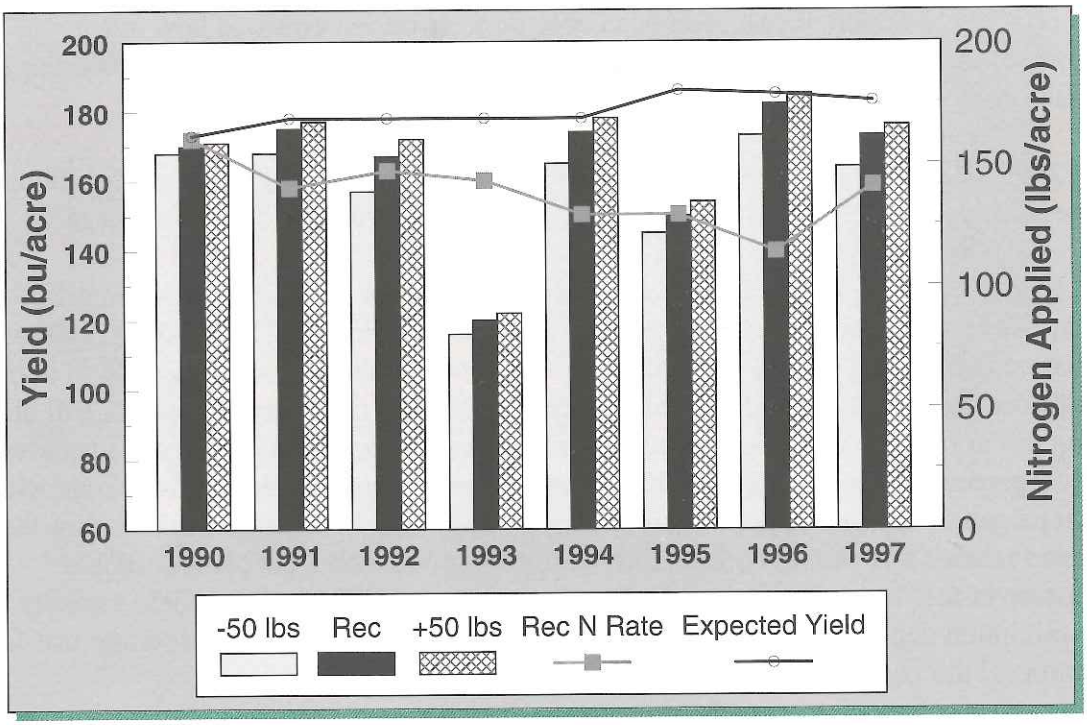
EC91-130	*Herbicide use in Nebraska—guide*
EC92-1509	*Insect management guide for Nebraska corn and sorghum*
EC92-1511	*Insect management guide for Nebraska alfalfa, soybeans, wheat, range and pasture*
CP 5	*European corn borer software*
CP 11	*WeedSOFT® -- weed control software developed by University of Nebraska weed scientists*

Summary of Results - 1997

As the Mid-Nebraska project begins to wind down, 1997 turned out to be a fairly average year. Parts of the eastern project area received plenty of rainfall in the middle and latter portions of the summer, and crops required very little supplemental irrigation. Some other areas of the project had a fairly dry year. Overall, yields were above the longterm average for the eight-year life of this project.

Nitrogen Management

Since 1990, we have compared University of Nebraska recommended nitrogen rates against higher and lower rates replicated on farm demonstrations. Results of the 1997 plots continue to follow the trends established over the prior seven years. The average yield of 173 bushels per acre on the recommended rate strips was less than three bushels below the yield of 176 bushels per acre achieved by applying an additional 50 pounds per acre of nitrogen fertilizer. These results should continue to bring into question the practice of over-fertilization, both economically and environmentally.



The above graph shows the results of the three different treatments over the life of the Mid-Nebraska project. The effect of weather and strict nitrogen management are clearly

visible. The eight-year yield average for the recommended rate strips is 164 bushels per acre, compared to 167 bushels per acre for the strip which received an additonal 50 pounds per acre of N. Strips which were deliberately under-fertilized by 50 pounds per acre yielded an average of 157 bushels per acre over those eight years. Expected yield over that same period was 180 bushels per acre, while the average recommended nitrogen application rate was only 138 pounds per acre. The University of Nebraska approach of using organic matter and crediting for soil and water nitrate, manure, and legumes continues to show that the risk from fine-tuning nitrogen management is very small.

Weather caused significant yield losses in 1993 and again in 1995, due to wind damage and early frost, respectively. This continues to be the single largest variable that production agriculture must face year in and year out.

Irrigation Management

Effective irrigation management can only occur if we are aware of how much supplemental water we are applying. This means using either an in-line flow meter or an ultrasonic flow measuring device to verify flow rates.

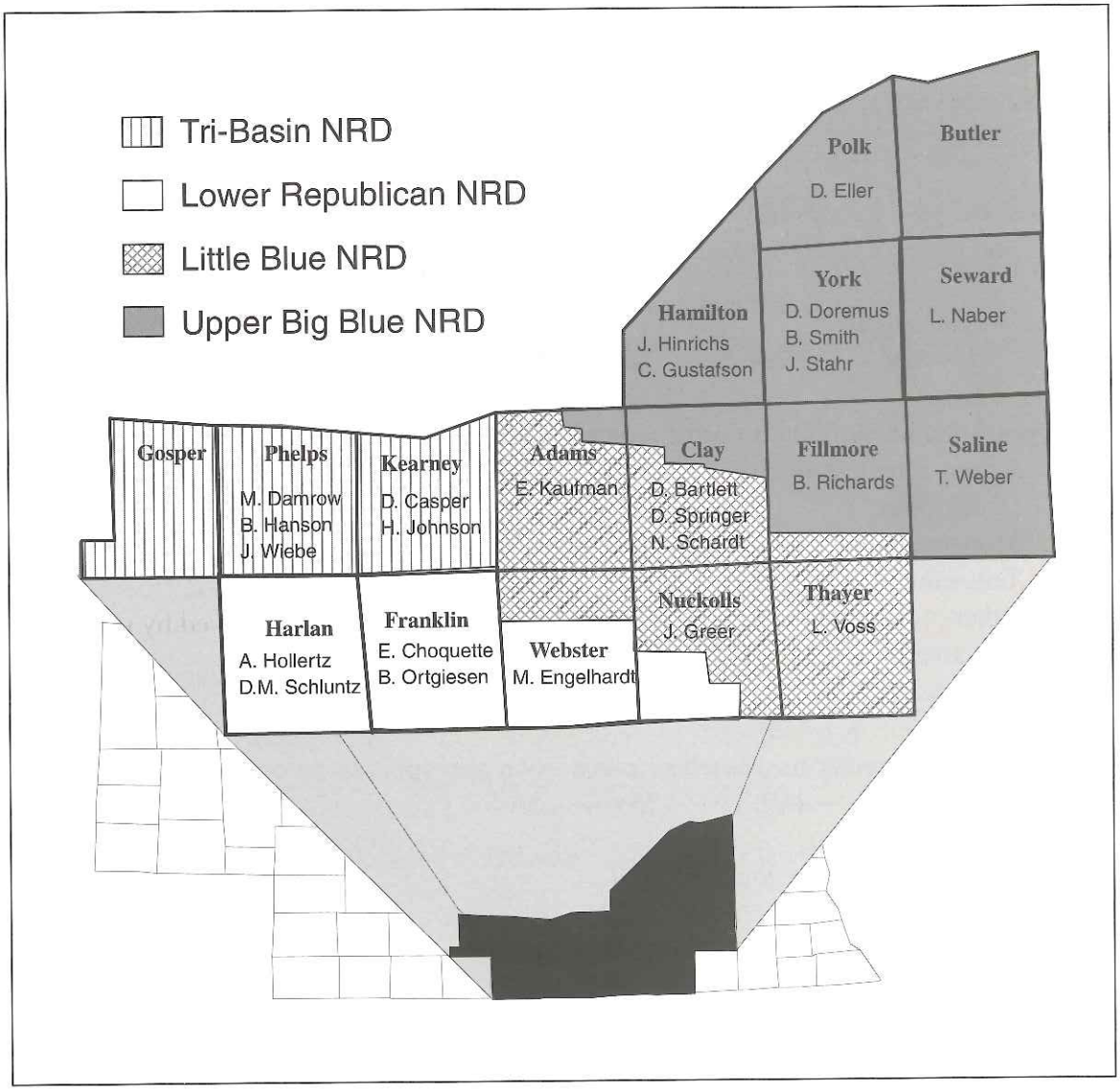
The goal of irrigation scheduling is to utilize as much soil water as possible without excessive crop stress, giving the maximum opportunity to hold and use rain water.

Individual site reports show the water status of the root zone. The irrigation graph from Bill Hanson's site (page 41) is a good example of scheduling for a 50 percent soil moisture deficit. Bill's first irrigation occurred as soon as the crop was layed by to allow for furrow irrigation. With little rainfall occurring early in the irrigation season, Bill did a good job in scheduling all the subsequent irrigations. His applications were made close to the 50 percent depletion level and his irrigation amounts nearly filled the root zone with each irrigation. By managing his soil moisture balance, Bill was able to fully utilize the limited rainfall that occurred during the season. By maintaining his plant available moisture in the "management zone", the range of soil moisture between field capacity and the minimum depletion level, Bill met his crop water needs, conserved his water use, and minimized the potential for nutrient leaching below the rootzone.

WATER QUALITY

Mid-Nebraska Demonstration Project

The project staff would like to thank the following cooperators for providing demonstration sites in 1997:



Survey Results from 1997

The Mid-Nebraska Demonstration Project was involved with 14 workshops and field days during 1997. Attendance at the meetings totaled approximately 700 producers, agribusiness, and agency people. As in the past, these meetings provided an opportunity to educate and demonstrate a wide array of best management practices and address current agronomic concerns. Topics included: ultrasonic water meter demonstrations; furrow flow estimates; surge irrigation; gray leaf spot management; filter strip design; corn rootworm resistance management; biotechnology of genetically engineered crops; tailwater recovery systems; nutrient management; and a summary of project demonstration results.

As in the past, a short survey was given to the meeting attendees. An example of the survey, and some of the results, are given below:

1. Do you irrigate?
   Yes —— 82% No —— 9%

If yes, what method(s) do you or your consultant use to schedule your irrigation?

Appearance and feel	68%
Check book	11%
Moisture blocks	10%
Tensiometer	5%
Other	10%
Don't schedule	3%
Don't know	3%

2. Do you currently measure how much water you apply?
   Yes —— 44% No —— 54%

If yes, what method do you use?

Flowmeter	60%
Canal schedule	8%
Pivot calculation	8%
Raingauge/pivot	8%
Estimate	7%
Consultant	2%

3. Do you sample for residual soil nitrate?
   Yes —— 67% No —— 18%

To what depth do you sample?
8" —— 9% 12" —— 14% 18" —— 11% 24" —— 22% 36" —— 42%

4. What areas of site specific management are currently used?

Yield monitoring	21%
Yield mapping	8%
Variable rate seeding	9%
Variable rate fertilizer application	17%
Grid soil sampling	9%
Variable rate herbicide application	6%
Remote sensing	3%
Other	1%
Do not currently use	37%

An urban tour was conducted in Hastings, Nebraska. This is a continuing effort with the Little Blue NRD to serve and educate both rural and urban audiences concerning the protection of water quality. Below are some of the results from the survey conducted at the tour.

1. Do you use a lawn service company?
   Yes —— 10% No —— 90%

2. How many pounds of nitrogen do you apply to your lawn per year?
   3 pounds —— 10% Don't know —— 86%

3. How much water do you apply when you water your lawn?
   ½ in —— 5% 1 in —— 5% 1 ¼ in —— 5% 1 ½ in —— 10%

   2 in —— 19% Don't know —— 52%

4. Do you utilize the Cooperative Extension Service for lawn and landscape care advice in recommendations?
   Yes —— 86% No —— 10%

5. Have you ever utilized any services from the Little Blue NRD?
   Yes —— 76% No —— 24%

Table 1. Summary of practices and results from 1997 demonstration sites with nitrogen strips.

Site	-- Used in N rate --		-- Measured during season --				Nitrogen Rate	Yield
	Expected Yield	Residual Soil NO_3-N	Gross Rainfall	Gross Irrigation	Water NO_3-N Content	Gross Water N Applied		
	bu/acre	lb/acre-3 ft	inches	inches/acre	ppm	lb/acre	lb/acre	bu/acre
Bartlett, Dennis (p. 18)	175	80	NA	NA	NA	NA	75 125 R 175	137.8 a 145.3 a 143.2 a
Casper, Dean (p. 32)	175	45	6.0	13.2	< 1.0	0.0	155 R 205 255	160.7 a 167.6 a 160.4 a
Choquette, Edwin (p. 22)	200	37	11.4	21.6	6.2	30.1	120 170 R 220	181.4 a 182.8 a 184.4 a
Eller, Dick (p. 44)	180	50	NA	NA	NA	NA	95 145 R 195	164.8 b 173.8 a 174.6 a
Greer, John (p. 36)	170	63	NA	NA	NA	NA	70 120 R 170	150.6 c 167.1 b 175.5 a
Hanson, Bill (p. 40)	180	57	7.7	16.7	2.0	7.5	100 150 R 200	148.6 b 165.4 a 166.2 a
Hollertz, Al (p. 28)	175	48	6.7	NA	NA	NA	95 145 R 195	158.0 a 156.0 a 155.0 a
Smith, Boyd (p. 54)	200	74	14.3	NA	9.2	NA	95 145 R 195	193.9 a 189.7 a 194.9 a
Stahr, Jerry (p. 56)	185	51	15.2	1.8	7.0	2.9	80 130 R 180	187.5 b 195.7 a 199.2 a
Weber, Tom (p. 45)	180	58	NA	NA	NA	NA	90 140 R 190	152.3 b 182.0 a 187.4 a
Wiebe, John (p. 42)	190	58	NA	NA	NA	NA	150 R 120 R * 170 *	153.7 a 155.8 a 155.9 a

*in addition to the applied nitrogen there was a 30-pound N credit from a manure application in 1996.

[1]Yields with the same letter are not significantly different at the 5% level of significance using Duncan's Multiple Range Test

R=Recommended NA=Not Available

Individual Demonstration Plot Data Summaries

Ed Kaufman, Adams County

Dennis Bartlett, Clay County

Darrel Springer, Clay County

Nathan Schardt, Clay County

Blaine Richards, Fillmore County

Edwin Choquette, Franklin County

Butch Ortgiesen, Franklin County

Charles Gustafson, Hamilton County

Joel Hinrichs, Hamilton County

Al Hollertz, Harlan County

D. M. Schluntz, Inc., Harlan County

Dean Casper, Kearney County

Harold Johnson, Kearney County

John Greer, Nuckolls County

Marty Damrow, Phelps County

Bill Hanson, Phelps County

John Wiebe, Phelps County

Dick Eller, Polk County

Tom Weber, Saline County

Larry Naber, Seward County

Leroy Voss, Thayer County

Meredith Engelhardt, Webster County

Dave Doremus, York County

Boyd Smith, York County

Jerry Stahr, York County

Ed Kaufman, Adams County

- Location: 6 miles south of Roseland, ½ mile east
- Soil Type: Holder silt loam with a 1-5% slope
- Preceding Crop: Soybeans
- Preplant Soil Prep: No-till
- Planting Date: October 17, 1996
- N Application Type: 80 lbs/acre N with 20 lbs/acre phosphorus preplant
- Harvest Date: July 16, 1997

SOIL FERTILITY			
pH	6.8	OM	1.4%
P	16 ppm	K	416 ppm
		Zn	4.0 ppm

SPECIAL PROJECT -- hybrid and variety wheat plot

In an effort to promote crop rotations, irrigation conservation, and economic considerations the Mid-Nebraska project involved two cooperators in conducting replicated wheat plots. The first plot was a dryland site with a population density study (p. 48). The second site was an irrigated wheat plot. The results of the irrigated plot are reported below.

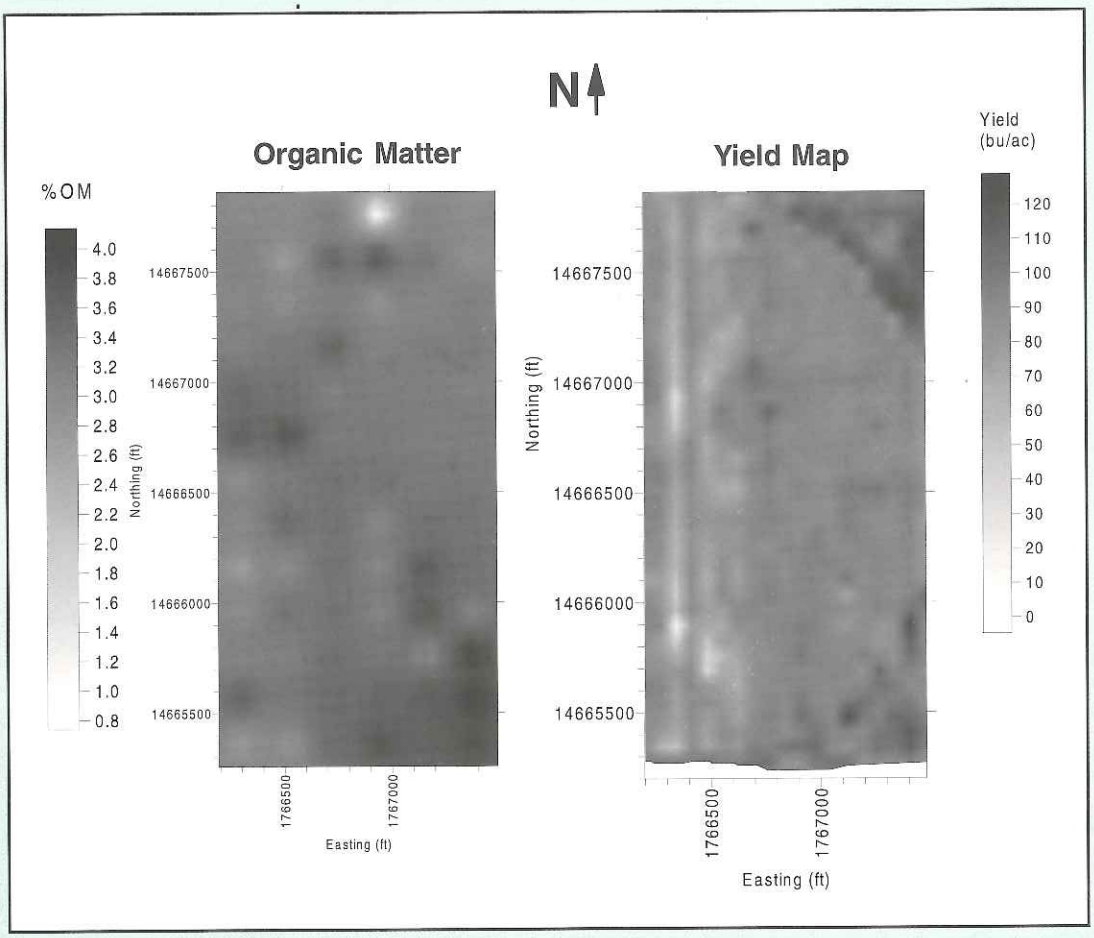
Ed Kaufman conducted this demonstration on a pivot-irrigated wheat field. One of the objectives of the demonstration was to compare a hybrid wheat with variety wheat. Three different wheat entries were randomly replicated. There were two varieties, Karl 92 and 2137. The third entry was a hybrid, Agri-Pro 7510. Karl 92 was planted outside of the plot area. No irrigation was applied to the field because over 20 inches of rainfall was received during the crop season. The field received 80 pounds per acre of actual N and 20 pounds per acre of phosphorus, preplant. The field was planted on October 14, 1996, and sprayed with a solution of Ally with 15 pounds per acre of N and 1 pint per acre of sulfur in the spring of 1997. A grid sampling of the field was done just prior to planting to determine organic matter, phosphorus, and pH levels.

This information will be used in future years to help with fertility decisions and interpreting yield results. At harvest, a yield monitor was used to map the yields from the field. The table shows the results of the plot yields.

Wheat Variety	Percent Moisture	Test Weight	Yield bu/acre
Karl 92	10.5	60	52.30
AP 7510	9.9	61	65.10
2137	11.0	60	62.73

There was no significant yield difference between AP 7510 and 2137 but both yielded significantly better than Karl 92*.

* Based on a 5% level of significance using Duncan's Multiple Range Test.



The grid sample organic matter content (left) as compared to the yields on the same field (right). The plot area can be seen in strips on the left side of the yield map. For 1997 there does not appear to be any direct correlation between percent of organic matter and yield.

Dennis Bartlett, Clay County

- Location: 3 miles east, 1 mile north of Harvard
- Soil Type: Hastings silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Disked once
- Planting Date: May 1, 1997
- Hybrid: Mycogen 2815
- Starter: None
- N Application Type: 160 lbs/acre Anhydrous Ammonia preplant
- Herbicide: 1.5 qts/acre Harness Extra, banded at planting
- Insecticide: 8 ozs/acre Pounce on July 9, 1997
- Harvest Date: November 10, 1997

SOIL FERTILITY			
pH	6.0	OM	2.4%
P	9 ppm	K	360 ppm
		Zn	1.0 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	1-Year Average Avg N Res	Avg N Applied	Avg Yield
	-50				75	138		75	138
1997	Rec		80	175	125	145	80	125	145
	+50				175	143		175	143

Darrel Springer, Clay County

- Location: 1 mile west, 2 miles north of Edgar
- Soil Type: Hastings silt loam with a 0-1% slope
- Preceding Crop: Soybeans
- Preplant Soil Prep: NA
- Planting Date: April 21, 1997
- Hybrid: Northrup King 7639 Bt
- Starter: 5 gal/acre of 10-34-0
- N Application Type: 180 lbs/acre Anhydrous Ammonia preplant; 30 lbs/acre 28-0-0 on June 22, 1997
- Herbicide: 1 qt/acre Lasso, banded at planting; 1 qt/acre Marksman, broadcast May 5, 1997
- Insecticide: 1.5 lbs/acre Fortress at planting
- Harvest Date: October 23, 1997

SOIL FERTILITY			
pH	6.1	OM	2.7%
P	30 ppm	K	501 ppm
		Zn	1.2 ppm

Nathan Schardt, Clay County

- Location: 4 miles south of Ong
- Soil Type: Hord silt loam with a 0-3% slope

Irrigation Management

Nathan was interested in learning to schedule his irrigations by estimating soil water using the 'appearance and feel' method. Determining the soil water content is one of the most important management tools that an irrigator has. With this knowledge, the irrigator can determine how much water to apply and when the application should be made. It also shows where that water is located in the profile.

The first step in scheduling by the 'appearance and feel' method is to determine the available water capacity of the soil. If more than one soil type is present, an average can be obtained or the predominate soil type can be used. Information on the available water capacity of your soils can be found in the county soil survey, which can be obtained through the local Natural Resources Conservation Service (NRCS) office.

Once the available water capacity is determined, the irrigator can probe the soil and evaluate the soil water in the active root zone at one-foot intervals. A useful guide to assist in the determination is Neb-Guide G84-690 *Estimating Soil Moisture by Appearance and Feel.* When the irrigator has the necessary information, a simple form such as the one to the right can be used in determining when and how much water to apply to a field.

SOIL WATER BALANCE

DATE	
FIELD / LOCATION	
CROP STAGE	
ROOT DEPTH *(Table 1)*	
E.T. *(Table 2)*	

NOTES:

ROOT DEPTH	REMAINING SOIL WATER		AVAILABLE WATER CAPACITY *(Table 3)*		CURRENT AVAILABLE WATER
1 FOOT	%	×	inches	=	inches
2 FOOT	%	×	inches	=	inches
3 FOOT	%	×	inches	=	inches
4 FOOT*	%	×	inches	=	inches
			inches		inches

* *Use only on last irrigation*

(A) (B)

MINIMUM ALLOWABLE WATER	WATER AVAILABLE FOR CROP USE	ESTIMATED DAYS UNTIL IRRIGATION REQUIRED
inches (A ÷ 2)	inches (B-C)	DAYS (D ÷ E.T.)
(C)	(D)	

IRRIGATION AMOUNT

Net irrigation required to refill active root zone today:

AVAILABLE WATER CAPACITY		CURRENT AVAILABLE WATER		ANY RAINFALL ALLOWANCE		NET IRRIGATION REQUIRED
inches (A)	-	inches (B)	-	inches	=	inches (E)

Net irrigation required to refill active root zone if remaining soil water reaches 50%:

AVAILABLE WATER CAPACITY		MINIMUM ALLOWABLE WATER		ANY RAINFALL ALLOWANCE		NET IRRIGATION REQUIRED
inches (A)	-	inches (C)	-	inches	=	inches (E)

Gross irrigation required

NET IRRIGATION REQUIRED		IRRIGATION SYSTEM EFFICIENCY *(TABLE 4)*		GROSS IRRIGATION REQUIRED
inches (E)	÷	decimal	=	inches

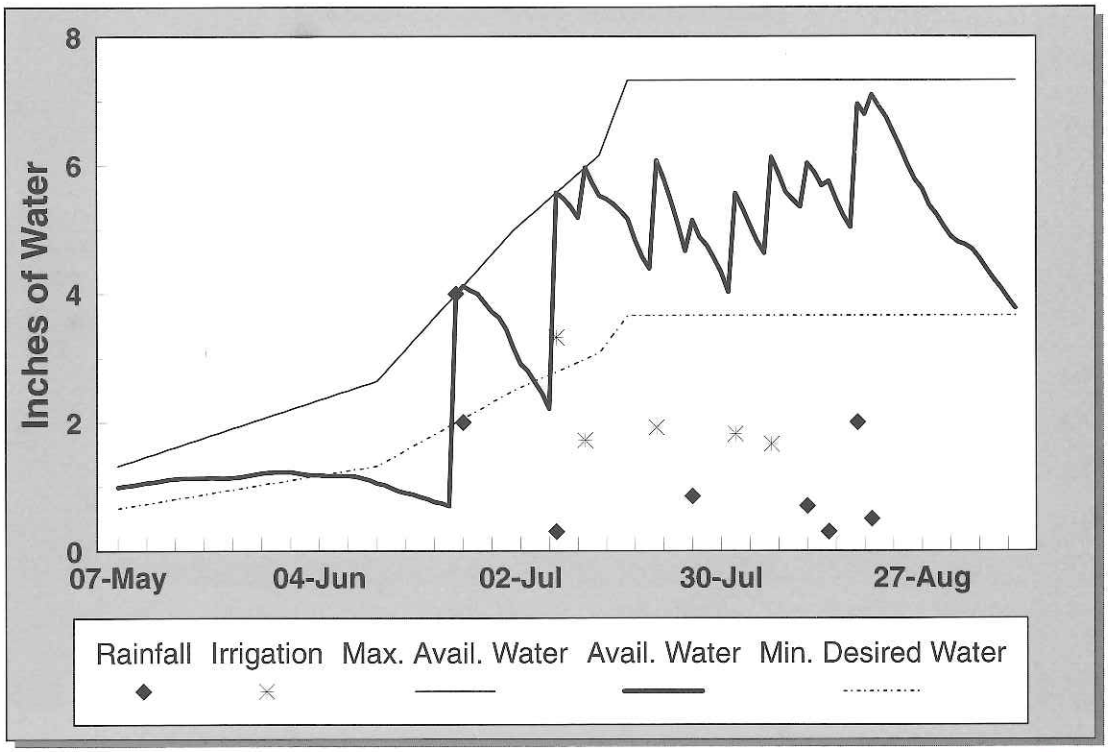
Form used to schedule irrigations on Nathan's field.

Irrigation scheduling is the process of applying the right amount of water at the right time. This scheduling sheet provides the irrigator or crop consultant an easy way to estimate the timing and amount of the next irrigation event. Information needed to use the worksheet is: current soil-water status, this can be determined using the 'appearance and feel' method or gypsum blocks; and estimated crop water-use that is available from a number of sources. The timing of the next irrigation event is estimated using the upper portion *(Soil Water Balance)* of the worksheet.

The lower portion *(Irrigation Amount)* is used to calculate the depth of water to be applied. Two options are available. The first assumes that the irrigation will begin immediately and simply refill the active root zone, similar to how a center pivot system might be managed. The second assumes that irrigation will be delayed until the active root zone reaches the maximum allowable deficit (MAD) of 50%. After computing the net irrigation requirement, the necessary gross application is calculated using the irrigation system efficiency.

The graph below represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.

Nathan did a good job of timing small application amounts and utilizing rainfall that occurred. By doing this he was able to keep the 'available water' within the irrigation management zone (area between the upper and lower line). As a result, Nathan conserved water and limited the potential for nutrient leaching while still meeting the crop's water needs.



Edwin Choquette, Franklin County

- Location: 2 miles east, 4 miles south of Upland corner on Highway 4, east side of road
- Soil Type: Holdrege silt loam with a 0-3% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Chopped stalks
- Planting Date: May 5, 1997
- Hybrid: Pioneer 3225
- N Application Type: 11-0-0 broadcast on May 8, 1997
- Herbicide: 2.4 qts/acre Bicep II, broadcast on May 8, 1997
- Insecticide: 8 ozs/1000 ft row of Force, T-banded at planting; 2 pts/acre dimethalate aerially applied August 4, 1997
- Harvest Date: October 10, 1997

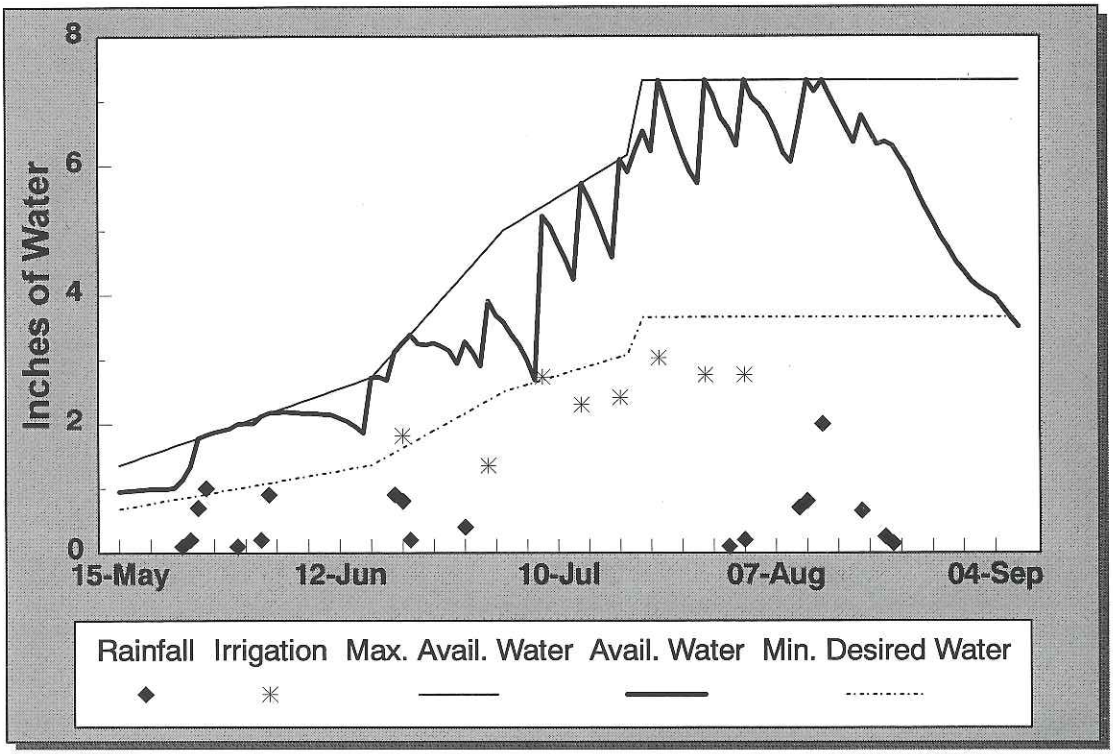
SOIL FERTILITY			
pH	7.0	OM	2.4%
P	34 ppm	K	376 ppm
		Zn	2.4 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	3-Year Average Avg N Res	Avg N Applied	Avg Yield
	-50				120	181		73	190
1997	Rec		37	200	170	183	46	123	183
	+50				220	184		173	190

Irrigation Management

The graph represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.



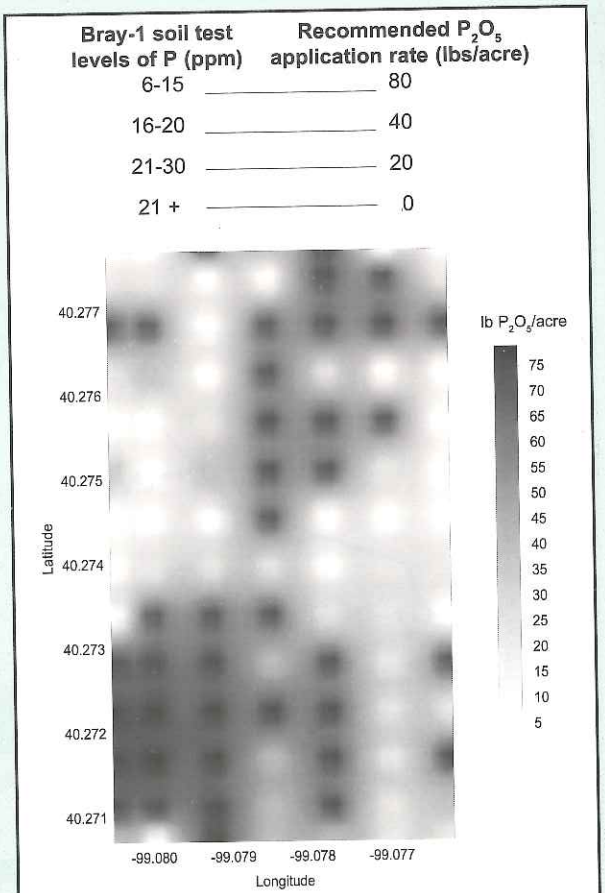
Butch Ortgiesen, Franklin County

- Location: 1 mile south, 1½ miles west of the Hildreth turnoff on Highway 4
- Soil Type: Holdrege silt loam with a 0-3% slope

SPECIAL PROJECT -- site-specific applications and limited irrigation

Butch Ortgiesen demonstrated a crop rotation on a field with a low-pressure pivot that pumps 350 gallons per minute. In the past, Butch rotated the four quadrants in the pivot, so two were planted to corn, one to beans, and one to wheat. For 1997 the quadrant of wheat was torn up due to excessive winter-kill and economic considerations. The rotation then shifted to half the pivot in beans and the other half in corn.

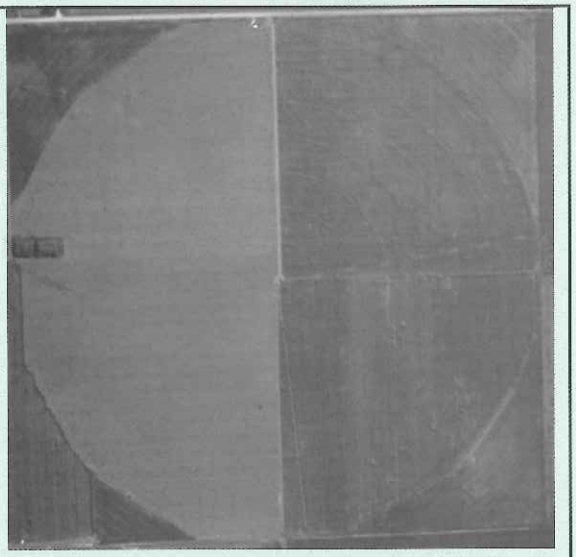
The 129-acre field received only 7.5 inches of rainfall during the crop season. With the help of a RAMS (Reinke Automated Management System), Butch was able to apply 12.4 inches per acre to effectively meet the water needs of the crop. The corn crop received a sum total of 19.9 inches per acre of water. The use of site-specific technologies are also being employed at this site in order to assist in the management decision process in the continuing evolution of the crop rotation plan. These technologies include variable rate fertilizer application, yield



Variable rate map for phosphorus application.

monitoring and mapping, and remote sensing.

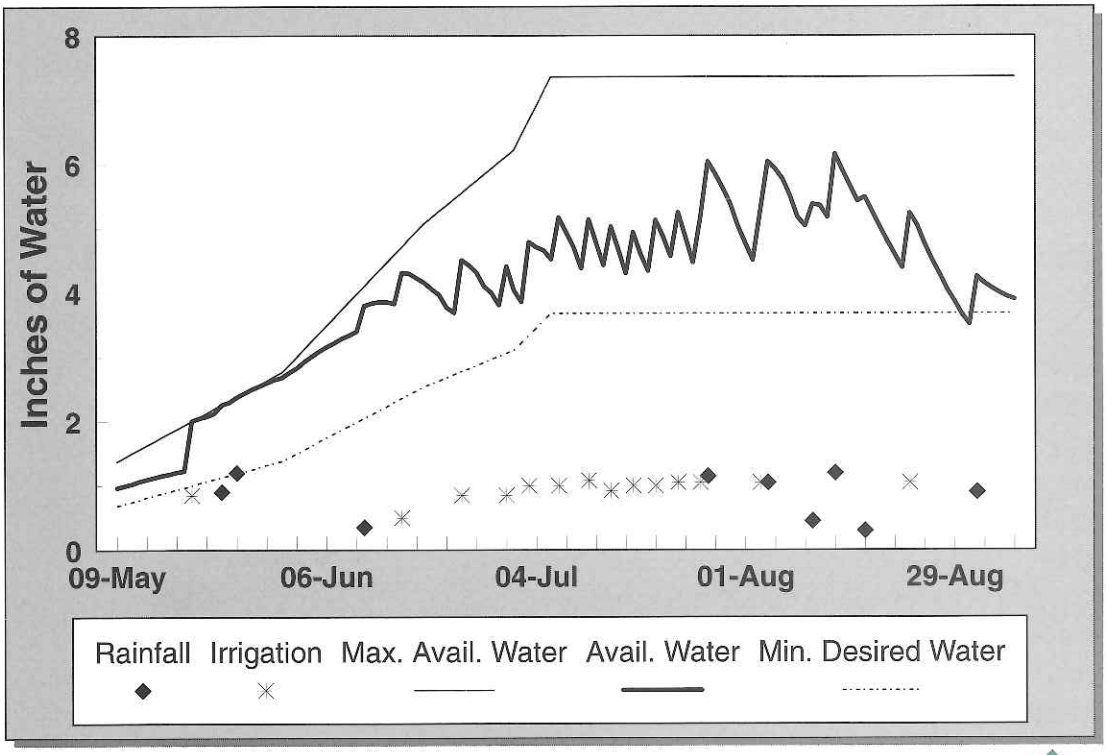
This site continues to offer a good opportunity to demonstrate the advantages of crop rotation, irrigation management, fertilizer management, and integrated pest management. Butch will continue learning to fine-tune this cropping system to fully utilize management techniques that limit crop inputs while efficiently using available resources.



Aerial photo showing beans on the left half and corn on the right half.

Irrigation Management

The graph represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.



Joel Hinrichs, Hamilton County

- Location: 4 miles north, 1 mile east of Giltner
- Soil Type: Crete silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: NA
- Planting Date: May 5, 1997
- Herbicide: Lasso
  Bicep
- Insecticide: Counter
- Harvest Date: October 17, 1997

SPECIAL PROJECT -- soil additive application

Joel had irrigation analysis on his field and he tested a product called 'Plus 2'. This product, a mixture of zeolite and polyacrylamide, is promoted as a soil additive that retards movement of water through the root zone. When used in combination with surface applied polyacrylamide, it is said to increase infiltration rate, reduce soil and pesticide runoff, hold water in the root zone and reduce irrigation requirements. University research on this product has been under arid conditions and on soils quite different from central Nebraska.

Joel applied 'Plus2' at the recommended rate of 20 pounds per acre. There were three replications of this treatment, applied through standard insecticide boxes Joel uses to apply Dipel at hilling. This method required diversion of the material toward inter-row spaces. Even distribution was not attained using this method, as the product bridged and did not flow very well. The product cost was $34 per acre and is said to last five to seven years.

Joel also tested the effect of leaving the root zone depleted versus closer to field capacity at maturity. He did this by leaving some rows unwatered when making his final application of water. Abundant rain in September negated the treatments and yields averaged 147 bushels per acre on the irrigated versus 146.4 bushels per acre without last irrigation.

		Yield (bu/acre)	Soil Moisture Calculations -- Oven-Dried (October 21, 1997)			
			2" - 8" Depth		14" - 20" Depth	
			100' from pipe	400' from pipe	100' from pipe	400' from pipe
			--- Percent Remaining Moisture ---			
Rep 1	+2	145.7	No Data Collected			
	None	145.6				
Rep 2	+2	147.5	66	85	79	85
	None	149.4	79	79	85	85
Rep 3	+2	150.5	85	79	79	91
	None	153.0	79	73	85	91
Averages	+2	147.9		82	79	88
	None	149.3	79	76	85	88

Al Hollertz, Harlan County

- Location: 7 miles south, 2 miles east of Holdrege
- Soil Type: Holdrege silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Disked twice
- Planting Date: April 26, 1997
- Hybrid: Golden Harvest 2547
- N Application Type: Sidedress Anhydrous Ammonia on April 10, 1997
- Herbicide: 2.4 ozs/acre Bicep, broadcast April 30, 1997
  0.5 ozs/acre Exceed, banded on May 30, 1997
- Insecticide: 1.5 pts/acre Penncap-M, aerially applied
- Harvest Date: October 22, 1997

SOIL FERTILITY			
pH	6.5	OM	2.1%
P	20 ppm	K	420 ppm
		Zn	1.2 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	6-Year Average Avg N Res	6-Year Average Avg N Applied	6-Year Average Avg Yield
	-50				95	158		62	166
1997	Rec		48	175	145	156	86	112	167
	+50				195	155		162	168

D. M. Schluntz, Inc., Harlan County

- Location: 3 miles north, ½ mile east, ¾ mile north from Republican City
- Soil Type: Hord and Hall silt loam with a 0-3% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Disked once
- Planting Date: May 2, 1997
- Hybrid: Pioneer 3225
- N Application Type: Anhydrous Ammonia
- Herbicide: 2 qts/acre Bicep II, broadcast at preemergence

SPECIAL PROJECT -- subsurface drip irrigation

Microirrigation (also called drip or trickle) is defined as all forms of irrigation where water filtration is required because of low flow rates and small openings at the discharge points. Although drip irrigation was pioneered in England in the 1940s, it was not until the advent of polyethylene plastics in the 1960s that drip irrigation was developed as a commercially viable technology in the United States and Israel. Drip tape is thin walled polyethylene hose with emitters molded or welded into the wall of the tube. Emitters are spaced along the tape, usually 1-foot apart for row crops. The tape comes in a variety of diameters, wall thickness, and flow rates. Drip tape can be placed on the soil surface, or buried at depths ranging from 2 to 24 inches. When buried, the system is referred to as Subsurface Drip Irrigation or SDI.

The Schluntz's installed a SDI system on 40 acres in 1997. The system uses drip tape buried approximately 18 inches on a 36-inch spacing. Mid-Nebraska staff monitored this site for soil-moisture content throughout the season. At present, experts recommend that SDI systems be managed the same way center pivots are, by applying small amounts of water relatively frequently. A comparison of the SDI system to one of the Schluntz's well-managed gravity-irrigated ground showed that the SDI system applied 31.8 acre-inches to 40 acres, for an average

Installation showing main line and emitter tapes. The two handles are used to change the flow of water between the two irrigation sets.

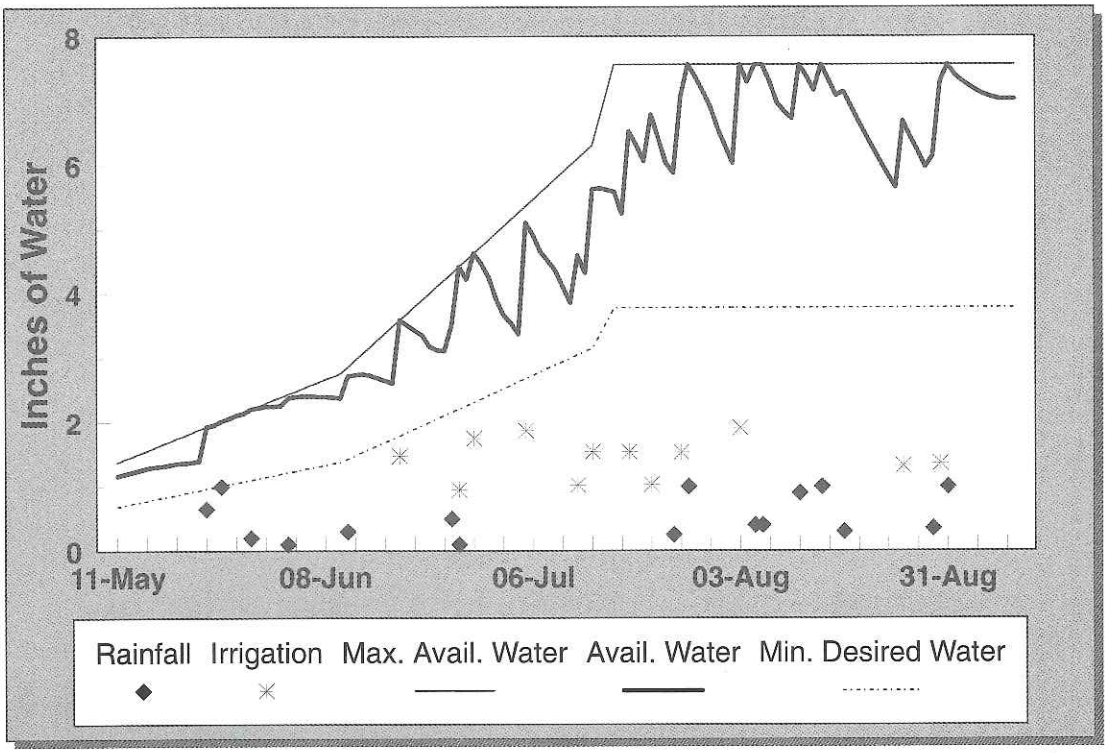
applied depth of 0.79 inches, whereas the gravity system applied nearly 2.7 inches.

Research performed by Kansas State University suggests that SDI systems can produce similar yields while using 25% to 33% less water when compared to pivot and furrow irrigated production systems respectively. It is believed that these water savings come from reducing system losses like evaporation, runoff, and deep percolation. If managed properly, a SDI system will not wet the soil surface eliminating soil evaporation losses. Further, since the crop canopy is not wetted, canopy evaporation losses are nonexistent. Because water is applied below the surface, runoff is eliminated. And while deep percolation can occur if SDI systems are not properly managed, with proper management these losses also can be eliminated.

With the capacity to supply water and nutrients "as needed", SDI holds promise as irrigation's "precision application" technology of the future. The potential to conserve water and preserve water quality while maintaining and perhaps increasing yields is intriguing. UNL scientists are currently planning research designed to establish region-specific SDI best management practices.

Irrigation Management

The graph represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.



Dean Casper, Kearney County

- Location: 5 miles south, 3 miles west, ¾ mile south of Minden
- Soil Type: Holdrege silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Rolling stalk chopper
- Planting Date: April 28, 1997
- Hybrid: Pioneer 3225
- Starter: 5 gal/acre of 10-34-0 at planting
- N Application Type: Anhydrous Ammonia preplant on April 1, 1997
- Herbicide: 1 qt/acre Bicep, banded at planting; 0.5 ozs/acre Exceed, banded at cultivation
- Harvest Date: October 23, 1997

SOIL FERTILITY			
pH	6.4	OM	2.4%
P	32 ppm	K	430 ppm
		Zn	0.9 ppm

Irrigation Management

Dean converted his field from surge irrigation to pivot irrigation in 1997. A comparison of water usage amounts over the years while Dean has been in the project can be seen below. In 1997, Dean applied nearly his highest irrigation application amount while receiving the lowest rainfall amount for the six-year period. Even so, Dean still had the fewest total inches of water applied to his field over the six-year period. The application per irrigation amount was also reduced from about 3.5 inches to about 1.2 inches. This comparison illustrates the application advantage of a center pivot over a furrow irrigation system.

Year	Irrigation	Rainfall	Total rainfall & irrigation
	(inches)	(inches)	(inches)
1992	11.59	13.55	25.14
1993	0.96	26.10	27.06
1994	5.67	14.05	19.72
1995	13.43	13.35	26.78
1996	11.78	21.30	33.08
1997	13.23	6.00	19.23

Pivot Irrigated

NITROGEN MANAGEMENT

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	2-Year Average Avg N Res	2-Year Average Avg N Applied	2-Year Average Avg Yield
	Rec				155	161		155	178
1997	+50	1	45	175	205	168	47	205	185
	+100				255	160		255	183

Dean has participated in the project since 1990. For the first six years he used a recommended rate of N along with a +50 rate and -50 rate. Based on plot results over the six-year period, a new site was located adjacent to the old site and a recommended rate, a +50 rate and a +100 rate was used.

The University of Nebraska algorithm used to determine nitrogen rates for corn is a general equation that applies to all soils statewide. Occasionally, a field's yield response to N application does not fit the generalized equation. Dean's field is a case in point. There has been a significant difference in yield between the recommended rate and the plus 50-pound rates in four of the years between 1990 and 1997. The average difference in yield has shown an advantage of almost ten bushels per acre for the plus 50 rate. In the other four years, the yield was not significantly different; the average yield difference was about seven bushels per acre between the two rates. The underlying cause for the recommended amount of nitrogen producing significantly lower yields half of the time is still unknown. This illustrates the value of monitoring the crop N status, and conducting on-farm trials with different N rates if the field does not seem to fit the generalized equation.

Harold Johnson, Kearney County

- Location: ½ mile east, 1½ miles north, ½ mile east of Norman
- Soil Type: Inavale loamy fine sand with a 0-3% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Disked twice
- Planting Date: May 10, 1997
- Hybrid: Crows 24001, 25001, 29004 soybeans
- Herbicide: 1 pt/acre Treflan, broadcast May 8, 1997
  1 pt/acre Basagran, banded June 22, 1997
- Insecticide: None

SOIL FERTILITY			
pH	5.7	OM	0.7%
P	15 ppm	K	179 ppm
		Zn	1.5 ppm

SPECIAL PROJECT -- site-specific management to aleviate crop stress

Harold Johnson is experiencing yield reductions at his site in Kearney County. In 1996, plots of varying amounts of N with and without N-Serve were replicated. The N-Serve plots showed a yield advantage over the non N-Serve plots, which was expected due to the sandy soil type. However, the field yields were still depressed. After eliminating other probable causes for the yield reduction (soil fertility, nematodes, moisture stress, and plant disease), a crop rotation to soybeans was suggested in 1997.

Before the 1997 crop season, 'smart', or directed sampling was conducted based on a 1996 aerial photograph. Areas of relatively good and effectively poor growth were selected from the geo-referenced image using GIS (geographic information system) software. A backpack GPS (global positioning system) was used to locate

these points in the field for detailed sampling prior to planting the 1997 crop. Soil sample analysis indicated no significant differences in nutrient availability, but sample collection indicated the potential for more compaction in the areas of poor growth. Deep ripping was suggested to help address the compaction problem.

The combination of aerial photography, GIS and GPS-directed sampling enabled project staff to help identify the likely problem with less time and expense than grid soil sampling or other evaluation methods.

Aerial photo (1996) of field planted to corn, with stars indicating sample locations for soil analysis.

John Greer, Nuckolls County

- Location: 6½ miles east of the junction of Highways 4 and 14 near Edgar
- Soil Type: Fillmore silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Chopped stalks
- Planting Date: April 25, 1997
- Hybrid: Pioneer 3394E
- Starter: 5 gal/acre of 10-34-0, applied in furrow at planting
- N Application Type: Preplant Anhydrous Ammonia on April 10, 1997
- Herbicide: 1 qt/acre Harness Extra and 1 oz/acre Sencor banded at planting; 4 ozs/acre Resource banded at cultivation
- Insecticide: 4 lbs/acre Aztec applied in furrow at planting
- Harvest Date: October 8, 1997

SOIL FERTILITY			
pH	7.0	OM	3.0%
P	51 ppm	K	422 ppm
		Zn	1.2 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	2-Year Average Avg N Res	2-Year Average Avg N Applied	2-Year Average Avg Yield
	-50				70	151		60	150
1997	Rec		63	170	120	167	65	110	162
	+50				170	176		160	167

Marty Damrow, Phelps County

- Location: 3 miles north, 1 mile east of Holdrege on Highway 183
- Soil Type: Holdrege silt loam with a 0-3% slope

SPECIAL PROJECT -- variable flow tailwater recovery system

In 1997, Marty Damrow installed one of two variable flow tailwater recovery system prototypes in the state of Nebraska on his farm near Holdrege. The tailwater recovery system project was an effort of many agencies and Ace Irrigation of Kearney. The following agencies were involved: Rainwater Basin Joint Venture, Cooperative Extension Service, Natural Resources and Conservation Service, Tri-Basin Natural Resources District, Central Public Power and Irrigation District, and the U.S. Fish and Wildlife Service. The installation of this tailwater recovery system was to prevent modification on the hydrology of wetlands in the watershed. Marty's installation utilized water storage on the end of his field to take irrigation and rainfall runoff from about 60 acres of the field to irrigate the remaining 20 acres of cropland in lieu of using a earthen reuse pit. His flowmeter on the system showed he reused approximately 238 acre-inches of runoff, which equates to 11.9 inches per acre over the 20 acres. The system had an average flow rate of 463 gallons per minute.

Variable flow tailwater recovery system used on Marty's field.

The adaptability of the tailwater

recovery system lends itself to being utilized in many management situations. The system's output can easily be adjusted from a constant flow to a variable flow depending on the amount of water entering the system. Other uses could include applications where land is unavailable or unfit for a earthen reuse pit to applications involving livestock waste systems.

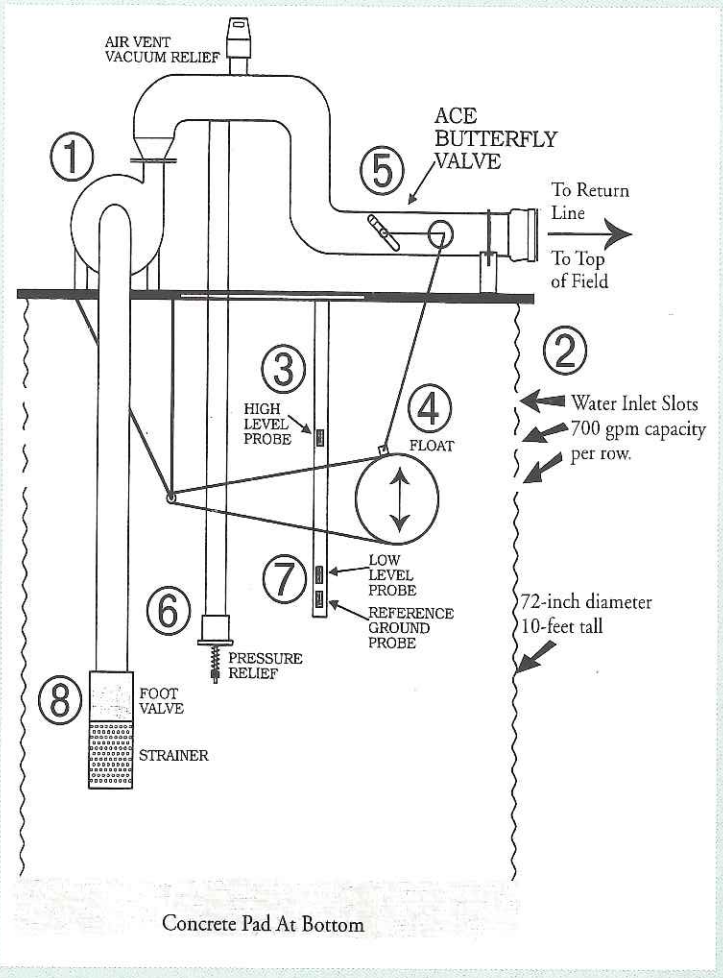
The motor and pump (1) are mounted on the lid of a 72-inch diameter pipe 10-feet tall.

Irrigation runoff enters the pipe through slots (2) in the pipe. When the water level reaches the high level probe (3), the motor is switched on.

As the water level drops inside the pipe, the float (4) pulls the butterfly valve (5) closed and reduces the gpm pumped to the return line.

As the butterfly valve closes, excess pressure is relieved through the pressure relief valve (6).

When the water level reaches the low level probe (7), the motor switches off.



Variable flow tailwater recovery system.

A foot valve (8) prevents water from draining from the pipe and keeps the pump primed. The float and butterfly valve linkage can be adjusted to change the minimum and maximum flow rates.

For further information on the Variable Flow Tailwater Recovery System contact Ace Irrigation & Manufacturing Company (800) 652-1984.

Bill Hanson, Phelps County

- Location: 6 miles north, 2 miles west, 1 mile north of Holdrege
- Soil Type: Holdrege silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: None
- Planting Date: April 25, 1997
- Hybrid: Pioneer 3375
- N Application Type: Preplant Anhydrous Ammonia on March 28, 1997
- Herbicide: 2 qts/acre Bicep II applied at planting
- Insecticide: 8 ozs/acre Penncap aerially applied July 24, 1997
- Harvest Date: October 1, 1997

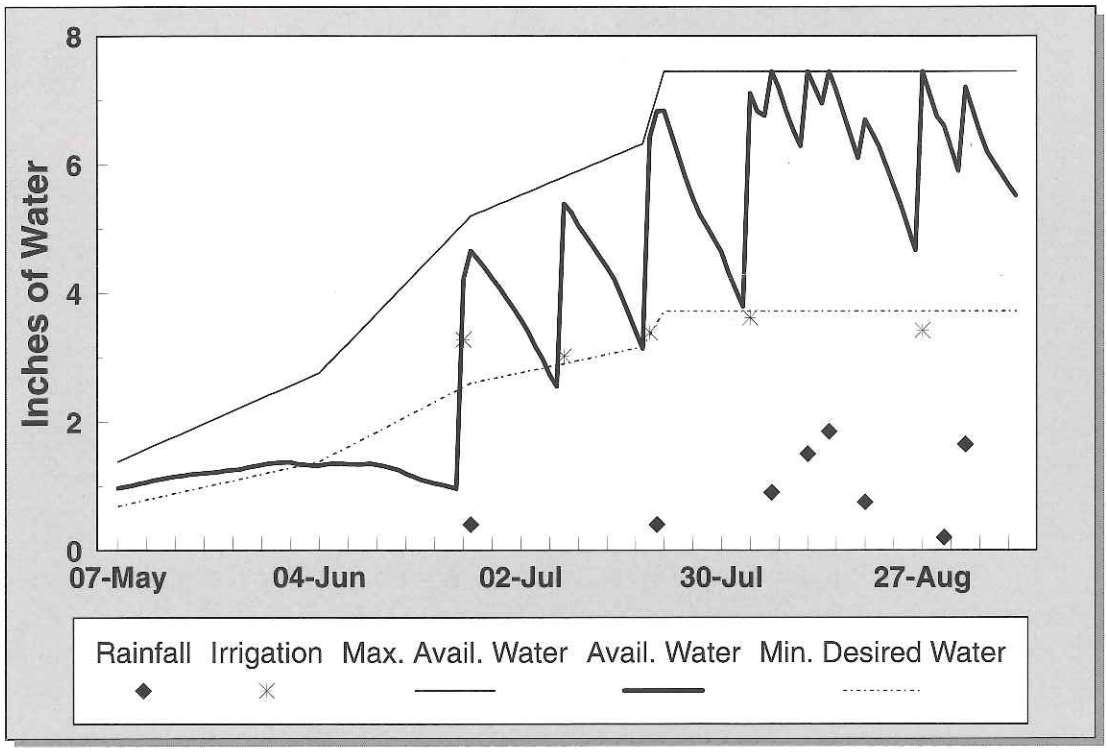
SOIL FERTILITY			
pH	5.7	OM	2.1%
P	24 ppm	K	391 ppm
		Zn	2.6 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	3-Year Average Avg N Res	Avg N Applied	Avg Yield
	-50				100	149		105	161
1997	Rec		57	180	150	165	47	155	174
	+50				200	166		205	174

Irrigation Management

The graph represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.



John Wiebe, Phelps County

- Location: 5 miles north, ¾ mile east of Loomis
- Soil Type: Holdrege silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Rolling stalk chopper
- N Application Type: Liquid fertilizer
- Harvest Date: October 22, 1997

SOIL FERTILITY			
pH	6.2	OM	2.6%
P	65 ppm	K	557 ppm
	Zn 4.8 ppm		

SPECIAL PROJECT -- manure utilization

This was John's second year to demonstrate the advantages of utilizing manure as a source of nutrients. In 1996, John applied manure at a rate of 29 tons/acre to two replicated treatments. A third replicated treatment received only commercial fertilizer. Additional commercial fertilizer was applied to the two manure treatments to meet crop needs based on amounts determined from soil and manure sampling.

In 1997, no manure was applied and all three replicated strips received commercial fertilizer based on a recommended rate determined by soil analysis results. The three replicated strips consisted of one treatment using a recommended 150-pound N application on the strip receiving only commercial fertilizer in 1996. The second strip received a 120-pound N application which, along with a 30-pound second year manure N credit, totaled 150 pounds of N. The third strip received a 170-pound N application which, along with a 30-pound second year manure N credit gave a total of 200 pounds of N. The results from the replicated strips showed no significant yield differences between the three strips in 1997.

Results imply that overfertilization did not provide a significant yield boost. However, allowing a second year N credit from a manure application proved to be beneficial in reducing the total amount of nitrogen purchased and applied. Second year manure credit considerations should be included when analyzing the initial cost of manure application. For further information on utilizing and applying manure, the following Extension Circular and Neb-Guides can be referenced:

EC89-117	Fertilizing Crops With Animal Manure
G97-1334A	Estimating Manure Nutrients from Livestock and Poultry
G97-1335A	Determining Crop Available Nutrients from Manure
G95-1267	Manure Applicator Calibration

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	2-Year Average Avg N Res	2-Year Average Avg N Applied	2-Year Average Avg Yield
1997	Rec (Commercial)	0	58	190	150	154	87	133	161
	Rec (Commercial with Manure N Credit)				120*	156		88	165
	+50 (Commercial with Manure N Credit)				170*	156		138	168

* A nitrogen credit of 30 lbs was given in 1997 to allow for a manure application of 29 tons per acre applied in 1996.

Dick Eller, Polk County

- Location: 5¾ miles north of the Highway 92 and 81 junction east of Shelby
- Soil Type: Holder silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Shred stalks
- Planting Date: April 27, 1997
- Hybrid: Golden Harvest H 2547
- Starter: 100 lbs/acre of 11-52-0, banded at planting
- N Application Type: 32 lbs/acre 28-0-0, banded at planting; 100 lbs/acre Anhydrous Ammonia sidedressed June 3, 1997
- Herbicide: 2.65 pts/acre Landmaster on April 22, 1997
  1.15 qts/acre Bicep II at planting
- Insecticide: 6.5 lbs/acre Counter CR, T-banded at planting
- Harvest Date: October 31, 1997

SOIL FERTILITY			
pH	5.5	OM	2.8%
P	44 ppm	K	369 ppm
		Zn	1.6 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	2-Year Average Avg N Res	2-Year Average Avg N Applied	2-Year Average Avg Yield
	-50				95	165		47	152
1997	Rec		50	180	145	174	134	97	164
	+50				195	175		199	168

Tom Weber, Saline County

- Location: 1 mile east, ½ mile north of Dorchester
- Soil Type: Crete silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Fall disked, field conditioner April 15, 1997
- Planting Date: April 22, 1997
- Hybrid: Pioneer 3394
- Starter: 30 lbs/acre of 15-0-5-1
- N Application Type: Dry fertilizer 90-0-0-1, broadcast April 15, 1997; 50-0-0-5 liquid sidedressed on May 25, 1997
- Herbicide: 2 qts/acre Bicep II, broadcast on April 1, 1997; 1 oz/acre Exceed, broadcast on May 20, 1997
- Insecticide: 6.7 ozs/1000 ft row of Aztec
- Harvest Date: October 13, 1997

SOIL FERTILITY			
pH	6.4	OM	2.7%
P	23 ppm	K	314 ppm
		Zn	5.2 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	2-Year Average Avg N Res	2-Year Average Avg N Applied	2-Year Average Avg Yield
	-50				90	152		80	159
1997	Rec		58	180	140	182	70	130	182
	+50				190	187		180	180

Leroy Voss, Thayer County

- Location: 2½ miles west of Bruning
- Soil Type: Crete silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Ridge-till
- Planting Date: April 23, 1997
- Hybrid: Pioneer 3489
- N Application Type: 185 lbs/acre Anhydrous Ammonia applied in the fall
- Herbicide: 2 pts/acre Surpass 100
- Insecticide: 2.5 ozs/acre Warrior, aerially applied
- Harvest Date: October 8, 1997

SOIL FERTILITY			
pH	6.4	OM	3.1%
P	60 ppm	K	405 ppm
		Zn	5.0 ppm

SPECIAL PROJECT -- starter fertilizer effects

Leroy was interested in seeing the effect of different starter fertilizer treatments when adequate levels of nutrients were already in the soil. Leroy applied 185 pounds per acre of anhydrous ammonia preplant. Soil samples taken from the field showed that the field required no other nutrients to achieve the 170-bushel expected yield based on University of Nebraska recommendations.

The demonstration consisted of four treatments, replicated three times. The treatments were 12 gallons per acre of 28-0-0, 12 gallons per acre of 10-34-0, a combination of 6 gallons per acre each of 28-0-0 and 10-34-0, and no starter fertilizer. All treatments were placed in a two-by-two band at planting. There was no significant difference in yield between treatments. The harvest results are shown in the following table.

Treatment	% Moisture	Adjusted Yield (15.5%) bu/acre	3 - Year Average bu/acre
12 gal/acre 28-0-0	15.4	173	163
12 gal/acre 10-34-0	15.5	173	163
6 gal/acre 28-0-0	15.5	173	166
6 gal/acre 10-34-0			
No starter	15.6	170	163

Meredith Engelhardt, Webster County

- Location: 4 miles south of the Bladen turnoff on Highway 4, then ½ mile west
- Soil Type: Hastings silt loam with a 0-1% slope
- Preceding Crop: Summer fallow
- Planting Date: October 2, 1996
- Hybrid: Ogallala
- Starter: 6 gal/acre of 10-34-0 applied at planting; 2 qts/acre Z
- N Application Type: 60 lbs/acre Anhydrous Ammonia applied preplant; 30 lbs/acre of 28-0-0 applied in early spring
- Harvest Date: July 15, 1997

SOIL FERTILITY			
pH	5.5	OM	2.2%
P	29 ppm	K	457 ppm
	Zn 1.0 ppm		

SPECIAL PROJECT -- wheat population study

In an effort to promote crop rotations, irrigation conservation, and economic considerations, the Mid-Nebraska project involved two cooperators in conducting replicated wheat plots. One was a study on an irrigated variety plot (p. 16). Results from the other, a dryland plot that included a population density study, are reported below.

Meredith Engelhardt conducted a population study in an effort to determine if increasing his wheat seeding rate would increase his yield. Three populations were chosen: 60 pounds (his usual planting rate), 70 pounds, and 80 pounds. The different rates were randomized and replicated three times. The variety Ogallala was planted on October 2, 1996. Meredith's soil test results showed he needed 90 pounds of nitrogen for a 60-bushel yield goal. Anhydrous Ammonia was used to provide 60 pounds per acre of preplant nitrogen with another 30 pounds per acre of nitrogen from a 28-0-0 solution applied in early spring. A solution of six gallons of 10-34-0 with two quarts of zinc was also applied at planting. The dryland field received about 12.5 inches of rainfall and was harvested on July 15, 1997.

For this year there was a significant yield advantage in increasing the seeding rate to 80 pounds over the 60- and 70-pound rates*. Meredith is continuing the trial in 1998 to see if the trend continues.

SEEDING RATE	PERCENT MOISTURE	TEST WEIGHT	YIELD BU/ACRE
60 lbs	9.8	61.7	51.4
70 lbs	9.7	61.9	52.3
80 lbs	9.7	61.7	55.3

* Based on a 5% level of significance using Duncan's Multiple Range Test.

Dave Doremus, York County

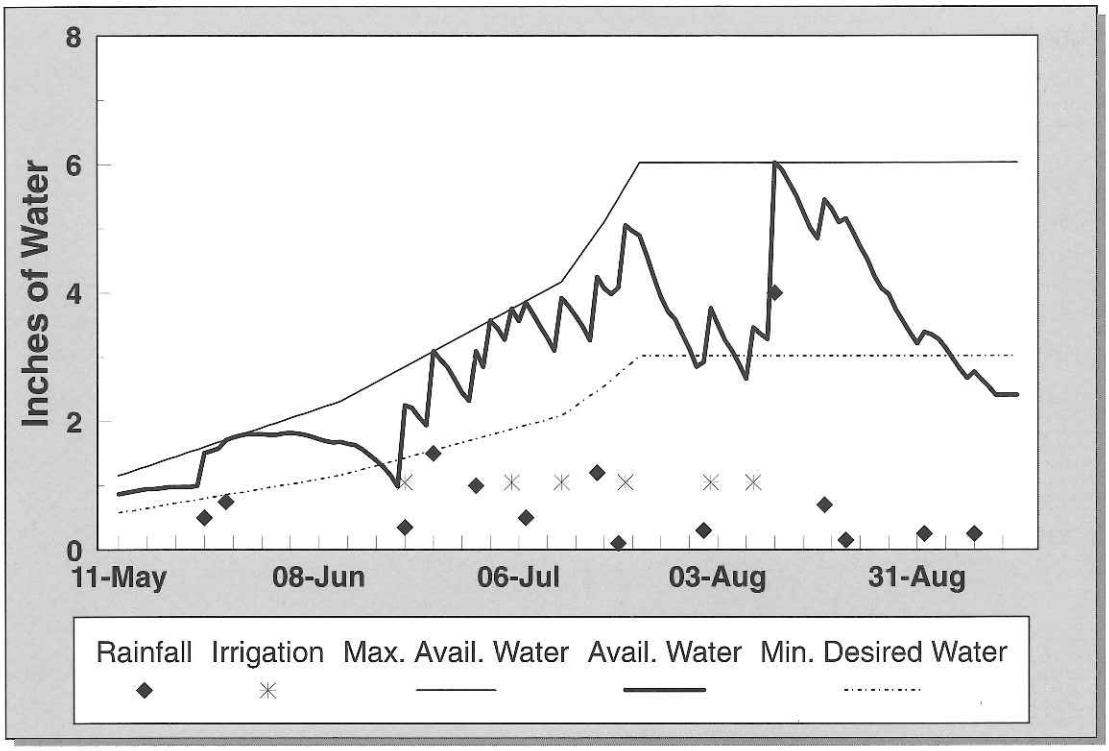
--corn plot--

- Location: 3 miles west, 1 mile south of Benedict
- Soil Type: Hastings silt loam with a 0-3% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Stalk chopper
- Planting Date: April 27, 1997
- Hybrid: Northrup King 7590 Bt
- Starter: 5 gal/acre of 10-34-0 at planting
- N Application Type: 140 lbs/acre Anhydrous Ammonia on April 10, 1997
- Herbicide: 12 ozs/acre Frontier, banded at planting; 1 oz/acre Exceed on June 10, 1997
- Insecticide: 3 ozs/acre Force, banded at planting
- Harvest Date: NA

SOIL FERTILITY			
pH	5.7	OM	2.3%
P	20 ppm	K	381 ppm
		Zn	0.8 ppm

Irrigation Management

The graph represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.



Dave Doremus, York County

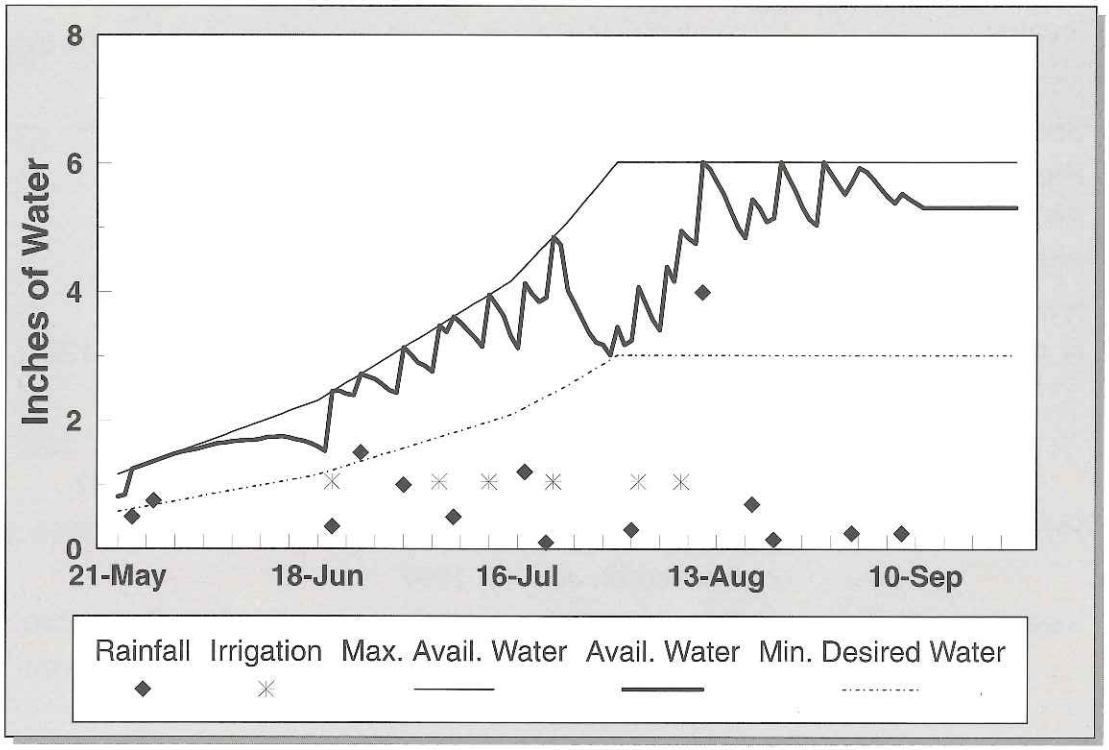
--soybean plot--

- Location: 3 miles west, 1 mile south of Benedict
- Soil Type: Hastings silt loam with a 0-3% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Stalk chopper
- Planting Date: May 10, 1997
- Hybrid: Northrup King 3006
- Starter: None
- N Application Type: None
- Herbicide: 12 ozs/acre Frontier, banded at planting; tank mix of Resolve/Cobra/Assurre II
- Insecticide: None
- Harvest Date: NA

SOIL FERTILITY			
pH	6.4	OM	2.4%
P	30 ppm	K	433 ppm
		Zn	1.7 ppm

Irrigation Management

The graph represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.



Boyd Smith, York County

- Location: 4 miles west, 1 mile south, ½ mile west of Highways 34 and 81 in York
- Soil Type: Hastings silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Shred stalks
- Planting Date: May 5, 1997
- Hybrid: Pioneer 3335
- N Application Type: 135 lbs/acre of 10-30-0, broadcast March 11, 1997; 26 lbs/acre of 10-0-0-10Zinc, broadcast March 11, 1997; 160 lbs/acre Anhydrous Ammonia April 9, 1997
- Herbicide: 1.2 qts/acre Bicep II, banded at planting; 0.8 ozs/acre Exceed on June 6, 1997
- Insecticide: 7 lbs/acre Pounce 1.5G on July 5, 1997; 2 pts/acre Penncap on August 3, 1997; 1 pt/acre Penncap on August 15, 1997
- Harvest Date: October 3, 1997

SOIL FERTILITY			
pH	5.8	OM	2.7%
P	17 ppm	K	424 ppm
		Zn	1.2 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	2-Year Average		
							Avg N Res	Avg N Applied	Avg Yield
	-50				95	194		48	177
1997	Rec		74	200	145	190	140	98	185
	+50				195	195		148	190

Jerry Stahr, York County

- Location: 1½ miles east of the Highway 81 & 34 junction in York
- Soil Type: Hastings silt loam with a 0-1% slope
- Preceding Crop: Corn
- Preplant Soil Prep: Shred stalks
- Planting Date: May 1, 1997
- Hybrid: Golden Harvest 2547
- Starter: 5 gal/acre of 10-34-0
- N Application Type: 130 lbs/acre Anhydrous Ammonia applied in the fall; 6 gal/acre of 28-0-0, sidedressed on June 21, 1997
- Herbicide: Bicep II, banded at planting; Clarity, broadcast on May 12, 1997
- Insecticide: Force, banded at planting; Dipel applied May 21, 1997
- Harvest Date: October 14, 1997

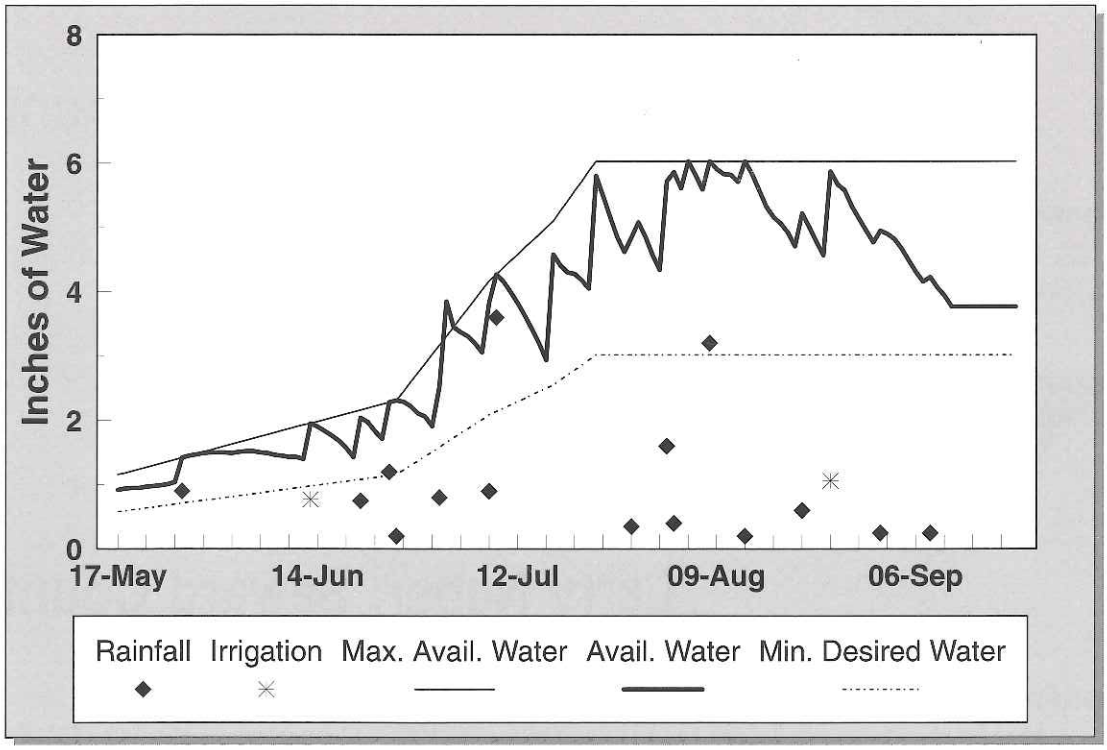
SOIL FERTILITY			
pH	6.1	OM	3.0%
P	27 ppm	K	487 ppm
		Zn	1.1 ppm

Nitrogen Management

Year	Treatment	Water N (lbs/acre)	Soil Res-N (lbs/acre)	Expected Yield (bu/acre)	N Applied (lbs/acre)	Yield (bu/acre)	7-Year Average Avg N Res	Avg N Applied	Avg Yield
	-50					188		86	164
1997	Rec		51	185	130	196	71	137	175
	+50				180	199		187	177

Irrigation Management

The graph represents the moisture status of the field during the crop season. The upper line indicates field capacity, or the maximum amount of water storable in the root zone after drainage by gravity. The middle line indicates soil moisture status. When the middle line reaches the upper line, runoff and/or deep percolation has occurred.



Thanks to the following individuals who were cooperators with the Mid-Nebraska project in 1997.

Blaine Richards, Fillmore County

General Information

A special thanks to Blaine for his assistance in 1997. Complications prevented the harvest of a nitrogen rate plot at his site.

Charles Gustafson, Hamilton County

General Information

A special thanks to Charles for the use of this site for irrigation management during the 1997 crop year.

Larry Naber, Seward County

General Information

A special thank you to Larry for his assistance in 1997. Complications prevented the harvest of a nitrogen rate plot at his site.

Who to contact in your area for more information...

Adams County

Ken Franzen, NRCS, 2727 W. 2nd, Suite 102, Hastings, NE 68901, 402/462-5412
Paul Swanson, CE, P.O. Box 30, Hastings, NE 68902, 402/461-7209
Douglas Carter, FSA, 2727 W. 2nd, Hastings, NE 68901, 402/463-6771
Greg Craig, Little Blue NRD, P.O. Box 100, Davenport, NE 68335, 402/364-2145
Cooperators:
Ed Kaufman, RR1, Box 15, Bladen, NE 68928, 402/756-1142

Butler County

Scott Willet, NRCS, 317 E Street, David City, NE 68632, 402/367-3074
Ed Siffring, CE, 451 5th St., David City, NE 68632, 402/367-7410
Mike Eller, FSA, P.O. Box 151, David City, NE 68632, 402/367-3074
Rod DeBuhr, Upper Big Blue NRD, 105 Lincoln Ave., York, NE 68467, 402/362-6601

Clay County

Janet Valasek, NRCS, 120 W. Fairfield, Suite 1, Clay Center, NE 68933, 402/762-3569
Chuck Burr, CE, 111 West Fairfield, Clay Center, NE 68933, 402/762-3644
David Studnicka, FSA, 100 S. Alexander, Clay Center, NE 68933, 402/762-3521
Greg Craig, Little Blue NRD, P.O. Box 100, Davenport, NE 68335, 402/364-2145
Cooperators:
Darrel Springer, RR 1, Edgar, NE 68935,402/224-5162
Dennis Bartlett, RR3, Harvard, NE 68944, 402/772-8771

Fillmore County

Kent Norquest, NRCS, 120 S. 12th St., Rm 2, Geneva, NE 68361, 402/759-4017
Terry Hejny, CE, 972 G St., Geneva, NE 68361, 402/759-3712
Bryan Dohrman, FSA, Box 426, Geneva, NE 68361, 402/759-4463
Rod DeBuhr, Upper Big Blue NRD, 105 Lincoln Ave., York, NE 68467, 402/362-6601
Cooperators:
Blaine Richards, RR 1, Grafton, NE 68365, 402/759-4653

Franklin County

E. Joe Vavricka, NRCS, 713-15th Ave., Franklin, NE 68939, 308/425-6276
Alan Corr, CE, P.O. Box 266, Franklin, NE 68939, 308/425-6277
James Shelton, FSA, Box 126, Franklin, NE 68939, 308/425-6234
Ron Wunibald, Lower Republican NRD, P.O. Box 618, Alma, NE 68920, 308/928-2182
Cooperators:
Edwin Choquette, RR 1 Box 55, Upland, NE 68981, 402/756-0164
Butch Ortgiesen, RR 1 Box 44, Wilcox, NE 68982, 308/478-5270

Gosper County

Curtis Scheele, NRCS, P.O. Box 41, Elwood, NE 68937, 308/785-2360
Gary Hall, CE, P.O. Box 146, Elwood, NE 68937, 308/785-2390
Loren Vancura, FSA, P.O. Box 137, Elwood, NE 68937, 308/785-3307
John Thorburn, Tri-Basin NRD, 1308 2nd Street, Holdrege, NE 68949, 308/995-6688

Hamilton County

Dennis Schroeder, NRCS, 1611 10th St., Aurora, NE 68818, 402/694-3500
Andy Christiansen, CE, P.O. Box 308, Aurora, NE 68818, 402/694-6174
Kelly Grossnicklaus, FSA, Box 148, Aurora, NE 68818, 402/694-3122
Rod DeBuhr, Upper Big Blue NRD, 105 Lincoln Ave., York, NE 68467, 402/362-6601
Cooperators:
Joel Hinrichs, 246 N. Pelham Ave., Giltner, NE 68841, 402/849-2669
Charles Gustafson, 801 W. 17 Road, Phillips, NE 68865, 402/886-2439

Harlan County

James D. Miller, NRCS, P.O. Box 320, Alma, NE 68920, 308/928-2089
Tony Anderson, CE, Box 258, Alma, NE 68920, 308/928-2119
Lee Christenson, FSA, Box 410, Alma, NE 68920, 308/928-2172
Ron Wunibald, Lower Republican NRD, P.O. Box 618, Alma, NE 68920, 308/928-2182
Cooperators:
Al Hollertz, RR2, Box 206A, Holdrege, NE 68949, 308/567-2243
D. M. Schluntz, Inc., RR1, Republican City, NE 68971, 308/799-2685

Kearney County

Shanda Weber, NRCS, 640 N. Minden Ave., Minden, NE 68959, 308/832-1895
Alan Corr, CE, Box 31, Minden, NE 68959, 308/832-0645 OR 308/832-2715
Richard Booker, FSA, Box 240, Minden, NE 68959, 308/832-2280
John Thorburn, Tri-Basin NRD, 1308 2nd Street, Holdrege, NE 68949, 308/995-6688
Cooperators:
Dean Casper, RR 3 Box 114D, Minden, NE 68959, 308/832-1653
Harold Johnson, 1156 41st Road, Minden, NE 68959, 402/756-0686

Nuckolls County

Larry Warneking, NRCS, P.O. Box 307, Nelson, NE 68961, 402/225-2311
Steve Melvin, CE, Box 386, Nelson, NE 68961, 402/225-2381
Dale Kovanda, FSA, Box 367, Nelson, NE 68961, 402/225-3401
Greg Craig, Little Blue NRD, P.O. Box 100, Davenport, NE 68335, 402/364-2145
Cooperators:
John Greer, RR 1, Edgar NE 68935, 402/224-4175
Nathan Schardt, RR2, Davenport, NE 68335, 402/364-2255

Phelps County

Buddy Steinshouer, NRCS, PO Box 798, Holdrege, NE 68949, 308/995-6141
Gary Hall, CE, 1308 2nd St., Holdrege, NE 68949, 308/995-4222
Kevin Pesek, FSA, Box 201, Holdrege, NE 68949, 308/995-6121
John Thorburn, Tri-Basin NRD, 1308 2nd Street, Holdrege, NE 68949, 308/995-6688
Cooperators:
Bill Hanson, RR 3 Box 90, Holdrege, NE 68949, 308/995-8348
John Wiebe, RR 1 Box 117, Loomis, NE 68958, 308/876-2261
Marty Damrow, RR3, Box 72c, Holdrege, NE 68949, 308/995-8323

Polk County

Kristi Schleif, NRCS, P.O. Box 526, Osceola, NE 68651, 402/747-2461
Coleen Pallas, CE, Box 215, Osceola, NE 68651, 402/747-2321
Ilene Anderson, FSA, Box 547, Osceola, NE 68651, 402/747-2111
Rod DeBuhr, Upper Big Blue NRD, 105 Lincoln Ave., York, NE 68467, 402/362-6601
Cooperators:
Dick Eller, RR 1 Box 97A, Shelby, NE 68662, 402/527-5698

Saline County

Jerry Bucy, NRCS, PO Box 741, Wilbur, NE 68465, 402/821-2031
Randy Pryor, CE, Box 978, Wilbur, NE 68465, 402/821-2151
Wenda Wait, FSA, PO Box 686, Wilbur, NE 68465, 402/821-2251
Ron Fleecs, Lower Big Blue NRD, PO Box 826, Beatrice, NE 68310, 402/228-3402
Cooperators:
Tom Weber, RR 1, Dorchester, NE 68343, 402/576-3736

Seward County

Connie Tvrdy, NRCS, 322 South 14th St., Seward, NE 68434, 402/643-6231
Dennis Kahl, CE, 216 South 9th St., Seward, NE 68434, 402/643-2981
Bruce Thompson, FSA, Box 389, Seward, NE 68434, 402/643-4586
Rod DeBuhr, Upper Big Blue NRD, 105 Lincoln Ave., York, NE 68467, 402/362-6601
Cooperators:
Larry Naber, RR 1, Utica, NE 68456, 402/534-2198

Thayer County

Brian Euse, NRCS, 1224 South Avenue, Hebron, NE 68370, 402/768-6228
Steve Melvin, CE, 225 North 4th, Hebron, NE 68370, 402/768-7212
Michael Bantam, FSA, Box 8, Hebron, NE 68370, 402/768-6520
Greg Craig, Little Blue NRD, P.O. Box 100, Davenport, NE 68335, 402/364-2145
Cooperators:
Leroy Voss, RR 1 Box 75, Bruning, NE 68322, 402/353-3805

Webster County

Merle L. Illian, NRCS, 20 N. Webster St., Red Cloud, NE 68970, 402/746-2268
Chuck Burr, CE, 621 N. Cedar, Red Cloud, NE 68970, 402/746-3417
Teresa Post, FSA, Box 487, Red Cloud, NE 68970, 402/746-2204
Ron Wunibald, Lower Republican NRD, P.O. Box 618, Alma, NE 68920, 308/928-2182
Cooperators:
Meredith Engelhardt, RR1, Box 65, Bladen, NE 68928, 402/756-1282

York County

Bill Gilliam, NRCS, 419 W. 6th Street, Suite 2, York, NE 68467, 402/362-5700
Gary Zoubek, CE, RFD 4, Box 46, York, NE 68467, 402/362-5508
Maxine Knauss, FSA, Box 485, York, NE 68467, 402/362-7751
Rod DeBuhr, Upper Big Blue NRD, 105 Lincoln Ave., York, NE 68467, 402/362-6601
Cooperators:
Boyd Smith, 941 Woodcrest Court, York, NE 68467, 402/362-7707
Jerry Stahr, RR 2 Box 75, York, NE 68467, 402/362-2574
Dave Doremus, RR1, Benedict, NE 68316, 402/732-6821

Notes...