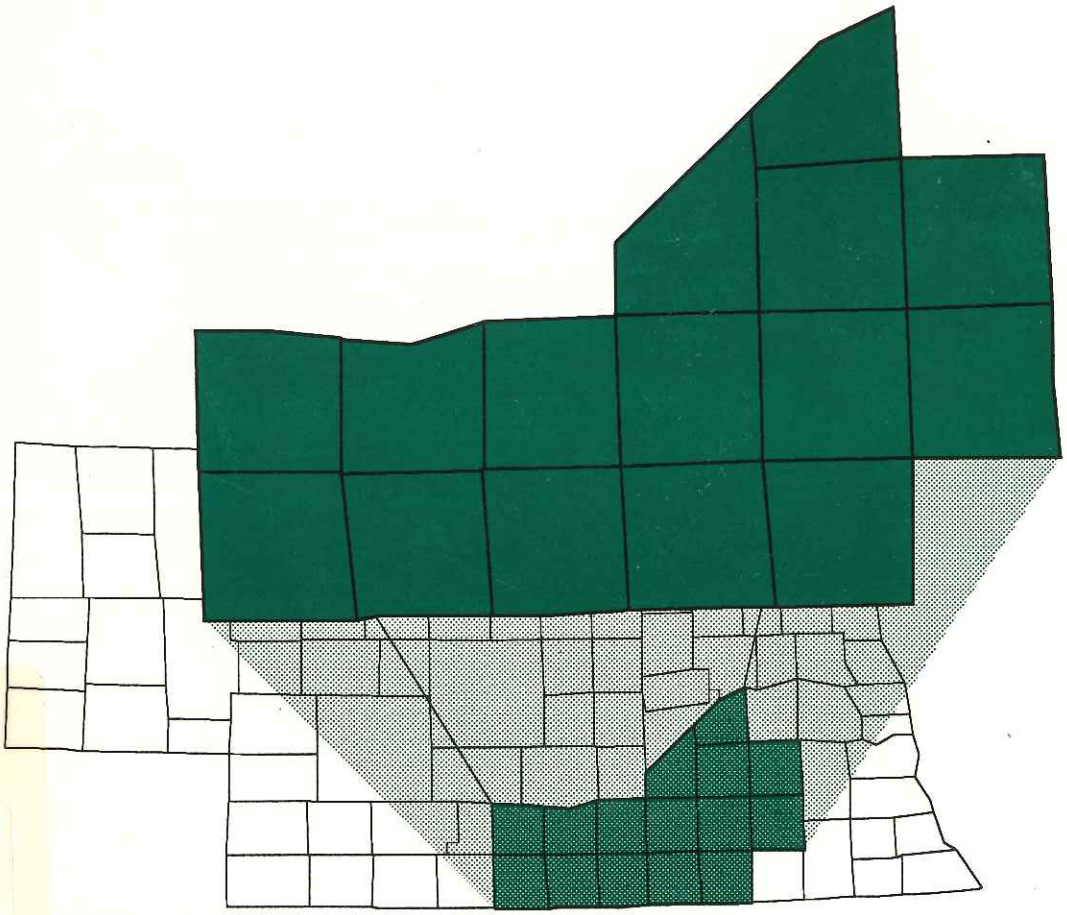
WATER QUALITY

Mid-Nebraska Demonstration Project

1994

Field Demonstrations of Best Management Practices to Protect Groundwater Quality



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Natural Resources Conservation Service
University of Nebraska Cooperative Extension

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- USDA Consolidated Farm Service Agency
- 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
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- USDA Agricultural Research Service
- Nebraska Department of Environmental Quality

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Mid-Nebraska Water Quality Demonstration Project

The Mid-Nebraska Water Quality Demonstration Project (MNWQDP) began in March, 1990 with the authorization of USDA funds from President Bush's Water Quality Initiative. One of eight projects selected nationwide in 1990, the project has four objectives:

1. Foster the adoption of management practices that will reduce nutrient and pesticide loading in the soil.

2. Promote producer adoption of irrigation management practices that provide adequate moisture to grow crops while reducing leaching of agrochemicals to groundwater.

3. Demonstrate that producers can achieve suitable economic returns while utilizing management practices that reduce inputs and chemical leaching to groundwater.

4. Effectively address critical water quality issues in Nebraska by integrating the resources and expertise of appropriate federal, state and local agencies and organizations.

There are 3.4 million acres of cultivated land in the 15-county area encompassed by the MNWQDP (see map opposite). This area has been irrigated for more than 60 years and continuous corn production is the most common agricultural practice on the majority of the irrigated acres. Investments made in irrigation capabilities and USDA farm program provisions strongly influence cropping decisions in this area.

This production history has left many areas of South Central Nebraska with high nitrate concentration in the vadose zone—the area between the root zone and the water table. As this nitrate reaches the ground water, community and private wells may become contaminated. Most wells are not affected. The MNWQDP was designed to prevent a problem from occurring. It cannot in a short time correct problems already existing

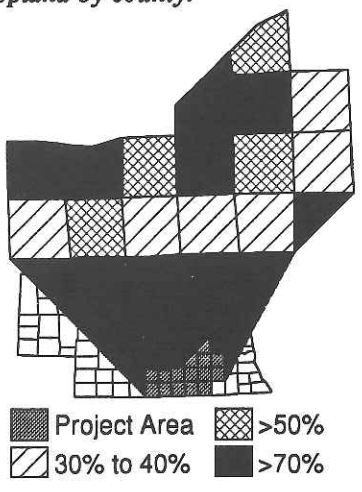
Best Management Practices

The MNWQDP is all about nitrogen and water. There are 15 Best Management Practices (BMPs) recommended to slow nitrogen moving from the crop root zone to ground water.

Nitrogen is an essential element for plants and animals. Nitrogen is consumed in many different forms. Plants use nitrogen as nitrate and as ammonium. Legumes, such as soybeans and alfalfa are capable of converting atmospheric nitrogen (N_2) into plant available forms. Plants need nitrogen to form amino acids, protein building blocks.

People need nitrogen in the amino acid or protein forms. People absorb amino acids in the small intestine and use them to synthesize protein; people cannot rely on ammonium and nitrate forms of nitrogen to synthesize protein.

Figure 1. MNWQDP project area, showing percent of irrigated cropland by county.



1989 NE Agricultural Statistics, NE Department of Ag.

Nitrate is a problem for infants because intestinal bacteria convert nitrate to nitrite in their bodies. Nitrite acts as an oxidizing agent to form methemoglobin in red blood cells (RBCs) inhibiting RBC ability to carry oxygen (resulting in the "blue baby" effect). Adults produce enzymes which convert methemoglobin to oxygen-carrying hemoglobin, making high nitrate concentrations less hazardous to adults. It is this potential for the production of nitrite in infants that warrants our concern about nitrate in groundwater.

Water moves through large and microscopic gaps in soil, working its way toward the water table. As it moves through soil, water is attracted to soil particles and other water molecules. It also is pulled by plant roots, making its journey complicated and diverse, but for the most part it is moving downward.

Water is a solvent and nitrate is water soluble. Nitrate doesn't move in dry soil. When water percolates downward, it carries nitrate with it resulting in nitrate leaching into the ground water.

Water management is the most important factor in the protection of South Central Nebraska ground water from nitrate contamination. The inherent inefficiency of gravity flow irrigation systems is a constant leaching threat.

The main challenge for farmers comes with the first irrigation. This is typically the least efficient irrigation of the year with most lost water leaving the bottom of the root zone, rather than the end of the furrow. It is a time when plant roots are not fully developed; plant consumption of water and nitrogen is low and nitrate concentration in the soil is high.

Nitrogen BMPs

Nine practices promoted through the Mid-Nebraska project help reduce nitrate loss to ground water.

Five of these reduce excessive applications. If we apply only the nitrate we need to produce an optimum economic yield, we are operating close to maximum efficiency of nitrogen use.

1. **Select a realistic yield goal**, which should be based on field history. One approach is to take the past five years and use that average, throwing out unusual years, both bad and good, and adding 5 percent for potential increased yields associated with newer hybrids and improved management.

2. **Credit irrigation water nitrate** by multiplying ppm from tested water by 2. Water tested at 10 ppm equals a 20-pounds nitrogen credit (10 ppm x 2 = 20 pounds). This adjustment allows credit from nine inches of irrigation water.

3. **Credit Legume Nitrate.** There is more nitrogen available to corn following soybeans, so, generally farmers should credit 45 pounds of nitrogen from soybeans in a rotation. When planting corn following alfalfa, a farmer should credit 150 pounds for a good stand and 120 pounds for one that's a little thin.

4. **Credit Soil Nitrate.** This recommendation has gone through some transitions over the years. The research behind it relates yields to nitrate in the four- to six-foot root zone. That does not mean the corn plant will consume all of that nitrate; it means that yields peak when a certain amount of nitrogen is located in the top six feet of soil. The shallower the sample, the greater the risk that the estimate is wrong. Three feet deep is preferable. Two feet deep is minimum for having confidence in the estimate.

The new University of Nebraska equation also credits expected release of nitrogen from organic matter. Literally tons of nitrogen are in the soil in organic matter. How much of that becomes available during the year depends largely on the weather. The UNL equation provides adjustment for the expected nitrogen release from organic matter in a typical year.

5. Credit manure, sludge or compost fertilizer nitrate. Like commercial fertilizer, these "waste" products contain nitrogen. A farmer must have waste fertilizers analyzed for nitrate-nitrogen and phosphate content because these nutrients vary in waste products.

6. Efficiently apply manures, sludges and compost. These products are a good nitrogen source but applying them correctly is critical to their success. The two ways to lose nitrogen with surface application are by evaporation and loss of the urea portion under warm damp conditions. Thus, the most efficient way to use these products is to knife them in or incorporate with tillage if the erosion potential is low.

7. Use nitrification inhibitors. One of the first restrictions in Special Protection Areas (SPAs) or water management areas is delaying application of ammonia fertilizers until soils are coolin the fall. Bacteria responsible for converting ammonium to nitrate are less active in cold soils. Since ammonium doesn't leach with water, little nitrogen leaves the root zone if it is kept in the ammonium form. Another way to decrease bacteria activity is to use chemical nitrification inhibitors, such as N-Serve or dicyandiamide (DCD).

8. Split-applying fertilizer reduces nitrate concentrations in soil during low plant consumption. If a farmer doesn't apply nitrogen before the plants need it, it is not going to be around to leach at first irrigation. Split applications allow a farmer to supply enough nitrogen to get plants going early in the spring and resupply in June, just prior to peak plant consumption. Applying nitrogen at sidedress or through fertigation constitutes split application.

9. Plant a fall cover crop. This practice is often difficult to accomplish, but well worth doing if possible. It is a particularly good practice when such circumstances as hail and wind reduce expected yield during the growing season. Often in those situations there is leftover nitrogen in the soil, ready to travel with September and October rains deep beyond the root zone. A crop of rye or a legume can capture nitrate and keep it in the root zone.

Irrigation BMPs

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

1. Level land. Many irrigation difficulties are related to water moving rapidly from one end of the field to the other. Reverse grades and potholes increase the amount of time it takes for water to move down a furrow. Every minute of delay means an added minute of infiltration. Leveling may be the most effective way to make a gravity system more efficiently move water and improve distribution.

2. Use reuse pits. Reuse pits allow a farmer to push water across the field as fast as he can (within erosive limits) without concern for runoff from the field. Timing is critical for keeping nitrate in the root zone. The faster water moves across the field, the shorter the irrigation time and the less water and nitrate leaving the root zone.

3. **Use a water flow meter to measure the amount of water applied**. Meters are tools which accurately measure irrigation water flow and help improve irrigation efficiency. Meters also are diagnostic tools; they can tell a farmer when a well is going bad long before he can. One of the goals of water management is to just replenish the deficit in the root zone. A person is hard-pressed to accomplish that mission accurately without a water meter.

4. **Schedule irrigation based on crop water use**. The goal is to not oversupply the system with water, which requires knowing how much water is enough and how much water is needed in the future. Scheduling irrigation involves measuring the root zone to determine *how much* water the crop needs and using crop water use information to estimate *when* the crop needs more.

5. **Use surge irrigation**. If used properly, surge alters the infiltration rate of a system. Surge irrigation is an automated system that changes infiltration rate through a series of off-and-on watering. Generally, where infiltration rates are high, surge can move water across the field faster, improving distribution, which reduces leaching opportunities.

6. **Rotate crops.** Crop rotation offers immediate benefits by reducing the amount of nitrogen plants need. It may also reduce the amount of irrigation water they need.

Pesticide BMPs

Pesticides are not a major problem in ground water 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**. Rotations can reduce the need for some pesticides (rootworm control in particular). Alternating the types of plants (grasses and broadleaf, annual and perennial) disrupts the environment for weeds and insects.

2. **Properly mix chemicals**. Many pesticide contamination incidents are point-source problems. Mixing pesticides around wells creates a point-source hazard from major spills, repeated small spills and back-siphoning.

3. **Practice Integrated Pest Management (IPM)**, which relies on accurate field scouting data. Field maps identify areas with particular weed problems or soil insects. Accuracy depends on the number of areas sampled and location of those areas.

The IPM approach minimizes pesticide use by making decisions based on field information and research. University research-based thresholds are available in many areas. Some are static (give a set level of infestation that triggers a treatment) and some are dynamic (include variables in value of crop, cost of treatment etc.). Static thresholds exist for western bean cutworm and soil cutworms. Dynamic thresholds are available for European corn borer, corn rootworm, and alfalfa weevil. Combining field data, threshold information and individual farm perceptions of economic and environmental risks aid in making reasonable treatment decisions.

4. **Effectively apply chemicals,** considering placement, timing and selection of pesticide. Banding herbicides reduces quantity, expense and environmental risk as does selecting products based on effectiveness, price and environmental compatibility. Most pesticides are rated for their risk as a leaching or runoff hazard (for more information, refer to *Understanding Pesticides and Water Quality* in Nebraska, EC94-135, available at local extension offices). Timing is a crucial factor for pest control. Controlling small weeds takes less chemical than large weeds. Also, since corn borers are only vulnerable while on leaves silks and tassels, applying pesticides too early or too late reduces effetiveness.

Reference Aids

Several publications and software resources are available through local cooperative extension to help producers implement the Best Management Practices.

Nitrogen Management

Neb Guides

G74-174A *Fertilizer suggestions for corn (rev. Jan 1994)*
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*

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*

Irrigation Management

Neb Guides

EC89-723 *Irrigation scheduling using soil moisture blocks in silty soils*
NF94-176 *Surge irrigation*
NF94-177 *Nebraska surge irrigation trials*
NF94-178 *Surge irrigaiton field layouts*
NF94-179 *Surge irrigation management*
G78-392 *Selecting and using irrigation propeller meters*
G78-393 *Water measurement calculations*
G85-753 *Irrigation scheduling using crop water use data*
G91-1021 *Managing furrow irrigation systems*

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 ground water contamination by nitrate-nitrogen*
G84-690 *Estimating soil moisture by appearance and feel*

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*

Other Extension Publications

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*

Summary of Results - 1991 to 1994

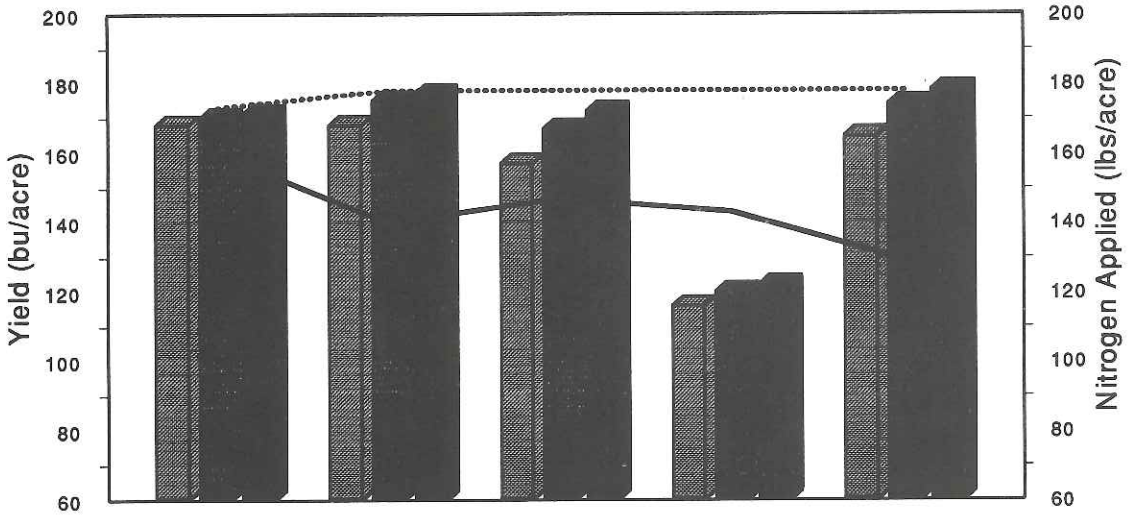
Yields improved across South Central Nebraska in 1994 although stand loss from wind was severe in some cases. Many demonstration sites had stands reduced 20,000 to 22,000 plants per acre. The demonstration sites were reasonably close to expected yields in 1994 for the first time since 1991 due to improved weather conditions (see figure 2).

Nitrogen Management

Twenty-six sites compared University of Nebraska recommended nitrogen rates against higher and lower rates in 1994. The recommended rate was statistically **equal to the high rate at 25 sites** and better than the high rate at one site. While there is no statistical difference, the high rate was numerically greater on 16 sites. The expected yield was not reached on nine of those sites, even with the high rate of nitrogen. Therefore, nitrogen likely was not the limiting factor (see Table 13, pages 21 - 22).

Deryl Bish (site 39) evaluated using and not using N-Serve for fall anhydrous ammonia application at different rates (see page 80 for results). This is a reasonable strategy for conditions such as those in 1992 where nitrate leaching loss is substantial. N-Serve inhibits ammonium conversion to nitrate. Ammonium is less likely to leach under wet conditions, which was not the case on this site in 1994. Therefore, the data show no advantage for using N-Serve.

Figure 2. Average plot yields by treatment, 1990-1994



	1990	1991	1992	1993	1994
Rec -	168	168	157	116	165
Rec	170	175	167	120	174
Rec +	171	177	172	122	178
Expected Yield	173	178	178	178	178
Rec. N Rate	160	140	147	143	129

Figure 2, page 8 shows effects of weather and risks associated with strict nitrogen management.

The most obvious weather effect was the wind damage of 1993 reducing yields by 50 bushels or more. In 1994, ten of 14 fields fell 10 bushels or more short of their 1994 expected yield, due to wind. Extra nitrogen did not help any of the 14 fields reach the expected yield. Damaged or destroyed crops did increase the soil nitrogen shown by 1994's decreased recommended rates to only 129 pounds per acre on average. The opposite occurred after the wet year of 1992; only 48 pounds of nitrate were left in the four-foot soil profile.

Hail and frost were big problems in 1992, as well as excessive rain. Yields on 13 fields were below the expected yield that year by 10 bushels or more. Two suffered hail damage and six showed nitrogen deficiency due to denitrification and nitrogen leaching. Only one of the fields came close to the expected yield with the high rate of nitrogen. Nitrification inhibitors and split application would likely have paid dividends on those fields in 1992.

Five years of field data show the risk from fine tuning nitrogen management is very small. Using the University of Nebraska approach of crediting soil, water, manure, legumes and organic mater results in yields within a couple of bushels of a higher rate of nitrogen. Even deliberately-underferterilized plots are still within 15 bushels of the high rate, after continuous treatment for five years.

Irrigation Water Management

Cooperators on all but one site used in-line flow meters in 1994. The meters are an essential tool for water management and troubleshooting irrigation systems. The furrow irrigation analysis method described later depends on knowing accurate 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.

In 1994, cooperators scheduled irrigation based on crop water use estimates and soil moisture deficits. In most fields, consultants estimated deficits using the hand-feel method. Cooperators on **eight** sites use moisture blocks to estimate deficit.

Individual site reports show the water status of the root zone. The irrigation graph from Dave Hamburger's site (page 47) is a good example of scheduling for a 50 percent soil moisture deficit. Dave's first irrigation filled the root zone and he relied on several light rains for the next three weeks. His second irrigation was a little early, but it was during the critical, late July stage of crop development. The last two irrigations were close to the 50 percent line, giving maximum room for rainfall.

Economic Impact

One of the goals of the Mid-Nebraska project is to induce management practices that are economical. The nitrogen management practices are consistently cost-neutral or profitable to farmers. Over five years, cooperators compared 115 UNL-based recommendations versus higher rates with no statistical difference in yields 80 percent of the time. Five percent of the time the recommended rate out-yielded the high rate; the high rate yielded better only 15 percent of the time. Assuming corn at $2.50 per bushel and nitrogen at $.12 per pound, cooperators had an 80 percent chance of saving $6 per acre and a 5 percent chance of saving $25 per acre (six of 115 plots gave a yield advantage average of 7.6 bushels with recommended rates). They also had a 15 percent chance of losing $19.75 per acre (17 of 115 plots averaged 10.3 bushels less). That leaves a $3.09-per-acre advantage for using the recommended rate.

Table 1 and Figure 3 on page 11 show the comparison of costs using four possible management systems. Only practices that are affected by the BMPs promoted in the project are shown. **This is not a complete list of expenses.**

Irrigation causes major differences between systems. The "basic system" wastes some water by not scheduling to take advantage of rainfall, but it's main handicap is poor water distribution. The savings shown in system 1 of 6.5 inches of water is mostly due to changing the combination of set time and gates opened. In some cases that change may not be practical due to odd set times, but the example is intended to show what is possible.

The Mid-Nebraska Water Quality Demonstration Project strives for the efficient use of resources. The implication is that management practices allow waste of chemicals and water in some cases. Demonstrations of alternative approaches and the use of research-based techniques help producers see how those different approaches might work on their farm. Those BMPs are listed on pages 4 through 6 of this report.

The recommended BMPs are designed for profitability as well as environmental protection. Some practices—mainly related to irrigation—are expensive and may be subsidized with cost-share from the USDA and Natural Resources Districts.

A basic system is defined below in order to describe the recommended changes and the expected economic effect of those changes.

The Basic System does not utilize deep soil sampling and **routinely applies 180 pounds of nitrogen** per acre every year. This is a continuous corn system that is **not using beetle counts** to determine treatment thresholds. Instead, soil insecticide is applied every year. This is a gravity flow irrigation system that aims to keep the crop fully irrigated with **no schedule to allow 50 percent depletion** before recharge.

The BMP systems can be applied in three different ways, depending on irrigation system used.

BMP System 1

The changes made are:

- deep soil sample and credit residual N
- irrigation water sample and credit for N
- hire a scout and use corn rootworm beetle thresholds
- install a water flow meter to help evaluate irrigation
- schedule irrigation and irrigate to a 50 percent depletion
- select best combination of set-times and gates

These BMPs could result in a 75-pound reduction of nitrogen applied--60 pounds by accounting for soil nitrate and 15 pounds by accounting for nine inches of irrigation water that has 7.5 ppm nitrate nitrogen.

Scouting provides a reduction of soil insecticide. The anticipated need for rootworm control is reduced to one year in three.

Table 1. Costs of selected BMPs

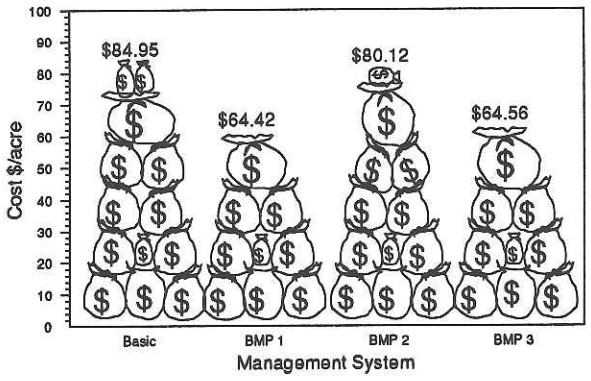
Selected Practices	Basic	BMP System 1	BMP System 2	BMP System 3
Soil & water sampling	$1.01	$1.75	$1.75	$1.75
Nitrogen product & application	28.4	18.65	18.65	18.65
Scouting rootworm beetles	0	2.78	2.78	2.78
[a]Soil insecticide	6.61	2.21	2.21	2.21
Irrigation scheduling	0	2.78	2.78	2.78
[b]Irrigation equipment, water, labor	48.93	36.26	51.96	36.4
TOTAL	84.95	64.42	80.12	64.56

[a]...Routine use of soil insecticide under basic system. Scouting for beetles & using threshold guidelines reduces application once in three years.
[b]Scheduling to 50% deficit is likely to reduce gross water applied through season. Reuse pit adds to System 2 cost; a surge valve to System 3. the basic System applies 21", System 1 applies 14.5", system 2 applies 11.1" + 3.4" reuse & System 3 applies 13.6"

The changes in irrigation management are likely to result in the elimination of one or two irrigations and improved efficiency related to better distribution of water.

BMP System 1 could reduce cost by **$20.52 per acre.** Reducing nitrogen saved $9.01, reducing insecticide saved $1.63 and water savings accounted for another $9.89.

Figure 3. Economic effects of Best Management Practices



BMP System 2

This is the same as BMP System 1 plus a 50 percent cost-shared irrigation reuse system .

This added BMP increases irrigation efficiency by capturing and reusing 3.4 inches of irrigation water. Without cost-share, this irrigation system is $5.81 per acre more expensive than the basic system.

BMP System 2 with cost-share could reduce costs by **$14.64 per acre.**

BMP System 3

The system is the same as BMP System 1 except surge irrigation is used .

This added BMP has the effect of increasing irrigation efficiency and reducing the amount of water used. It works by altering the infiltration rate in the furrow, reducing the irrigation advance time. This allows a change to shorter set times or an increase in the number of gates per set.

BMP System 3 could reduce costs by **$20.38 per acre.**

Environmental Impact

The goal of the project is to reduce nutrient and pesticide loading of the soil and to improve irrigation management that will reduce nitrate and pesticide leaching to ground water and improve economic efficiency. Two surveys conducted in 1994 determined the success of reaching these goals.

Table 2. Survey Results, comparing 1991 & 1994 Surveys

Item	1991	Goal	1994
•Adjust N rate up for fall apply	30%	15%	30%
•Use water flow meters	28%	50%	34%
•Use surge valve irrigation	5%	15%	12%
•Use atrazine routinely	34%	20%	29%
•Attend N/water mgmt. program	18%	75%	51%
[the following questions had no specific goals attached]			
•Take deep soil samples for nitrate credit	63%	———	70%
•Reduce nitrogen based on soil sample	49%	———	82%
•Use a monitor for anhydrous application	35%	———	42%
•Nitrogen credit given after legumes	56%	———	84%
•Use crop consultant	68%	———	78%
•Use crop water use reports	69%	———	78%
•Most common yield expectation	180 bu	———	180 bu
•Most common N rate used	200 lb	———	180 lb

The first survey, conducted in early 1994 was a follow-up to a 1991 survey, targeting the same sample set. The 1991 survey functioned as a baseline for setting project goals. Table 2 shows the results of the two surveys.

The second 1994 survey, conducted during 15 of the 16 field days sampled 716 farmers and agricultural businessmen attending the field tours. Three hundred ninety-three farmers responded. This survey was of people who attended the field days only and it is not likely representative of all farmers. Nonetheless, it shows practices these farmers have adopted and we can assume many other farmers who did not attend these field days have adopted similar conservation-minded and economically-practical practices.

The survey also determined how many acres were farmed and how many changes in nitrogen and water application due to management have occurred since the Mid-Nebraska project began in 1990. The figures in Table 4 are **estimates** based on the responses from those who say they were influenced by the project. Respondents say they have reduced nitrogen application 20 pounds per acre (consistent with the other 1994 survey) and have reduced water application on the average by one inch per acre.

Put in perspective, that is over 1,900 tons of nitrogen valued around $220 per ton. That is a savings of $418,000 per year for those farmers surveyed. How much is 311,450 acre inches of water? It is a 10-year supply of home water for a city of 40,000 people. It is enough water to fill the reflecting pool in Washington D.C. to a height six times taller than the Washington monument. This means Nebraska farmers are making changes which significantly impact ground water protection.

Table 3. 1994 MNWQDP field tours survey results

Item	Response
•Percent with surge valves	17%
•Percent with N monitors	55%
•Influenced by the MNWQDP	69%
•Reduced atrazine use since 1990	57%

Table 4. Extrapolations from 1994 Field Tour Survey

Item	Impact
•Acres influence	185,350
•Pounds nitrogen reduced/year	3,804,725
•Acre inches irrigation reduced/year	311,450

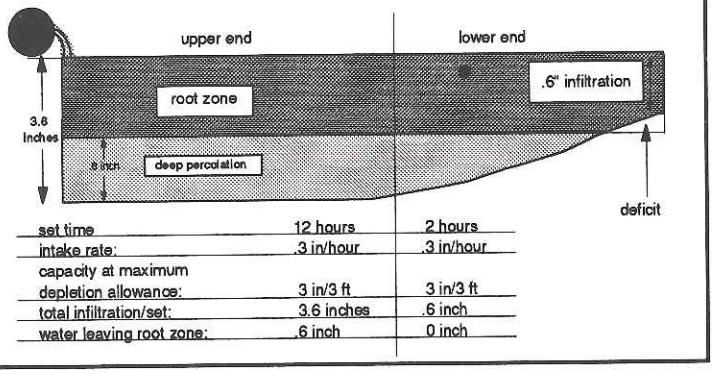
Furrow Irrigation Evaluation

Performance of furrow irrigation systems is affected by field traits and management. Some field traits, such as soil texture, are not easily changed. Others, such as slope and furrow length, can be changed within limits. Management offers the greatest flexibility, allowing farmers to change number of gates per set, set time and every row or every other row irrigation.

The Problem

Soil is porous, allowing water to move through it. Even when soil is wet, water continues to move downward through it. This movement is called the infiltration rate.

Figure 4. South-Central Neb. typical furrow irrigation situation



set time	12 hours	2 hours
intake rate:	.3 in/hour	.3 in/hour
capacity at maximum depletion allowance:	3 in/3 ft	3 in/3 ft
total infiltration/set:	3.6 inches	.6 inch
water leaving root zone:	.6 inch	0 inch

Furrow irrigation is operated by applying water at one end of the field and allowing it to flow downhill to the other end. The process is fairly slow, taking several hours to travel 1300 or perhaps even 2600 feet. All the time water is moving along the furrow, it is infiltrating through the soil.

Nitrate is an anion that is water soluble. Water moving downward through soil will carry nitrate with it. It is not a problem as long as it moves short distances, as the root growth will keep pace with the nitrogen.

If it takes too long to get water to the end of the furrow, the opportunity for water to leach nitrate beyond the root zone is great. Therefore, furrow irrigation systems must be evaluated to determine if it is taking too long to move water down the furrow and to determine how the rate might be changed. Figure 4 shows the problem graphically.

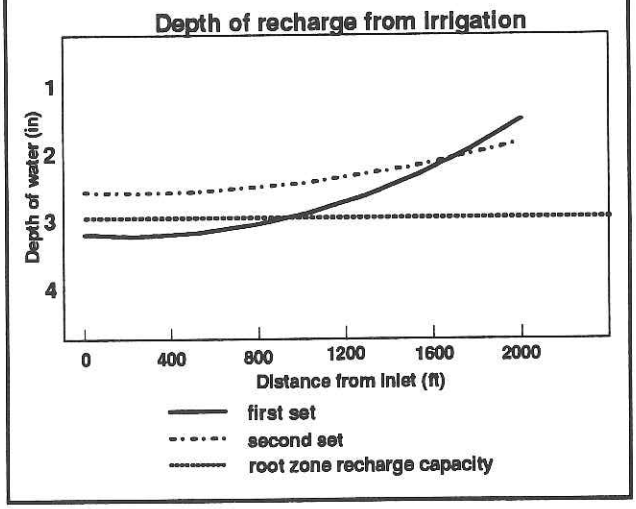
The Solution

A system has been developed to help farmers evaluate a furrow irrigation system without consuming too much time. The system has been computerized to accelerate the analysis and this computer program is called **the Volume Balance Model-Modified (VBMM).**

The system requires the following information:

1. soil texture (sand, loam, clay)
2. water flow rate in gallons/minute
3. set time in hours
4. average number of hours for water to move to the furrow end
5. average furrow length
6. average slope percent
7. average row spacing
8. average wetted furrow spacing (irrigating every row or every other row)
9. number of gates open
10. estimated soil moisture deficit in inches
11. furrow shape

Figure 5. Irrigation recharge example



The model will *estimate* the amount of infiltration at eight locations along the furrow. It will *estimate* how much water is running off the field. The model is not intended to give a precise description of what is occurring on the set because the data consists of estimates and averages. **It does give a basis for predicting what changes can be made to improve the system.** It is quick and easy and can be done in the course of routine field work.

The system was used on several fields in the 15-county Mid-Nebraska Water Quality Demonstration Project area. The following example is from a site in Clay County. Figure 5 on the previous page and Table 6 shows the effect of changing set time and gates on water distribution.

On his first set the farmer had adequate infiltration in the upper end of the field, but was not getting enough water into the lower end. If he simply ran his set longer, he would have improved the infiltration at the lower end of the field, but the cost would be excessive infiltration at the upper end.

The change from a 12-hour set to an eight-hour set, coupled with reducing gates from 60 to 40, resulted in reduced advance time from nine hours to four hours, which resulted in more even distribution of water on the field and no infiltration beyond the root zone.

This model is available by contacting an Extension Office or the Natural Resources Conservation Service.

An additional aid to determine if a system is providing a good distribution of water across the field is the concept of **cutoff ratio**. The cutoff ratio is obtained from the following formula: **Cutoff Ratio (CR) = advance time/set time.**

Table 7 shows recommended CR for different soil types and irrigation systems. Calculate the CR for the first set. If the ratio is smaller than recommended, the set time is too long in relation to the time it takes for water to move across the field. The results of a smaller than recommended CR is excessive runoff and/or water infiltration.

If the CR is much larger than recommended, it is taking too long for water to move across the field in relation to set time. The results of this situation is likely to be excessive infiltration of water on the upper end of the field.

Changes in set time, and/or number of gates open would improve the situation. Fewer gates open would likely improve the second situation.

Table 6. Effects of changing set time & gates on water distribution

	Set Time (hours)	Gates Open	Advance Time (hours)	Gross Application (hours)	Cutoff Ratio
Set 1	12	60	9	3.2	0.75
Set 2	8	40	4	3.2	0.5

•Assume a loam soil with a reuse pit.

Table 7. Recommended cutoff ratios

System Type	Recommended Cutoff Ratio		
	Sandy Soils	*Loamy Soils*	*Clayey Soils*
No Reuse	0.45	0.6	0.7
With Reuse	0.25	0.35	0.45
Blocked Ends	0.69	0.85	.9

Special Demonstrations - 1994

Inhibiting Urea Fertilizer to reduce ammonia volatilization

In 1994 cooperator Steve Yost demonstrated the potential for the urease inhibitor N-(n-butyl) thiophosphoric triamide (NBPT) to minimize nitrogen loss by ammonia volatilization of urea applied to ridge-till, irrigated corn.

Soil Samples

A University of Nebraska technician collected soil samples on April 27 from the demonstration area and UNL analyzed the samples for general fertility and residual nitrate-nitrogen. He drew general fertility samples to a depth of eight inches and residual nitrate-N samples to a depth of four feet.

Table 8. Soil test results

pH	6.35
Phosphorus (Bray-1, ppm)	18.00
Potassium (ppm)	465.00
Organic matter (%)	3.03
Zinc (DTPA, ppm)	1.66
Sodium (ppm)	13.00
Nitrate-nitrogen (4 ft. avg. ppm)	5.00
Nitrate-nitrogen (4 ft. avg. lb/a)	72.00

The site soil type was a Crete silt loam soil with a 0 to 1 percent slope. The location of the study area in relation to Steve's field, and the study layout, are shown in Figure 6 on the following page

Tillage and Fertilizer Application

Steve's 1993 crop at this site was corn. He shredded stalks, but didn't till the site. He planted corn on May 7.

Steve inadvertently applied 60 pounds of nitrogen per acre to the study area at planting time. Consequently, he applied the balance of the nitrogen (100 pounds of nitrogen per acre) as urea or urea+ NBPT on May 16, instead of applying all the nitrogen in one application as initially planned. When the corn was just emerging, Steve broadcast applied the fertilizer with a calibrated Barber spreader to strips eight rows wide (30-inch row width, 20-foot total width) by 200 feet long. He applied treatments in a paired comparison with four replications.

According to UNL recommendations Steve needed to apply 135 pounds per acre of nitrogen for an expected yield of 180 bushels per acre.

Chlorophyll Meter Readings

University technicians took initial chlorophyll meter readings on June 21, at growth stage V6-7, and on June 28, at growth stage V8. Each recorded observation was the average of 30 readings. There were no significant differences between fertilizer with NBPT and fertilizer without (see Table 9).

Irrigation Management

Steve furrow-irrigated this site, scheduling irrigation according to UNL procedure (see page 45 for Steve's irrigation BMPs).

UNL researchers collected climatic data from an automated weather station four miles away to monitor precipitation, air and soil temperatures.

Table 9. Chlorophyll readings & yield in four replicated treatment comparisons

Fertilizer Source	Replication	Chlorophyll Reading 6/21/94	Chlorophyll Reading 6/28/94	% Greensnap	Yield (bu/a)
Urea	1	53.70	56.00	34.50	179
Urea+NBPT	1	55.20	55.90	22.50	188
Urea+NBPT	2	55.30	57.70	19.00	183
Urea	2	54.10	57.80	26.00	168
Urea+NBPT	3	54.00	58.40	30.50	163
Urea	3	55.40	58.20	23.00	173
Urea	4	55.50	56.70	35.50	146
Urea+NBPT	4	54.80	59.10	28.50	150
Urea	MEAN	54.70	57.20	29.70	166
Urea+NBPT	MEAN	548.00	57.80	25.10	171
		NS	NS	NS	NS

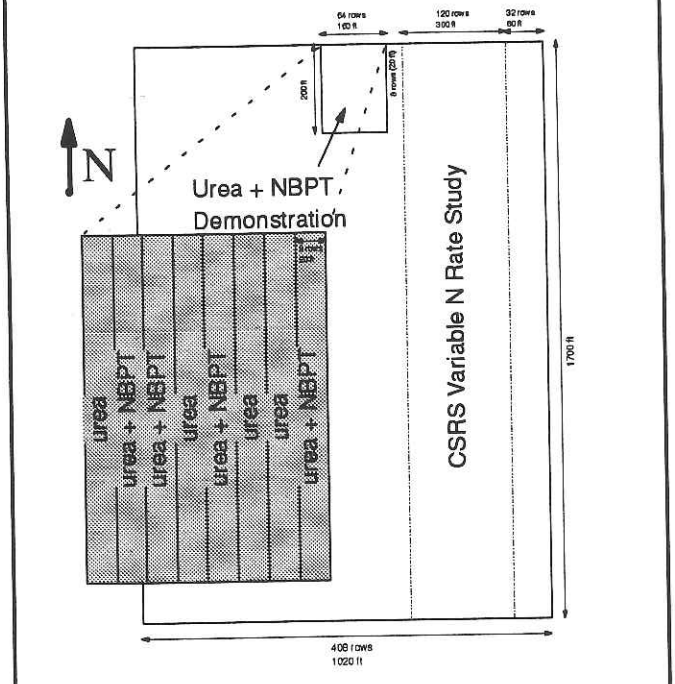
NS = not significant at the .05 level of significance

Steve recorded precipitation at the field. The first measurable precipitation, post-fertilization, .25 inches, occurred five days after the application. Steve measured .25 inches of rain two days later and .7 inches eight days later. Figure 7 is a summary of climatic conditions recorded at the automated weather station at fertilization.

Wind damage

On July 1, the site suffered substantial damage due to north winds clocked between 70 and 80 miles per hour. The crop was at about the V14 stage . The average stalk breakage in the study was 27 percent, with individual ranges from 16 percent to 49 percent. Figure 8 shows the negative correlation between stalk breakage and grain yield.

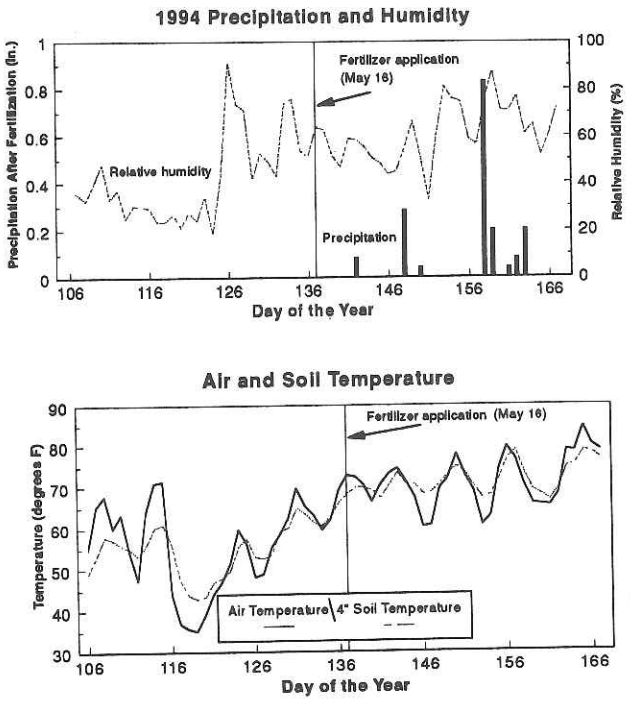
Figure 6. Plot design, NBPT demo - Steve Yost farm



Yield Results

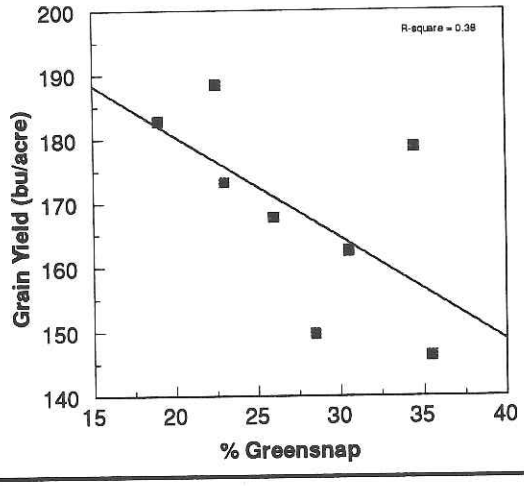
The middle four rows of the Urea/NBPT demonstration strips were harvested with a UNL combine and weigh wagon on October 14.

Figure 7. Climate data. NBPT demo. 1994



Although the average advantage using Urea+ NBPT fertilizer was 4.4 bushels per acre yield, the difference was not statistically significant (Table 9.). There was a significant replication effect due, in part, to variable wind damage. Soon after the July 1 windstorm, the yield differences between treatments were minimized due to reduced plant population.

Figure 8. Greensnap damage NBPT demo. 1994



Variable Rate Nitrogen Application

David Doremus and Colin Petersen, both in York County conducted variable rate nitrogen application demonstrations in 1994 in cooperation with the Great Plains Coop in Benedict.

The coop collected soil in the spring of 1994 in an alternating grid pattern every 200 feet down the row and every 48 feet (16 rows) across the field. A lab analyzed for soil samples for organic matter in the top eight inches and residual nitrate to a depth of three feet.

The producers and the coop established fertilizer treatment programs, which varied between the two sites. The Colin Petersen demonstration, had two treatments (fixed N rate and variable N rate) applied to six replications of field-length strips. Colin applied all nitrogen preplant. The David Doremus site had four treatments (fixed N rate, variable N rate, fixed preplant N rate plus sidedress, and variable preplant N rate plus sidedress) applied in four replications of field-length strips. The preplant sidedressed treatments received sidedress N were reduced by 45 pounds of nitrogen per acre.

Colin Peterson used the University of Nebraska nitrogen recommendation algorithm for corn to calculate nitrogen rates, calculating the fixed N rate based on an expected yield of 180 bushels per acre, an average of 7.6 ppm nitrate-nitrogen and 2.6 percent organic matter. The variable rate was based on an average expected yield of 180 bushels per acre and site-specific residual nitrate and organic matter.

David Doremus applied the fixed nitrogen rate treatment according to his standard practice. He calculated the variable and sidedress treatments according to the UNL nitrogen recommendation algorithm for corn. For the fixed+sidedress treatment he used an expected yield of 180 bushels per acre along with average values of 9.2 ppm nitrate-nitrogen and 2.8 percent organic matter. Variable and variable+sidedress treatments were based on an average expected yield and site specific residual nitrate and organic matter.

Table 10. N application amounts & yield-variable rate application demo. 1994

Cooperator	Treatment	Average N Applied (lb/a)	Variable Rate Range (lb/a)	Grain Yield (bu/a)
Doremus	Fixed	157		170
	Variable	110	54 to 117	168
	Fixed + sidedress	113		168
	Variable + sidedress	108	24 to 87	170
Petersen	Fixed	130	104 to 135	221
	Variable	123		221

Results

Soil residual nitrate and organic matter maps for both sites are shown in Figures 9 through 12. Colin Petersen's field generally showed less variability than David Doremus' in both residual nitrate and organic matter, but neither site had areas considered extreme for either variable. A summary of results from the two sites is shown in Table 10. There was no significant effect of treatment on grain yield at either site. Colin Peterson's farm produced excellent yields, with both the fixed and variable rate treatments, producing 221 bushels per acre On average, Colin applied slightly less nitrogen to the variable rate

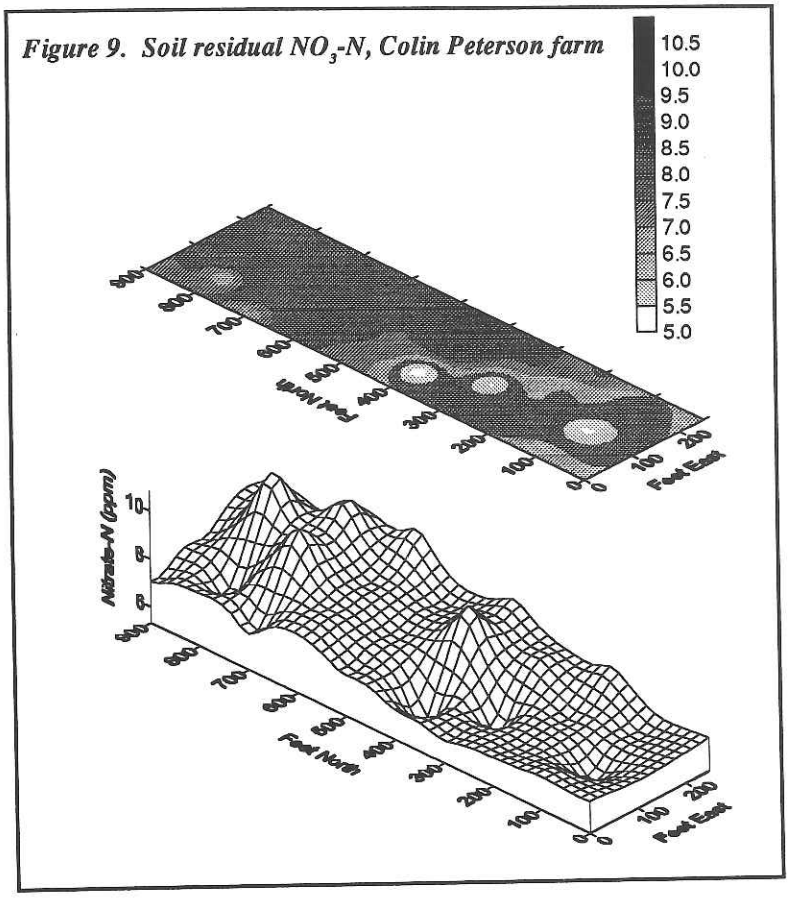


Figure 9. Soil residual NO_3-N, Colin Peterson farm

strips (123 pounds per acre) then he applied to the fixed rate strips (130 pounds per acre). This site demonstrated the soil's capability to mineralize nitrogen and produce optimum yield under good conditions where yield exceeded 220 bushels per acre even though Colin applied nitrogen for an only 180-bushel-per-acre expected yield.

Grain yield at the David Doremus site , although quite good, was likely reduced by hail which damaged the field on August 25. Treatment yields ranged from 168 to 170 bushels per acre, with no significant effect on yield by treatment. The average amount of nitrogen applied with the fixed N rate treatment was significantly higher than the other three treatments as David set it according to his standard practice rather than the UNL equation.

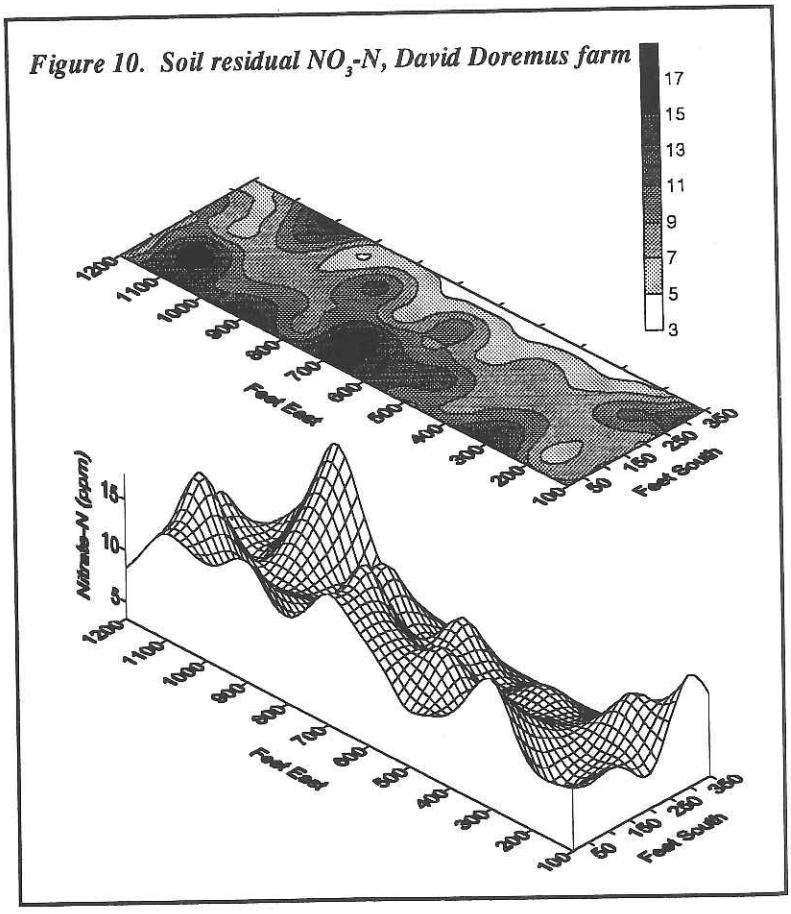


Figure 10. Soil residual NO_3-N, David Doremus farm

Summary

Results from these two sites in York County are consistent with observations at most other variable nitrogen rate research and demonstration sites. Total N applied was slightly less with variable rate application with no significant effect on grain yield. These results suggest variable rate-applied nitrogen may be potentially more efficient than uniform-applied nitrogen. The economic and environmental influences of variable rate nitrogen application are uncertain at this point. The costs currently associated with annual intensive grid soil sampling are greater than any savings using variable treatment compared to uniform treatment.

Researchers currently are evaluating the grid density required to adequately predict nitrogen rate, as well as ways to generate nitrogen recommendation maps without intensive soil sampling. Researchers also are studying the potential for variable rate nitrogen application to reduce residual nitrate in soil. If they can significantly reduce leached using variable rate application, the practice may be beneficial even with no substantial changes in yield or total applied nitrogen.

Figure 11. Soil organic matter, Colin Petersen farm

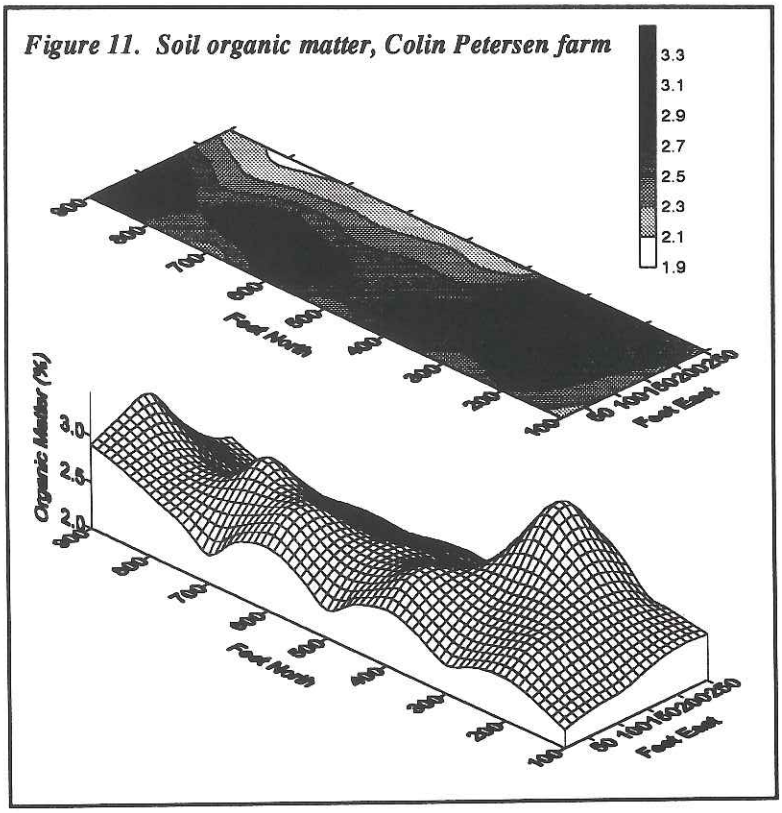
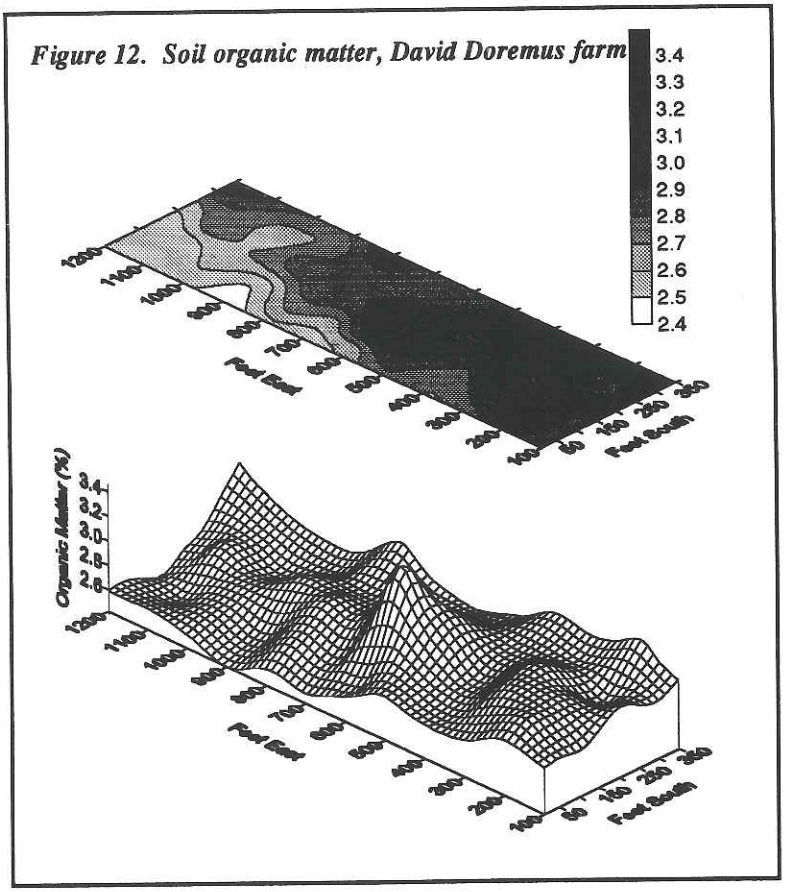


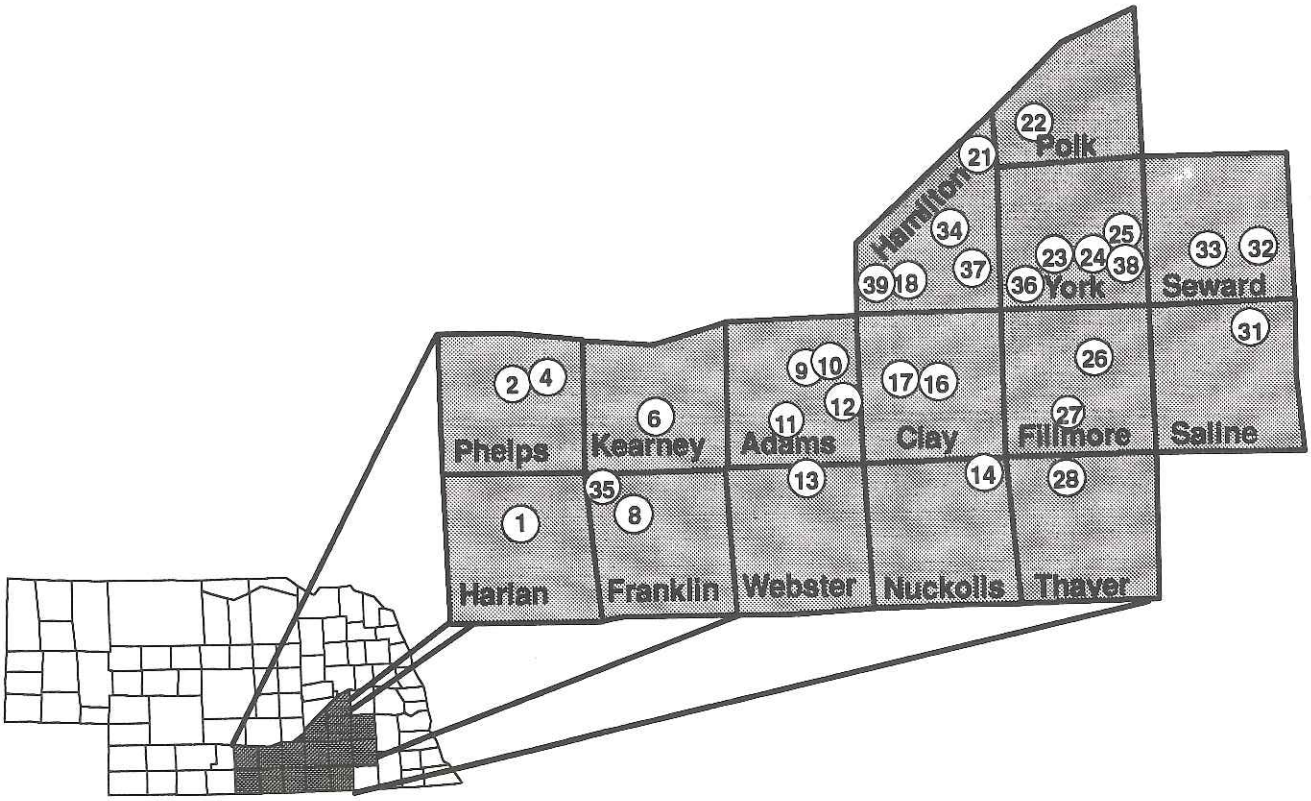
Figure 12. Soil organic matter, David Doremus farm



WATER QUALITY

Mid-Nebraska Demonstration Project

The project staff would like to thank the following for providing demonstration sites in 1994



1 Al Hollertz
2 Chris Erickson
4 Lloyd Erickson
6 Dean Casper
8 John & Gene Jelken
9 Milton Ruhter
10 Ramsey/McLeod
11 Christensen/Stevens
12 Bruce Bohlen
13 Kevin Karr
14 Lale Oellerich
16 Steve Yost
17 Dave Hamburger
18 Clayton Higgins
21 Joel Anderson
22 Mark Newcomer
23 Jerry Stahr-Pivot
24 Jerry Stahr-Gravity
25 Brad Rathje
26 Howard Lefler
27 Jim Bedlan
28 Leroy Voss
31 Wayne Hansen
32 Dean Rocker
33 Doug Cast
34 The Grain Place
35 Butch Ortgiesen
36 Brian Janzen
37 Deon Goertzen
38 Ron Uffelman
39 Deryl Bish

Table 13. Summary of practices and results from all the 1994 demonstration sites.

Site	--Used in N rate recommendation--			--Measured during season--			Nitrogen Rate	Yield[1]
	Expected Yield	Residual Soil NO_3-N	Gross Rainfall	Gross Irrigation	NO_3-N Content	Gross Water N Applied		
	bu/acre	lb/acre-4ft	inches	in/acre	ppm	lb/a	lbs/acre	bu/a
1	175	152	15.05	11.68	4.5	11.83	38 88R 138	163a 166a 164a
2	175	124	10.45	13.73	5.7	17.61	49 99R 149	202a 201a 202a
6	175	17	14.05	5.67	<1.0	0.00	124 174R 224	152b 164a 173a
8	160	76	11.45	13.12	8.5	25.09	56 106R 156	137b 153ab 160a
9	190	25	13.77	11.28	2.1	5.33	97 147R 197	145b 157a 160a
10	170	49	13.62	7.50	4.1	6.92	80 130R 180	112b 119ab 126a
11	200	61	16.10	13.81	2.1	6.53	139 189R 239	176b 180a 181a
12	160	91	13.85	5.16	8.4	9.75	62 112R 162	71 75 66
13	175	57	14.75	3.75	2.4	2.03	97 147R 197	165b 178a 189a
14	180	79	9.00	8.63	4.7	9.13	74 124R 174	164b 177a 177a
16	180	45	12.25	4.13	2.0	1.86	63 93 123 153R	118c 140b 153a 157a
17	190	102	10.95	10.96	6.3	15.54	69 119R 169	166ab 170a 162b
18	170	50	12.65	9.54	4.6	9.87	33 83R 133	133b 142a 145a
21	175	66	13.60	2.76	10.7	6.64	76 126R 176	156a 161a 161a
22	175	67	10.90	9.29	5.4	11.29	83 133R 163	168b 193a 199a

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

R=Recommended

Site	--Used in N rate recommendation--			--Measured during season--			Nitrogen Rate	Yield[1]
	Expected Yield	Residual Soil NO_3-N	Gross Rainfall	Gross Irrigation	NO_3-N Content	Gross Water N Applied		
	bu/acre	lb/acre-4ft	inches	in/acre	ppm	lb/a	lbs/acre	bu/a
23	185	43	12.60	4.29	6.4	6.18	113 163R 213	204a 211a 210a
24	185	68	12.60	10.94	7.9	19.45	89 139R 189	168b 177a 177a
25	200	54	13.05	5.50	<1.0	0.00	112 162R 212	176a 178a 179a
26	180	74	9.80	6.52	8.7	12.76	78 128R 178	184a 187a 187a
27	180	56	8.00	9.47	2.1	4.47	87 137R 187	182a 181a 181a
28	160	43	8.70	11.28	4.6	11.67	80 130R 180 200	176b 193a 200a 197a
31	170	51	14.65	11.93	1.1	2.95	88 138R 188	139b 156a 165a
32	180	67	11.45	8.62	5.1	9.89	50 100R 150	173b 189a 191a
33	180	56	10.80	2.46	17.6	9.74	84 134R 184	155b 170a 174a
35	175	41	8.70	26.73	2.4	14.43	116 166R 216	158b 176a 181a
36	170	73	9.55	16.55	2.6	9.68	82 132R 182	143a 142a 149a
37	190	80	15.65	6.01	7.1	9.60	76 126R 176	154b 174a 180a
38	200	123	10.80	NA	NA	0.00	0R 50 100	243a 244a 245a

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

R=Recommended

Individual Demonstration Plot Data Summaries

Please note:

Each site is unique; not all practices are demonstrated at each site. The basic format includes General Information, Nitrogen Management, Irrigation Management and Integrated Pest Management information. Some sites will have information on all of these categories, while others may not, depending upon the individual practices of each cooperator.

The rootzone graphs in the irrigation management sections of each site (where included) represent 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. It increases with time as the root zone expands. The middle line indicates soil moisture status and it is based on a volume balance using estimates of evapotranspiration. Rainfall and irrigation recharge the soil moisture. When the middle line reaches the upper line, runoff and/or deep percolation of water has occurred. Scheduling should attempt to recharge the soil before 50 percent depletion occurs, indicated by the lower line.

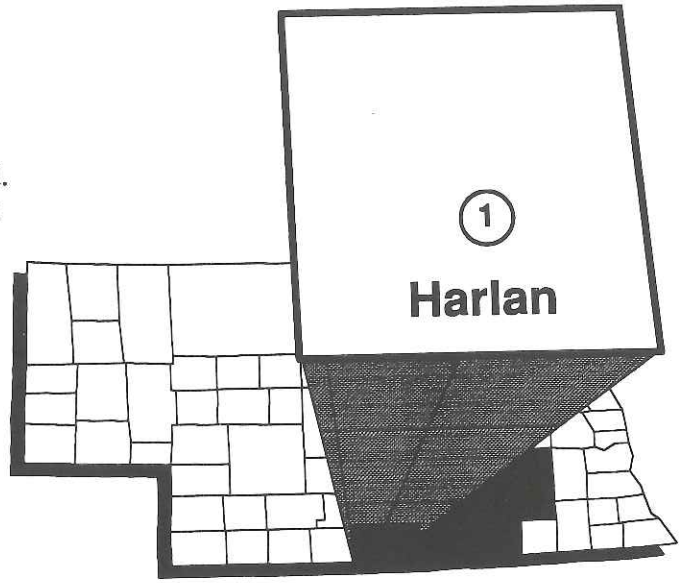
Site 1

Al Hollertz - Harlan County

General Information:

Site 1 is located seven miles south and two miles east of Holdrege on the Al Hollertz farm in Harlan County. Al rotates between corn/soybeans on this field. The soil type is a Holdrege silt loam with a 0-1 percent slope.

Al shredded stalks on April 1, 1994 and ridge planted Asgrow RX 897 on May 10, 1994.



Nitrogen Management

Al included nitrogen rate comparison plots in this field. The plots were six rows wide, 1168 feet long and replicated four times. After planting, Al broadcast applied 34 pounds phosphate and ten pounds of nitrogen, combined with herbicide on May 14, 1994. He sidedressed anhydrous ammonia in the bottom of the furrow on June 15, 1994.

The recommended rate of nitrogen was determined using a 175- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 175 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 4.5 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

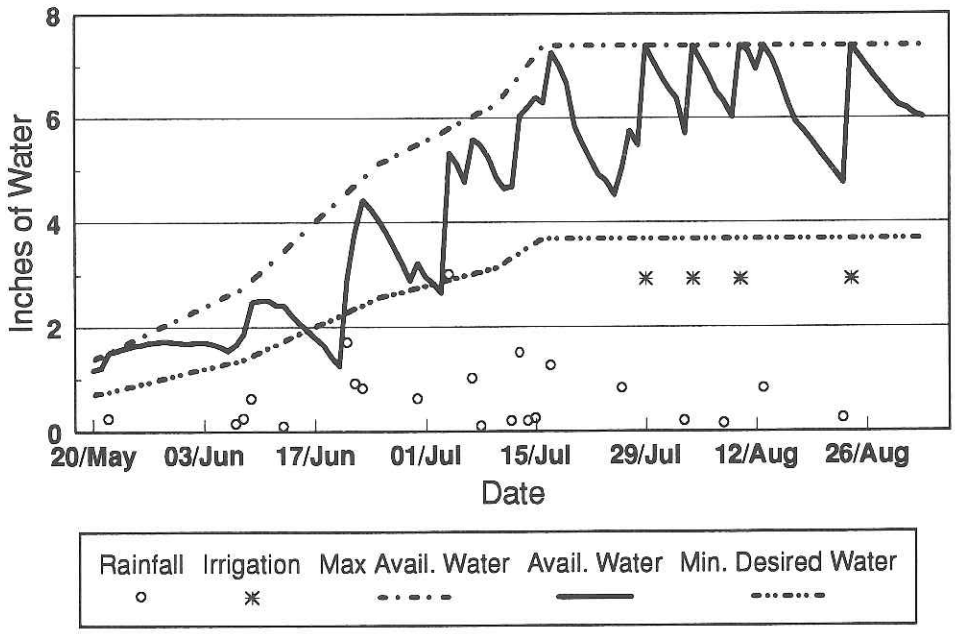
General Fertility	
pH	6.7
OM	2.40%
P	14 ppm
K	428 ppm
Zn	.95 ppm
S	4 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	38	88	138
Yield avg. (bu/acre)	163	166	164
Test wt. (lbs/acre)	56	56	56
Moisture (%)	16.8	16.4	16.5

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				60	165		
1990	**Rec**		126	175	110	166		
	50+				160	170		
	-50		55		110	167		
1991	**Rec**	14	50	175	160	172		
	50+		54		210	173		
	-50		56		40	135		
1993	**Rec**	14	68	175	90	136	Avg. N	Avg.
	50+		65		140	136	Applied	Yield
	-50		197		38	163	62	158
1994	**Rec**	14	152	175	88	166	112	160
	50+		219		138	164	162	161

Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Al scheduled irrigation in 1994 using soil moisture blocks, appearance and feel, and the checkbook methods. The field received 15.05 inches of rainfall between May 20 and September 2, 1994. Al applied 11.68 inches of water in four irrigation applications in 1994.



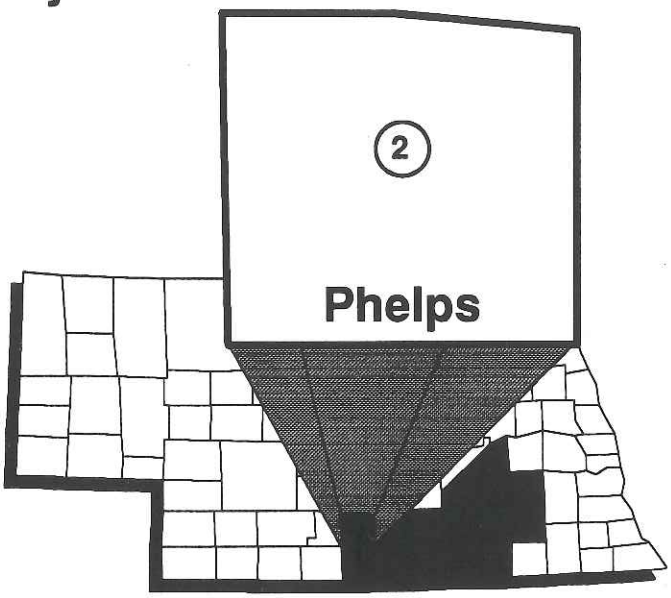
Site 2

Chris Erickson - Phelps County

General Information:

Site 2 is located on the Chris Erickson farm three miles east, two miles north and ¼ mile east of Holdrege. Chris has practiced continuous corn production on this field. The soil type is a Holdrege silt loam with a 0-1 percent slope.

Chris disked in the fall and spring field cultivated before planting Pioneer 3346 on April 23, 1994.



Nitrogen Management

Chris included nitrogen rate comparison plots in this field. The plots were 12 rows wide, 1335 feet long and replicated four times. He sidedressed anhydrous ammonia on June 6, 1994.

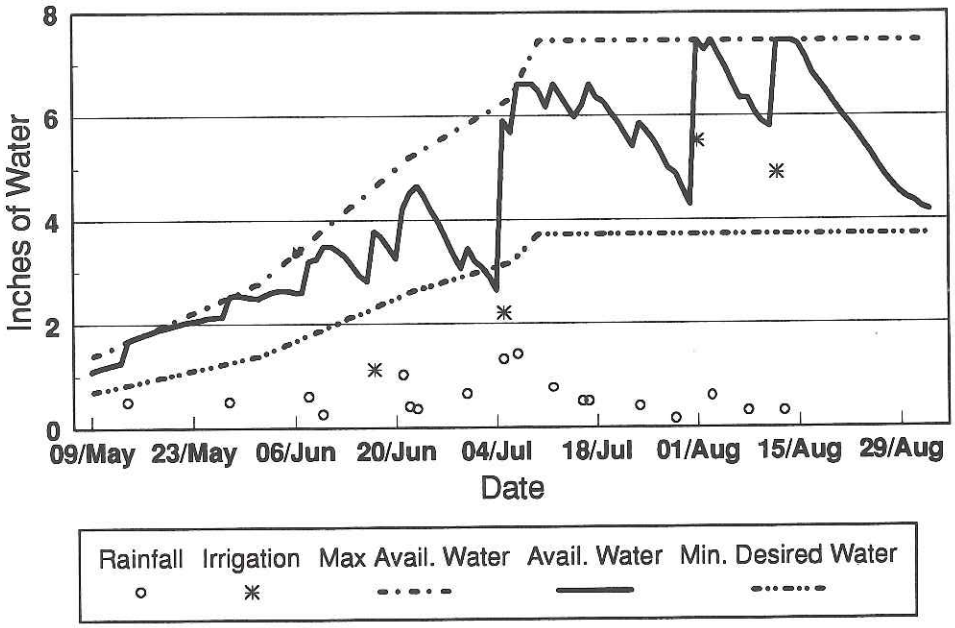
The recommended rate of nitrogen was determined using a 175- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 175 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 5.7 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

General Fertility	
pH	6.3
OM	2.50%
P	22 ppm
K	423 ppm
Zn	1.77 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	49	99	149
Yield avg. (bu/acre)	202	201	202
Test wt. (lbs/acre)	59	59	59
Moisture (%)	14.9	15	15.3

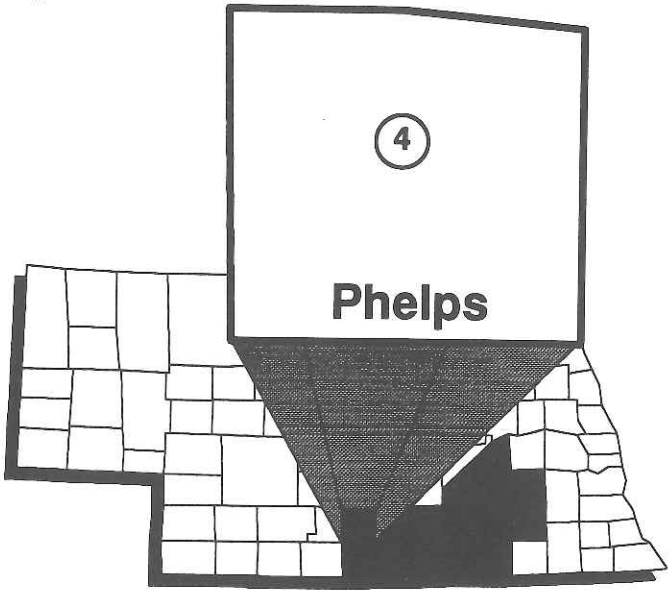
Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Chris scheduled irritation in 1994 using the appearance and feel and the checkbook methods. The field received 10.45 inches of rainfall between May 9 and September 2, 1994. Chris applied 13.73 inches of water in four irrigation applications in 1994.



Site 4

Lloyd Erickson - Phelps County



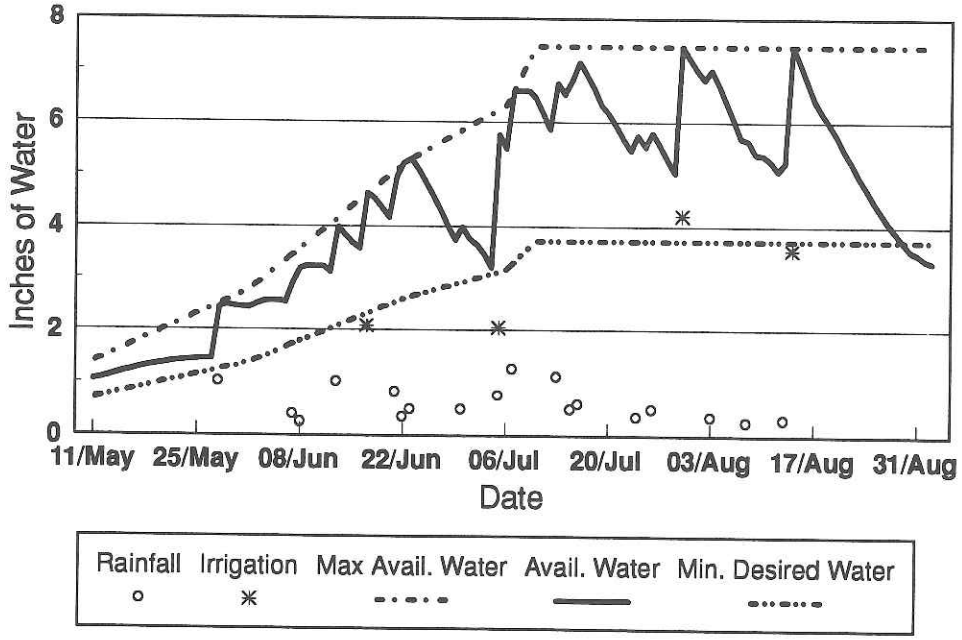
General Information:

Site 4 is located three miles north and ¼ mile east of Holdrege on the Lloyd Erickson farm in Phelps County. Lloyd has practiced continuous corn production in this field. The soil type is a Holdrege silt loam with a 0-1 percent slope.

Lloyd shredded stalks in the fall and followed up with rolling cutter on April 22, 1994. He planted Pioneer 3417 on April 23, 1994.

Irrigation Management

This site was gravity irrigated, using a surge valve, watering alternate (every other) furrows. Lloyd scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 10.75 inches of rainfall between May 11 and September 2, 1994. Lloyd applied 11.87 inches of water in four irrigation applications in 1994.



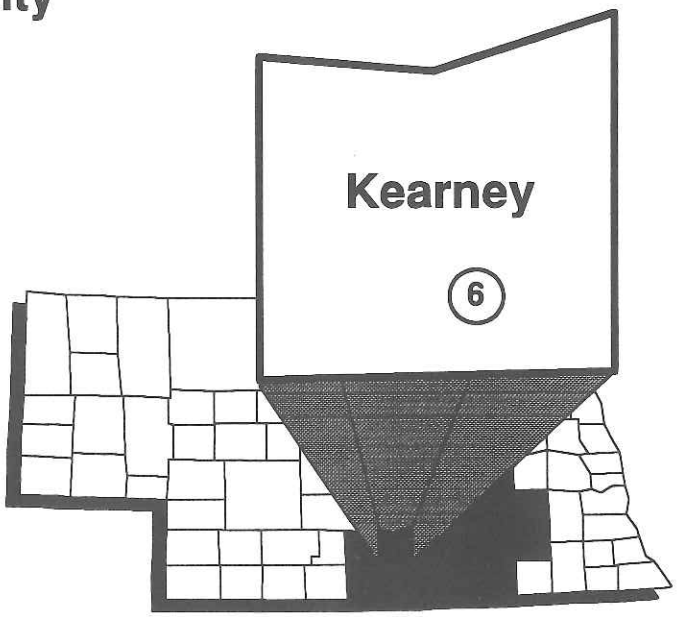
Site 6

Dean Casper - Kearney County

General Information:

Site 6 is located on the Dean Casper farm five miles south, three miles west and ¾ mile south of Minden in Kearney County. This site has been in continuous corn production. The soil type is a Holdrege silt loam with a 0-1 percent slope.

Dean shredded stalks on April 5, 1994 and planted Pioneer 3379 on April 27, 1994.



Nitrogen Management

Dean included nitrogen rate comparison plots in this field. The plots were six rows wide, 1204 feet long and replicated four times. Dean applied anhydrous ammonia preplant on April 4, 1994. At planting, he applied 35 pounds of nitrogen using 32-0-0 in a band.

The recommended rate of nitrogen was determined using a 175- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 175 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for less than 1.0 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

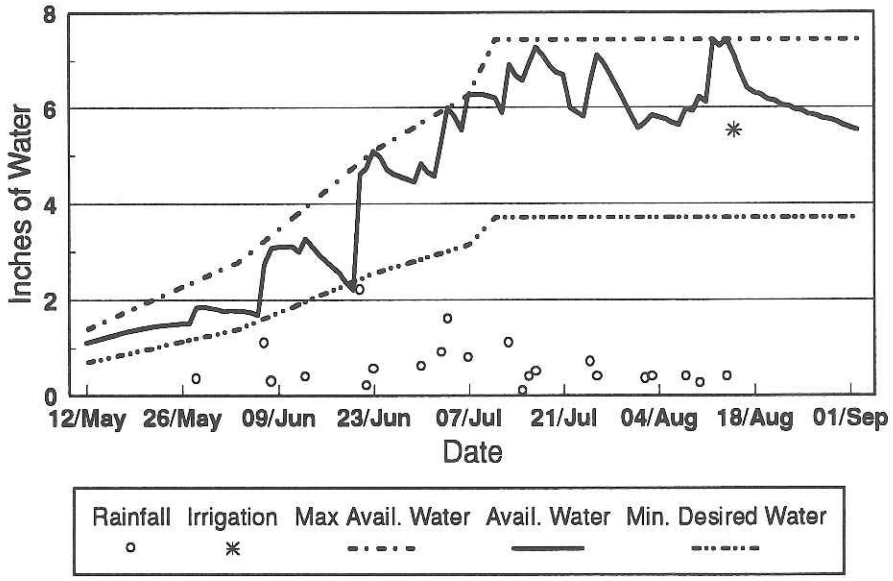
General Fertility	
pH	6.8
OM	2.40%
P	13 ppm
K	439 ppm
Zn	.74 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	124	174	224
Yield avg. (bu/acre)	152	164	173
Test wt. (lbs/acre)	56	56	56
Moisture (%)	15.1	15.7	17.1

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	5-Year Average	
	-50				75	148		
1990	**Rec**		110	175	125	165		
	50+				175	173		
	-50	2	25		148	140		
1991	**Rec**		33	175	198	160		
	50+		29		248	172		
	-50	3	10		158	139		
1992	**Rec**		13	175	208	148		
	50+		14		258	153		
	-50		20		124	90		
1993	**Rec**	3	16	175	174	99	Avg. N Applied	Avg. Yield
	50+		21		224	108		
	-50		17		124	152	126	134
1994	**Rec**	3	17	175	174	164	176	147
	50+		21		224	173	226	156

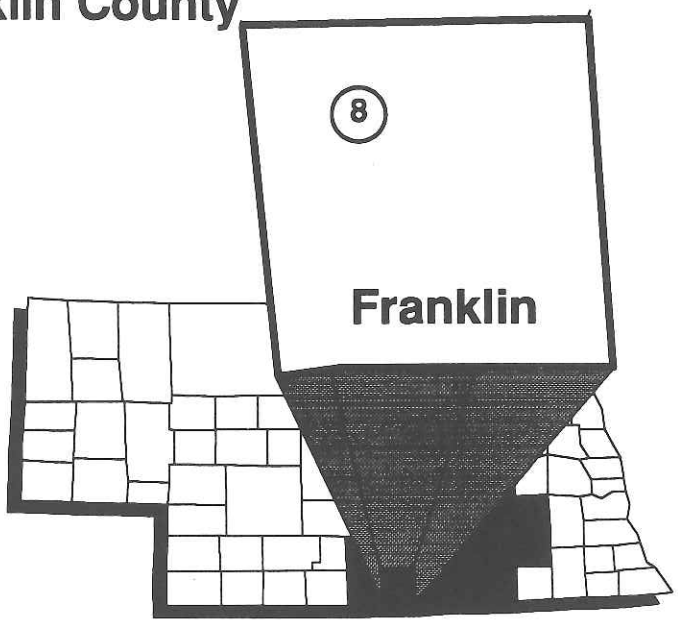
Irrigation Management

This site was gravity irrigated, watering every furrow. Dean scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 14.05 inches of rainfall between May 12 and September 2, 1994. Dean applied 5.67 inches of water in one irrigation in 1994.



Site 8

Gene & John Jelken - Franklin County



General Information:

Site 8 is located on the Gene and John Jelken farm five miles south and two miles west of the Hildreth corner on Highway 4 in Franklin County. They have practiced continuous corn production on this field. The soil type is a Holdrege silt loam with a 0-1 percent slope.

Gene's tillage practices included chopping stalks on April 10, 1994, disking on April 12, 1994 and rotatory hoeing on May 12, 1994. He planted Pioneer 3394 on April 27, 1994.

Nitrogen Management

Gene and John included nitrogen rate comparison plots in this field. The plots were 20 rows wide, 711 feet long and replicated four times. They broadcast applied nitrogen with a floater using 32-0-0 on May 5, 1994.

The recommended rate of nitrogen was determined using a 160- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 160 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 8.5 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

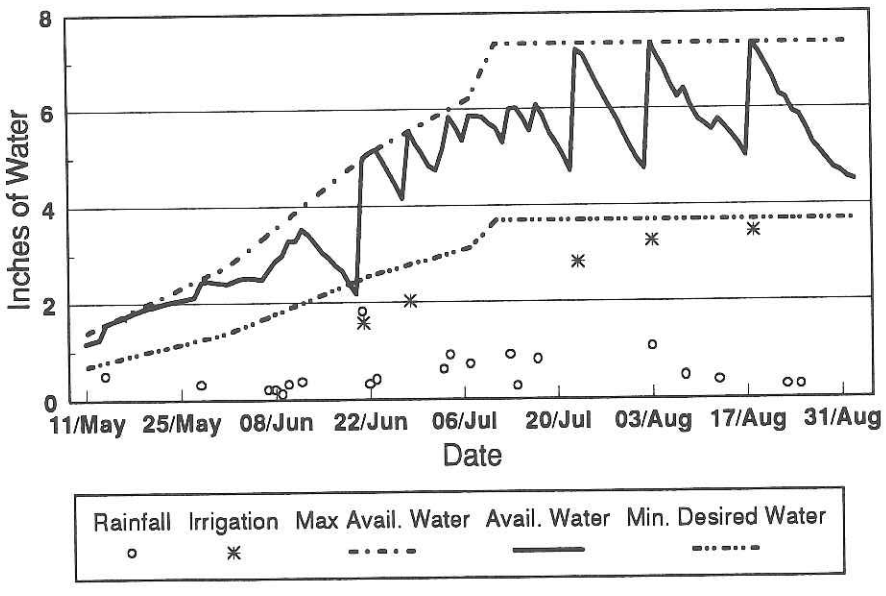
General Fertility	
pH	6.5
OM	2.7%
P	19 ppm
K	504 ppm
Zn	4.47 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	56	106	156
Yield avg. (bu/acre)	137	153	160
Test wt. (lbs/acre)	56	56	56
Moisture (%)	15.9	16.6	16.5

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	5-Year Average	
	-50				120	184		
1990	**Rec**		47	160	170	186		
	50+				220	176		
	-50		34		100	186		
1991	**Rec**	18	49	160	150	182		
	50+		64		200	188		
	-50		54		80	163		
1992	**Rec**	18	64	160	130	171		
	50+		49		180	168		
	-50		57		74	130		
1993	**Rec**	18	43	160	124	132	Avg. N Applied	Avg. Yield
	50+		69		174	133		
	-50		62		56	137	86	160
1994	**Rec**	18	76	160	106	153	136	165
	50+		92		156	165	186	165

Irrigation Management

This site was gravity irrigated using a surge valve, watering every furrow. The Jelkens scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 11.45 inches of rainfall between May 11 and September 2, 1994. The Jelkens applied 13.12 inches of water in five irrigation applications in 1994.



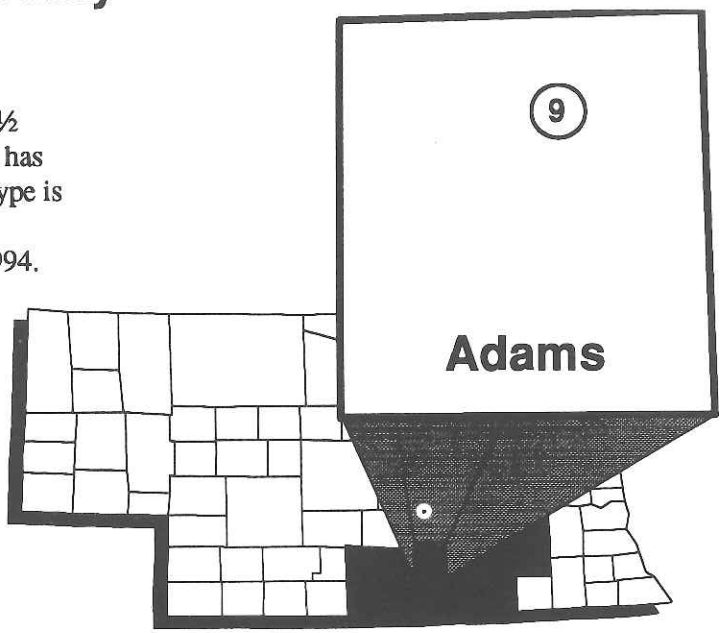
Site 9

Milton Ruhter - Adams County

General Information:

Site 9 is located on the Milton Ruhter farm 2½ miles south of Prosser in Adams County. Milton has rotated corn and soybeans on this site. The soil type is a Hord silt loam with a 0-1 percent slope.

Milton planted corn following soybeans in 1994. He leveled the lower end of his field and chiseled and disked it in the spring; he ridge planted the rest of the field. Milton planted Ohlde 226 on April 19, 1994.



Nitrogen Management

Milton included nitrogen rate comparison plots in this field. The plots were eight rows wide, 1916 feet long and replicated four times. Milton split-applied nitrogen using 28-0-0. He applied 10 gallons in a band at planting on April 19, 1994. During the first cultivation on May 27, Milton applied 22 gallons and he applied the remainder at hilling, on June 15, 1994.

The recommended rate of nitrogen was determined using a 190- bushel yield goal. The rate applied was calculated by subtracting soil, legume, and irrigation water nitrogen from the nitrogen required for 190 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 2.1 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

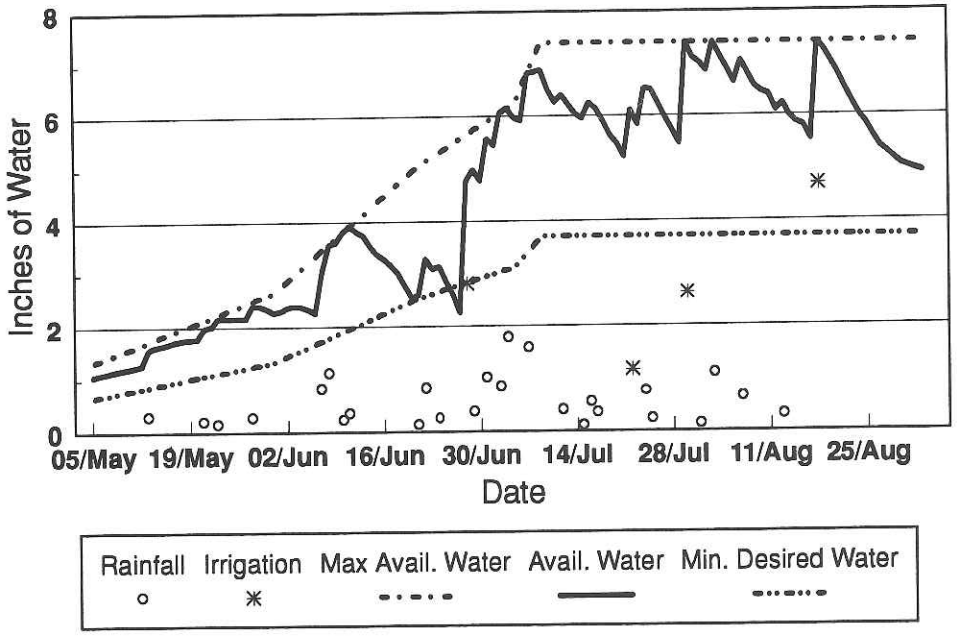
General Fertility	
pH	6.3
OM	2.0%
P	52 ppm
K	497 ppm
Zn	2.41 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	97	147	197
Yield avg. (bu/acre)	145	157	160
Test wt. (lbs/acre)	56	56	56
Moisture (%)	15.1	15.8	15.8

Year	Treatment	Water N (lbs/a)	Soil Res (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	5-Year Average	
1990	-50				90	174		
	Rec		51	180	140	172		
	50+				90	177		
1991	-50				65	179		
	Rec	8	76	190	115	184		
	50+				165	188		
1992	-50		58		75	188		
	Rec	6	60	190	125	185		
	50+		55		175	194		
1993	-50		51		79	94		
	Rec	6	53	190	129	94		
	50+		55		179	96	Avg. N Applied	Avg. Yield
1994	-50		28		97	145	81	156
	Rec	6	25	190	147	157	131	158
	50+		32		197	160	161	163

Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Milton scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. He also used soil moisture blocks to determine moisture status. The field received 13.77 inches of rainfall between May 5 and September 2, 1994. Milton applied 11.28 inches of water in four irrigation applications in 1994.



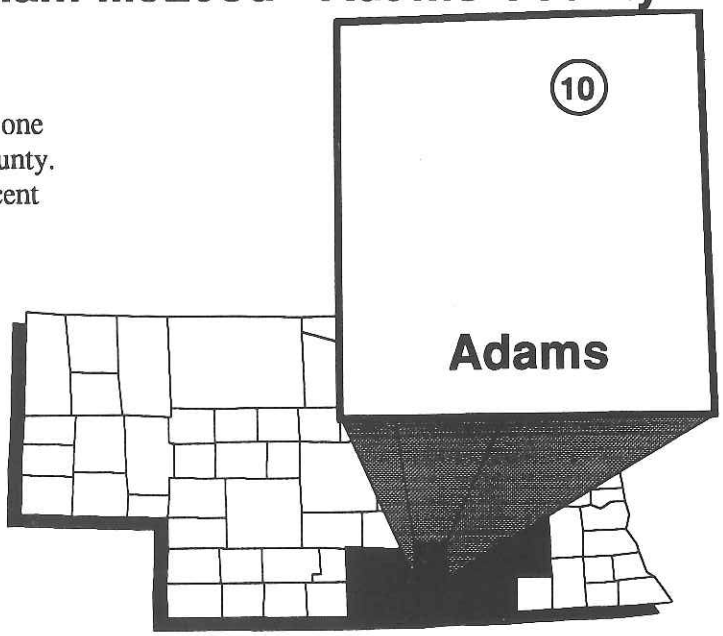
Site 10

Site 10 Myles Ramsey/William McLeod - Adams County

General Information:

Site 10 is located on the William McLeod farm one mile south and ½ mile east of Prosser in Adams County. The soil type is a Kenesaw silt loam with a 0-1 percent slope.

Myles disked prior to land leveling and then chiseled 8 inches deep in October, 1993. He shallow-field cultivated on May 8, 1994, before planting Golden Harvest 2530 on May 9, 1994.



Nitrogen Management

Myles included nitrogen rate comparison plots in this field. The plots were 12 rows wide, of varied length and replicated four times. Myles' yields were below the yield goal in 1994 due to 35 percent green snap. He applied nitrogen with four gallons 12-0-0-26 and six gallons 10-34-0 placed in a two-by-two band at planting. Myles sidedressed Anhydrous ammonia on June 3, 1994.

The recommended rate of nitrogen was determined using a 170- bushel yield goal. The rate applied was calculated by subtracting soil, manure, and irrigation water nitrogen from the nitrogen required for 170 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 4.1 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

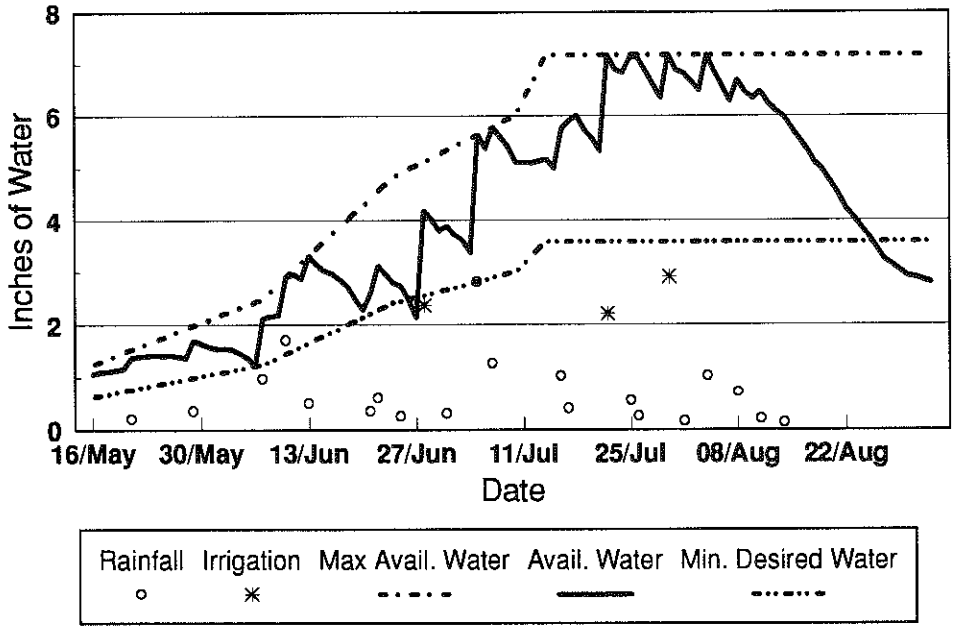
General Fertility	
pH	7.3
OM	1.10%
P	22 ppm
K	396 ppm
Zn	2.1 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	80	130	180
Yield avg. (bu/acre)	112	119	126
Test wt. (lbs/acre)	55	55	55
Moisture (%)	14.6	15.2	15.2

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				120	161		
1990	**Rec**		58	170	170	163		
	50+				220	162		
	-50		36		118	166		
1992	**Rec**	11	39	170	168	173		
	50+		46		218	175		
	-50		33		128	95		
1993	**Rec**	11	39	170	178	95	Avg. N Applied	Avg. Yield
	50+		70		228	95		
	-50				80	112	112	134
1994	**Rec**	11	49	170	130	119	162	138
	50+				180	126	212	140

Irrigation Management

This site was gravity irrigated using a surge valve, watering every furrow. Myles scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 13.62 inches of rainfall between May 16 and September 2, 1994. Myles applied 7.5 inches of water in three irrigations in 1994.



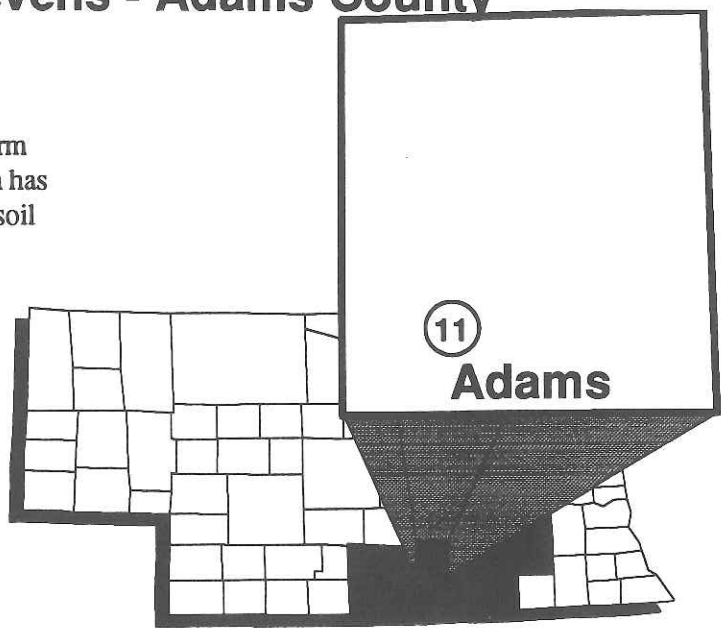
Site 11

Larry Christensen/Dan Stevens - Adams County

General Information:

Site 11 is located on the Christensen/Stevens farm five miles south of Holstein in Adams County. Dan has practiced a corn/soybean rotation on this site. The soil type is a Hord silt loam with a 0-1 percent slope.

Dan disked in November 1993 and then on May 5, 1994, when he planted Fontanelle 4832.



Nitrogen Management

Dan included nitrogen rate comparison plots in this field. The plots were eight rows wide, 2541 feet long and replicated four times. He sidedressed anhydrous ammonia on May 25, 1994. The field sustained up to 20 percent green snap in 1994, resulting in yields below the expected yield.

The recommended rate of nitrogen was determined using a 200-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 200 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 2.1 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

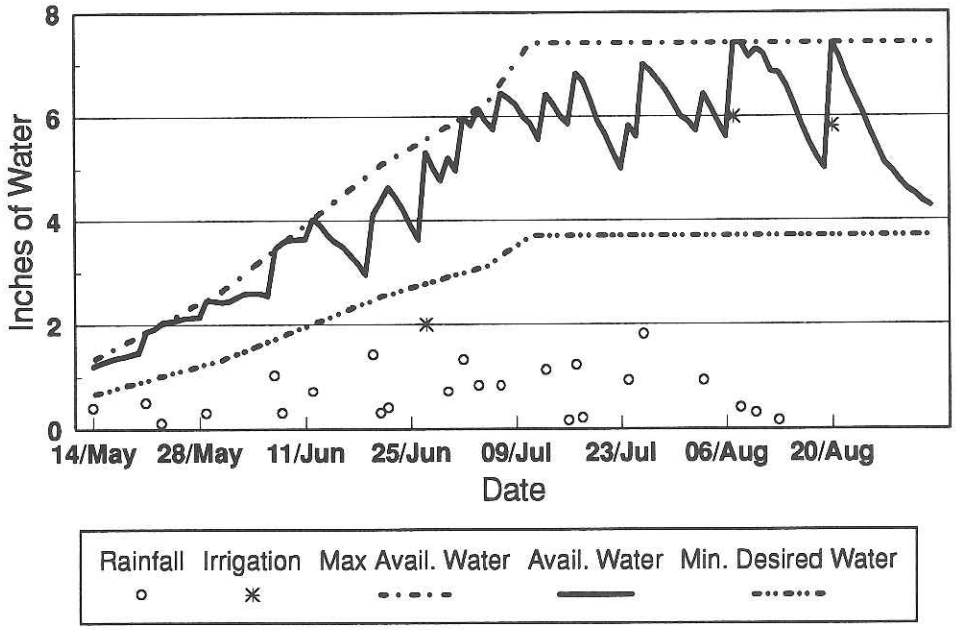
General Fertility	
pH	6.6
OM	1.70%
P	10 ppm
K	315 ppm
Zn	1.27 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	139	189	239
Yield avg. (bu/acre)	176	180	181
Test wt. (lbs/acre)	56	56	56
Moisture (%)	12.8	13.1	13.8

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				85	168		
1991	**Rec**		129	200	135	178		
	50+				185	182		
	-50		30		172	185		
1992	**Rec**	4	28	200	222	195		
	50+		24		272	197		
	-50		27		151	143		
1993	**Rec**	4	40	200	201	145	Avg. N Applied	Avg. Yield
	50+		54		251	142		
	-50		48		139	176	137	168
1994	**Rec**	4	61	200	189	180	187	175
	50+		92		239	181	237	176

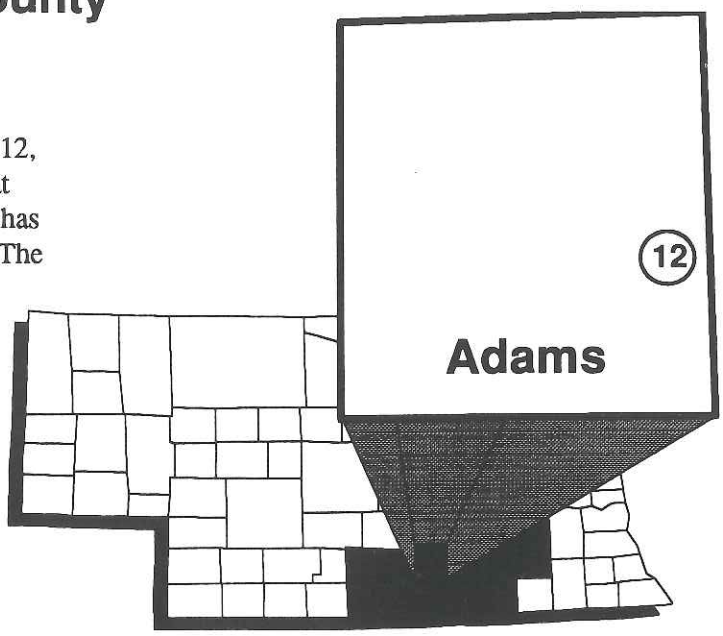
Irrigation Management

This site was gravity irrigated, watering every furrow. Dan scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 16.10 inches of rainfall between May 14 and September 2, 1994. Dan applied 13.81 inches of water in three irrigation applications in 1994.



Site 12

Bruce Bohlen - Adams County



General Information:

The Bruce Bohlen farm is the location of Site 12, one mile south of the Muriel Elevator on Showboat Road south of Hastings in Adams County. Bruce has kept this site in continuous seed corn production. The soil type is a Hastings silt loam with a 0-1 percent slope.

Bruce shredded stalks and disked in October 1993. He disked again April 10, 1994 and field cultivated before planting Pioneer seed corn (code name HEAP) on April 19, 1994.

Nitrogen Management

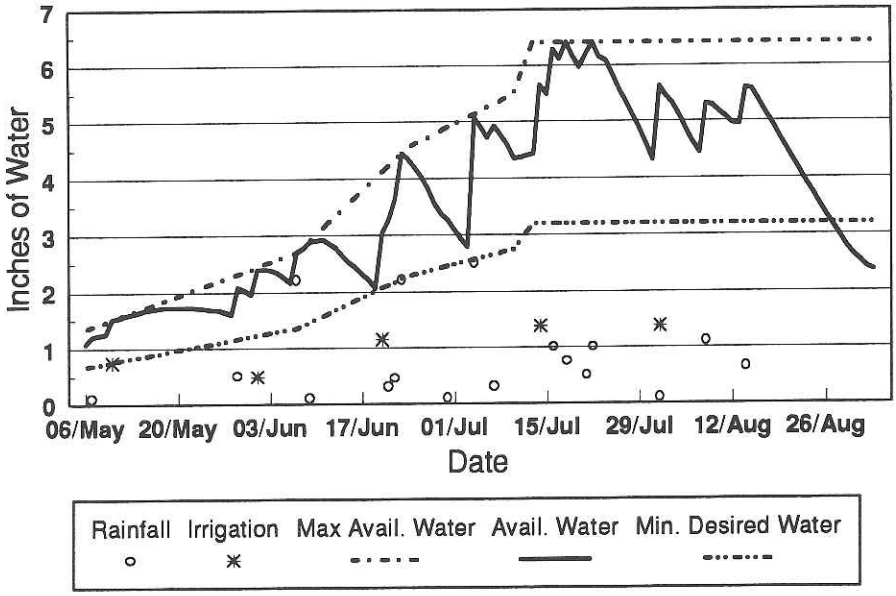
Bruce included nitrogen rate comparison plots in this field. The plots were eight rows wide, 2432 feet long and replicated four times. Bruce split-applied nitrogen with anhydrous ammonia preplant on April 2, 1994. At planting, he applied one gallon of 28-0-0, nine gallons of 10-34-0 plus one quart of zinc in a two-by-two placement on April 19, 1994.

The recommended rate of nitrogen was determined using a yield goal of approximately 60 to 80 bushels per acre. The rate applied was determined in consultation with Pioneer Hybrid, University of Nebraska South Central Research and Extension Center and Bruce. Seed corn yields are highly variable and this recommendation was consistent with the anticipated yield of this inbred. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 8.4 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

Irrigation Management

This site was pivot irrigated. Bruce scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 13.85 inches of rainfall between May 6 and September 2, 1994. Bruce applied 5.16 inches of water in five irrigation applications in 1994.

See page 15 for an explanation of the graph on the right.



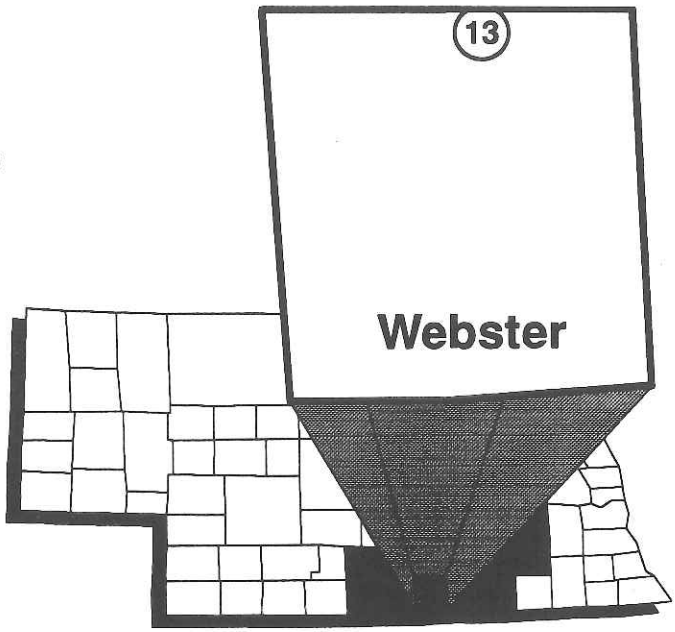
Site 13

Kevin Karr - Webster County

General Information:

Site 13 is located on the Kevin Karr farm ½ mile north of Bladen in Webster County. Kevin has kept this site in continuous corn production since 1990. The soil type is a Hastings silt loam with a 0-1 percent slope.

Kevin shredded stalks on April 1, 1994, before ridge planting Pioneer 3162 on April 21, 1994.



Nitrogen Management

Kevin included nitrogen rate comparison plots in this field. The plots were 12 rows wide, 1275 feet long and replicated four times. He applied anhydrous ammonia preplant between the old ridges on April 9, 1994. At planting, Kevin applied 3½ gallons of 10-34-0 in the seed furrow.

The recommended rate of nitrogen was determined using a 175- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 175 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 2.4 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

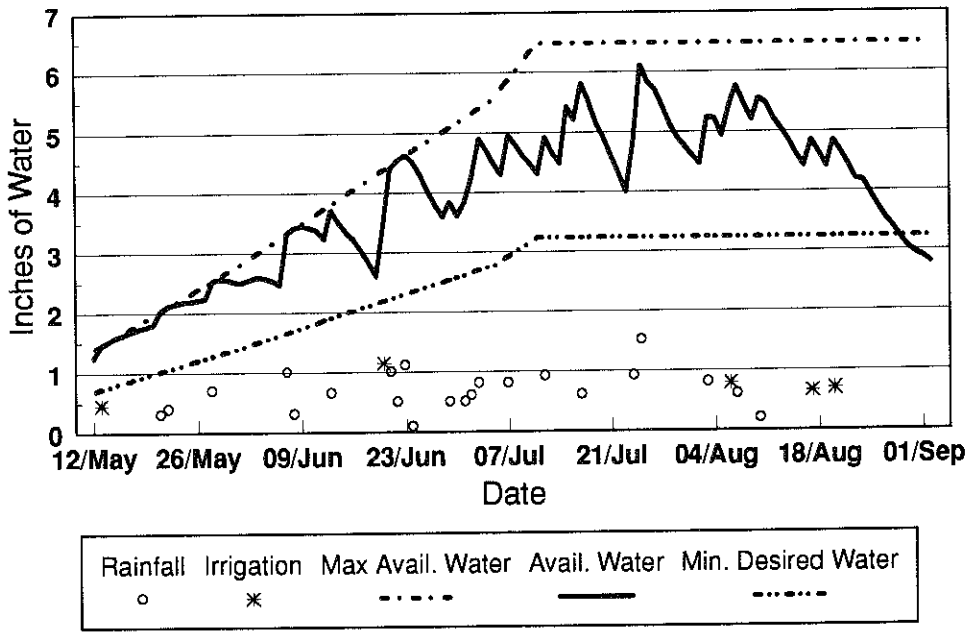
General Fertility	
pH	6.3
OM	2.40%
P	23 ppm
K	484 ppm
Zn	1.34 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	97	147	197
Yield avg. (bu/acre)	165	178	189
Test wt. (lbs/acre)	59	59	59
Moisture (%)	15.9	16.2	16.2

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				92	194		
1991	**Rec**		91	175	142	191		
	50+				192	199		
	-50		123		47	177		
1992	**Rec**	7	129	175	97	194		
	50+		187		147	196		
	-50		39		110	149		
1993	**Rec**	7	35	175	160	153	Avg. N Applied	Avg. Yield
	50+		43		210	154		
	-50		58		97	165	87	171
1994	**Rec**	7	57	175	147	178	137	179
	50+		81		197	189	187	185

Irrigation Management

This site was pivot irrigated. Kevin scheduled irrigation in 1994 using soil moisture blocks, appearance and feel, and the checkbook methods. The field received 14.75 inches of rainfall between May 12 and September 2, 1994. Kevin applied 3.75 inches of water in five irrigation applications in 1994.



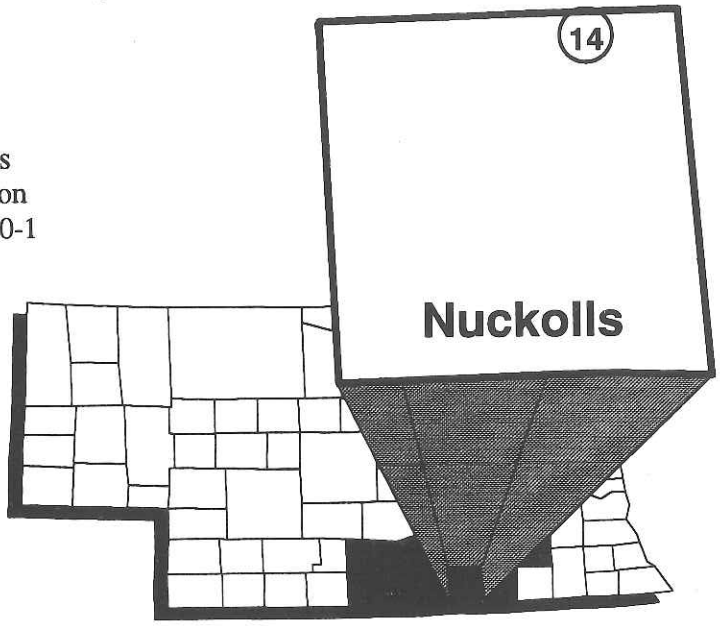
Site 14

Lale Oellerich - Nuckolls County

General Information:

Site 14 is located on the Lale Oellerich farm two miles west and ¼ mile south of Davenport in Nuckolls County. Lale has practiced continuous corn production in this field. The soil type is a Crete silt loam with a 0-1 percent slope.

Lale shredded stalks on April 5, 1994 and ridge planted Pioneer 3162 on April 27, 1994.



Nitrogen Management

Lale included nitrogen rate comparison plots in this field. The plots were eight rows wide, 1817 feet long and replicated four times. Lale applied anhydrous ammonia preplant on April 2, 1994.

The recommended rate of nitrogen was determined using a 180- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 180 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 4.7 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

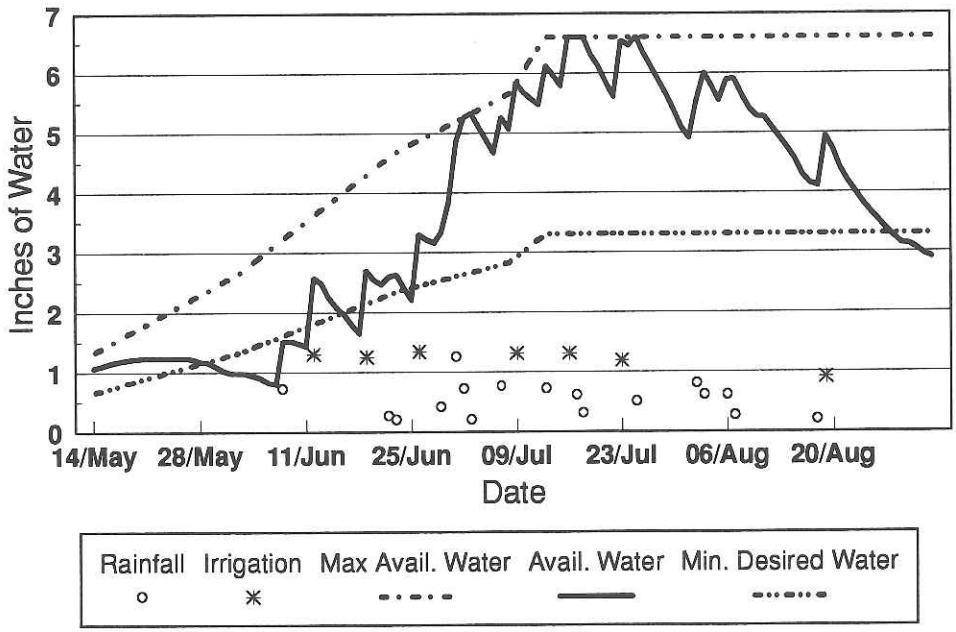
General Fertility	
pH	6.2
OM	3.00%
P	86 ppm
K	638 ppm
Zn	1.68 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	74	124	174
Yield avg. (bu/acre)	164	177	177
Test wt. (lbs/acre)	58	58	58
Moisture (%)	16.2	16.6	15.9

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50							
1990	**Rec**	17	314	180	0	163		
	50+				50	154		
	-50							
1992	**Rec**	17	586	180	0	153		
	50+		542		50	147		
	-50		51		86	126		
1993	**Rec**	7	57	180	136	138	Avg. N	Avg.
	50+		38		186	123	Applied	Yield
	-50		76		74	164	80	145
1994	**Rec**	7	79	180	124	177	65	158
	50+		98		174	177	115	150

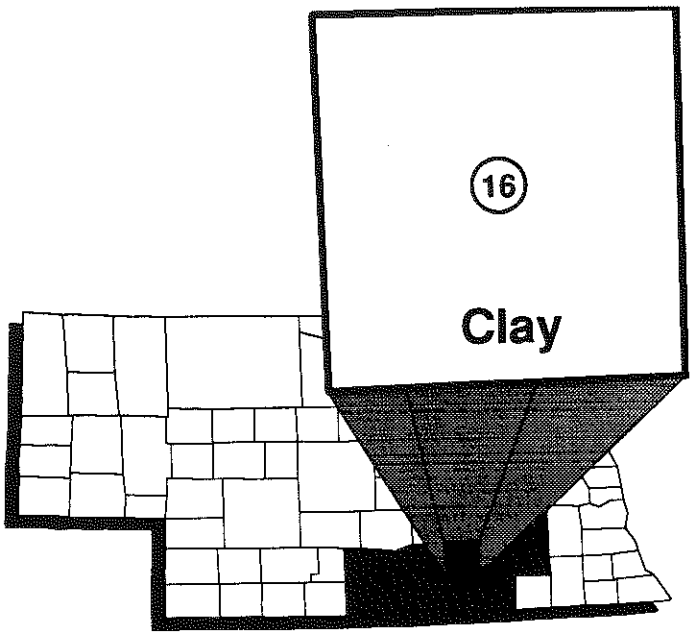
Irrigation Management

This site was pivot irrigated. Lale scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 9.0 inches of rainfall between May 14 and September 2, 1994. Lale applied 8.63 inches of water in seven irrigation applications in 1994.



Site 16

Steve Yost - Clay County



General Information:

Site 16 is located on the Steve Yost farm, four miles north and two miles west of Clay Center on U.S. Highway 6 in Clay County. Steve practices a corn/ soybean rotation program. In 1994, Steve planted corn. The soil type is a Crete silt loam with a 0-1 percent slope.

Steve shredded stalks November 1, 1993. He ridge planted Golden Harvest 2530 on April 25, 1994.

Nitrogen Management

Steve included nitrogen rate comparison plots in this field. The plots were eight rows wide, 2546 feet long and replicated four times. Steve's yields were lower than average this year due to 32 percent green snap from a July 1 wind storm. Steve split-applied nitrogen with 40 percent of the required amount at planting and 60 percent at cultivation using 28-0-0 liquid formulation.

The recommended rate of nitrogen was determined using a 180-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 180 bushels of corn. The soil nitrate was measured in 4-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 2.0 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

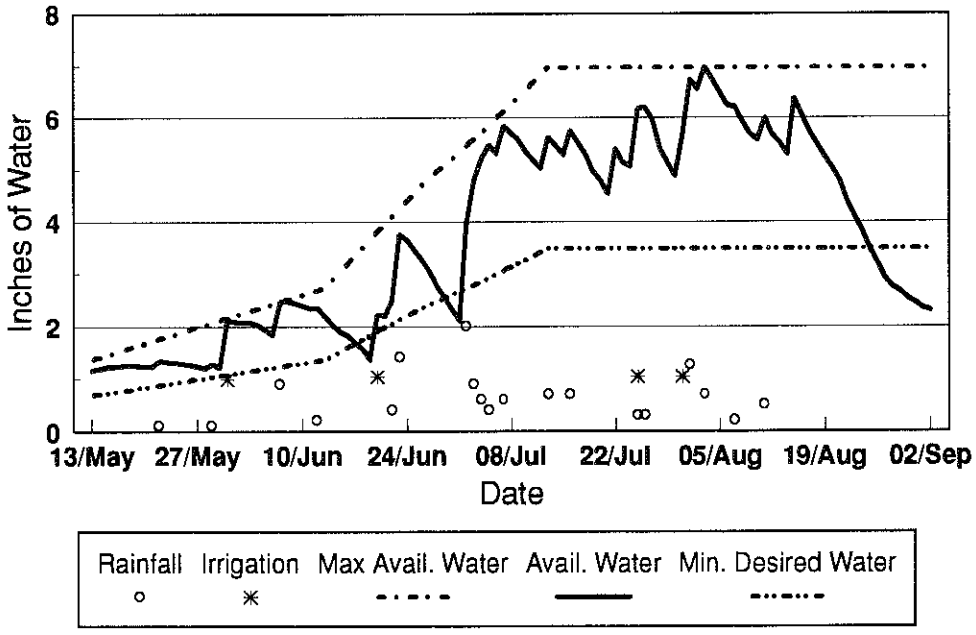
General Fertility	
pH	6.20
OM	2.70%
P	9 ppm
K	421 ppm
Zn	1.41ppm
S	5 ppm

Treatment-1994	Rec	-30	-60	-90
N rate (lbs/acre)	153	123	93	63
Yield avg. (bu/acre)	157	153	140	118
Test wt. (lbs/acre)	56	56	55	55
Moisture (%)	13.2	13.6	14.1	14

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	3-Year Average	
1991	**Rec**		23	180	215	177		
	-40				175	170		
	-80				135	171		
	-120				95	162		
1993	**Rec**	6	57	180	101	96		
	-30		53		71	108		
	-60		58		41	102	Avg. N Applied	Avg. Yield
	-90		51		11	98		
1994	**Rec**	6	45	180	153	157	156	143
	-30		36		123	153	123	144
	-60		39		93	140	90	138
	-90		32		63	118	56	126

Irrigation Management

This site was pivot irrigated. Steve scheduled in 1994 using soil moisture blocks, and the checkbook methods. The field received 12.25 inches of rainfall between May 13 and September 2, 1994. Steve applied 4.13 inches of water in four irrigations.



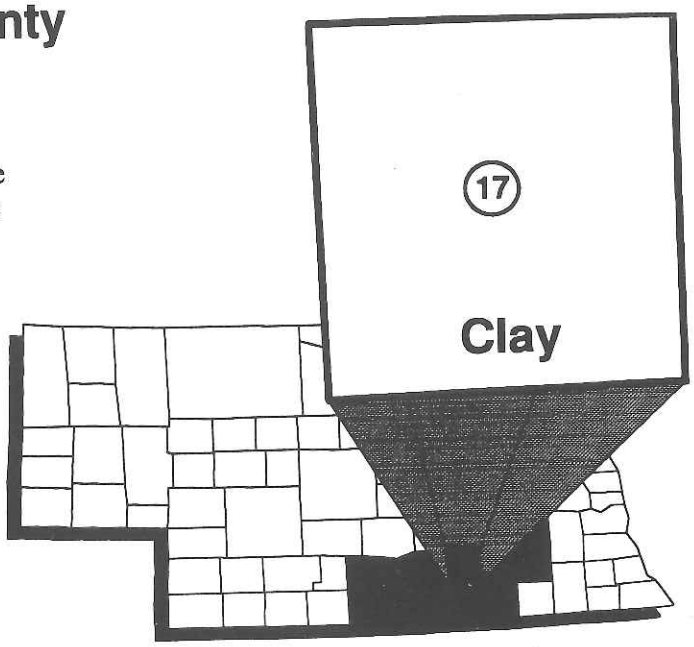
Site 17

Dave Hamburger - Clay County

General Information:

Site 17 is located on the Dave Hamburger farm one mile east of Inland on Highway 6 in Clay County. The soil type is a Crete silt loam with a 0-1 percent slope.

Dave disked on April 15 and April 30, 1994. He planted NC+ 6414 on May 5, 1994.



Nitrogen Management

Dave included nitrogen rate comparison plots in this field. The plots were 6 rows wide, 1614 feet long and replicated four times. Anhydrous ammonia was applied preplant on April 19, 1994. Dave's yield was below the yield goal due to 20 percent greensnap damage.

The recommended rate of nitrogen was determined using a 190- bushel yield goal. The rate to be applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 190 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 6.3 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit is calculated by multiplying the ppm nitrate by two. This is conservative and is based on a yearly application of nine inches of water.

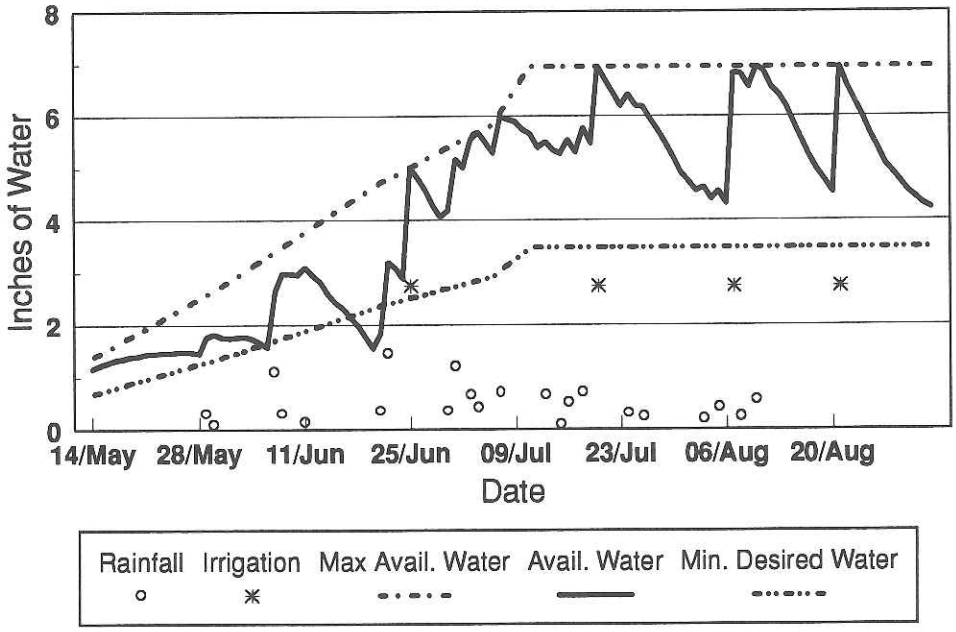
General Fertility	
pH	6.1
OM	2.80%
P	16 ppm
K	447 ppm
Zn	6.9 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	69	119	169
Yield avg. (bu/acre)	166	170	162
Test wt. (lbs/acre)	56	56	56
Moisture (%)	14.5	14.1	15.5

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				65	184		
1991	**Rec**		125	180	115	191		
	50+				165	195		
	-50		38		145	92		
1992	**Rec**	13	44	190	195	90		
	50+		38		245	88		
	-50		72		79	139		
1993	**Rec**	13	84	190	129	136	Avg. N	Avg.
	50+		128		179	132	Applied	Yield
	-50		77		69	166	90	145
1994	**Rec**	13	102	190	119	170	140	147
	50+		151		169	162	190	144

Irrigation Management

This site is gravity irrigated. Irrigation was scheduled in 1994 using the appearance and feel and checkbook methods. The field received 10.95 inches of rainfall between May 14 and September 2, 1994. Dave applied 10.96 inches of water in four irrigation applications in 1994.



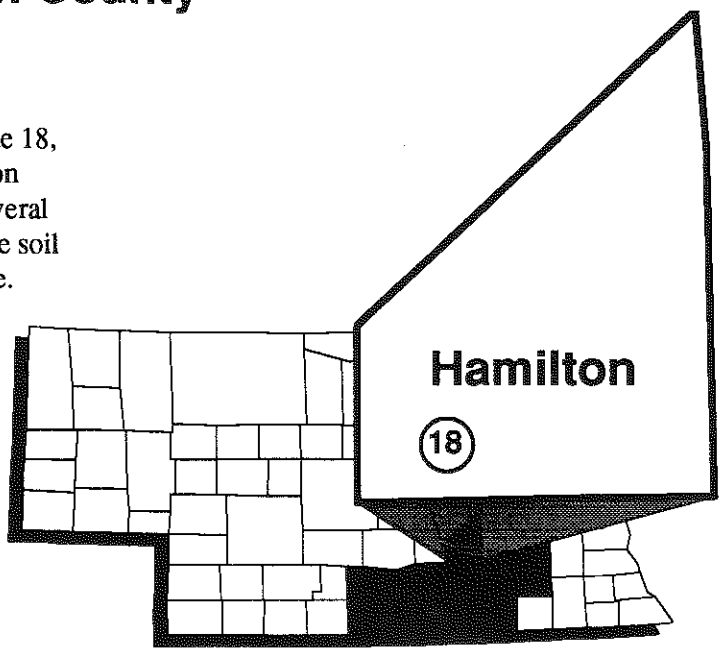
Site 18

Clayton Higgins - Hamilton County

General Information:

The Clayton Higgins farm is the location of Site 18, ½ mile west of Giltner in Hamilton County. Clayton kept this field in continuous corn production for several years then switched to a corn/soybean rotation. The soil type is a Hastings silt loam with a 0-1 percent slope.

Clayton shredded stalks on April 19, 1994 and then ridge planted Pioneer 3162 on April 20, 1994.



Nitrogen Management

Clayton included nitrogen rate comparison plots in this field. The plots were 12 rows wide, 1053 feet long and replicated four times. He applied anhydrous ammonia preplant on March 24, 1994 and he applied five gallons of 10-34-0 in the furrow at planting. Clayton's yields were below the yield goal due to 24 percent green snap.

The recommended rate of nitrogen was determined using a 170- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrogen from the nitrogen required for 170 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water accounted for 4.6 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

General Fertility	
pH	6.2
OM	3.20%
P	24 ppm
K	566 ppm
Zn	1.7 ppm

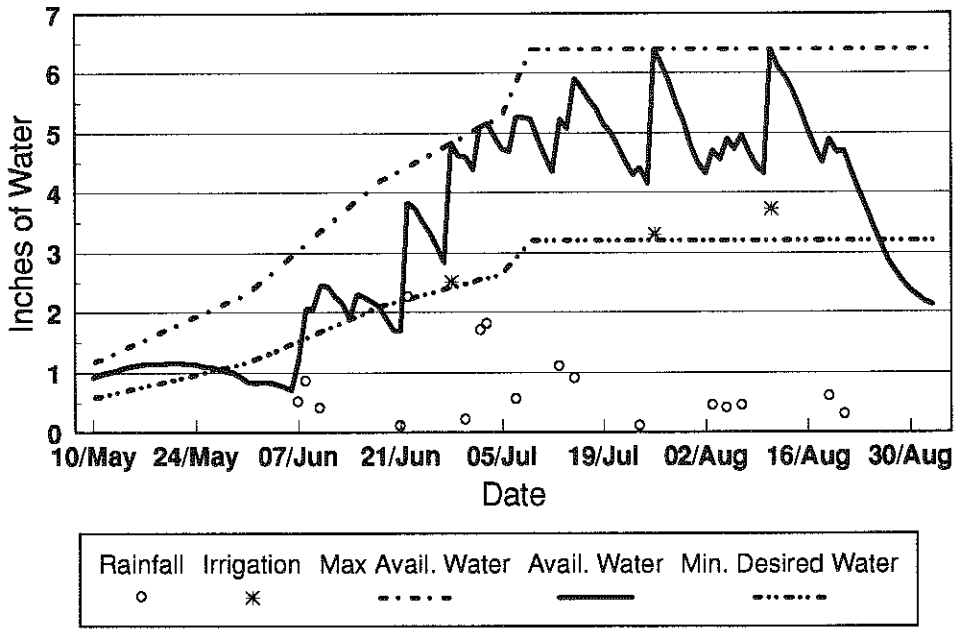
Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	33	83	133
Yield avg. (bu/acre)	133	142	145
Test wt. (lbs/acre)	55	55	55
Moisture (%)	17.9	17.9	18.5

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)		
	-50 NH3				58	152		
	-50 LIQ				58	154	2-Year Average	
1991	**Rec**		132	180	108	168		
	Rec LIQ				108	169	Avg. N Applied	Avg. Yield
	50+ NH3				158	167		
	-50NH3				150	151	104	152
	-50 LIQ				150	143	104	149
1992	**Rec NH3**				200	157	154	163
	Rec LIQ				200	152	154	161
	50+ NH3				250	152	204	160
1993		soybeans were planted in the plot area in 1993					3-Year Average	
	-50				33	133	80	145
1994	Rec	7	50	170	83	142	130	156
	50+				133	145	180	155

Irrigation Management

Clayton used a surge valve on this gravity irrigated site, watering alternate (every other) furrows. Clayton scheduled irrigation in 1994 using soil moisture blocks, the appearance and feel and checkbook methods. The field received 12.65 inches of rainfall between May 10 and September 2, 1994. Clayton applied 9.54 inches of water in three irrigation applications in 1994.

See page 15 for an explanation of the graph below.



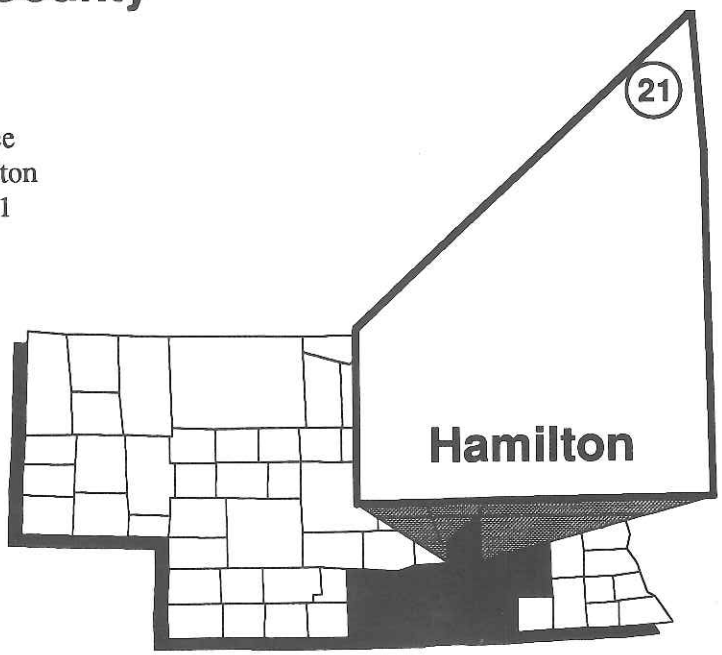
Site 21

Joel Anderson - Hamilton County

General Information:

Site 21 is located on the Joel Anderson farm three miles east and two miles south of Hordville in Hamilton county. The soil type is a Holder silt loam with a 0-1 percent slope.

Joel shredded stalks in the fall of 1993. He ridge planted Pioneer 3417 on April 26, 1994.



Nitrogen Management

Joel included nitrogen rate comparison plots in this field. The plots were six rows wide, 2662 feet long and replicated four times. He applied the entire amount of nitrogen in a preplant application using anhydrous ammonia. Joel's yields were less than expected due to approximately 30 percent greensnap from a July 1 wind storm.

The recommended rate of nitrogen was determined using a 175-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 175 bushels of corn. The soil nitrate was measured in four-feet deep soil samples. Irrigation water credit was calculated by multiplying the ppm nitrate by two. The irrigation nitrogen accounted for 10.7 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

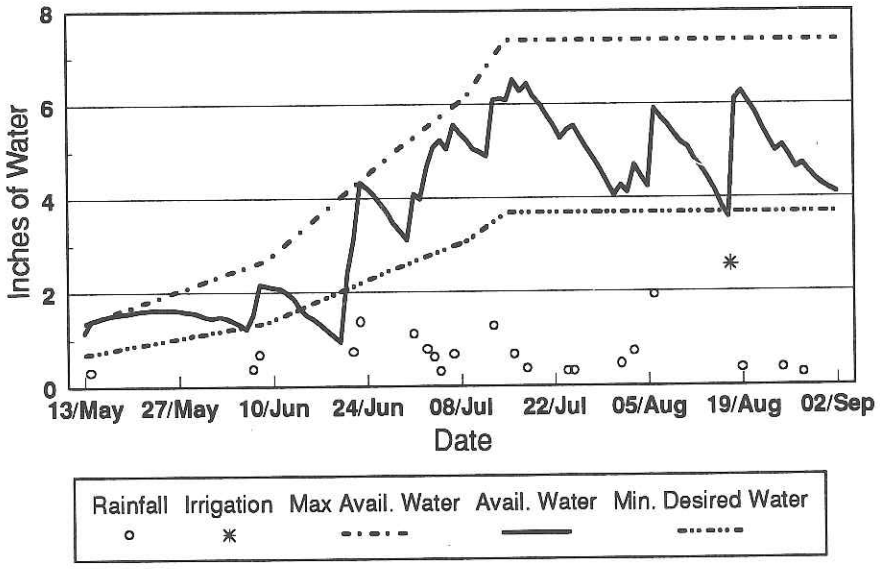
General Fertility	
pH	6.3
OM	2.80%
P	23 ppm
K	475 ppm
Zn	2.13 ppm

Treatment-1994	-50	Rec	+30
N rate (lbs/acre)	76	126	176
Yield avg. (bu/acre)	156	161	161
Test wt. (lbs/acre)	58	58	58
Moisture (%)	13.7	13.3	13.3

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	2-Year Average	
	-50				82	103		
1993	**Rec**	14	41	175	132	118	Avg. N Applied	Avg. Yield
	50+				182	120		
	-50		49		76	156	79	130
1994	**Rec**	14	66	175	126	161	129	140
	50+		63		176	161	179	141

Irrigation Management

This site was gravity irrigated, watering every row. Joel scheduled irrigation in 1994 based on the appearance and feel and the checkbook methods. The field received 13.60 inches of rainfall between May 13 and September 2, 1994 and Joel applied 2.76 inches of water in one irrigation.



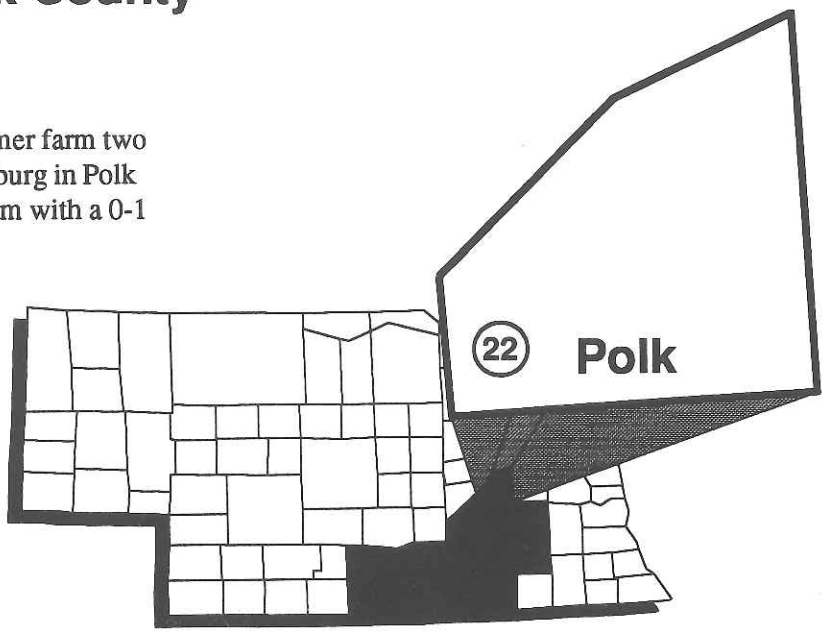
Site 22

Mark Newcomer - Polk County

General Information:

Site 22 is located on the Mark Newcomer farm two miles south and three miles east of Stromsburg in Polk county. The soil type is a Hastings silt loam with a 0-1 percent slope.

Mark shredded stalks in the fall of 1993. He planted Pioneer 3162 on April 30, 1994.



Nitrogen Management

Mark included nitrogen rate comparison plots in this field. The plots were 14 rows wide, of varied length, and replicated four times. Mark applied the entire amount of nitrogen as anhydrous in a sidedress application on May 27, except for six pounds which he applied with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 175-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 175 bushels of corn. The soil nitrate was measured in four feet deep soil samples taken from the 1992 recommended rate strips. The irrigation nitrogen accounted for 5.4 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

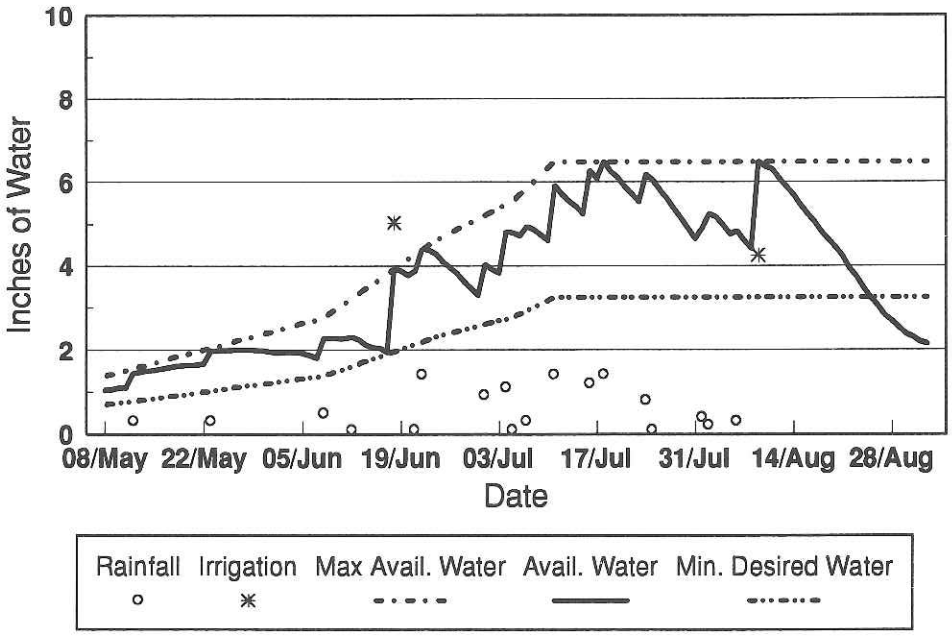
General Fertility	
pH	6.3
OM	2.60%
P	19 ppm
K	375 ppm
Zn	.79 ppm

Treatment-1994	-50	Rec	+30
N rate (lbs/acre)	83	133	163
Yield avg. (bu/acre)	168	193	199
Test wt. (lbs/acre)	58	57	58
Moisture (%)	15.3	15.3	16.3

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)
	-50				145	185
1990	**Rec**	9	29	175	195	185
	30+				225	185
	-50		40		135	160
1991	**Rec**	3	43	175	185	157
	30+		46		215	159
	-50		127		62	197
1992	**Rec**	12	99	175	112	190
	30+		99		142	199
	-50		62		38	149
1993	**Rec**	12	66	175	88	145
	30+		58		118	150
	-50		46		83	168
1994	**Rec**	11	67	175	133	193
	30+		54		163	199

Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Mark used a reuse pit to irrigate this field. He scheduled irrigation in 1994 using soil moisture blocks and the checkbook methods. The field received 10.90 inches of rainfall between May 8 and September 2 and Mark applied 9.29 inches of water in two irrigations.



Site 23

Jerry Stahr - York County

General Information:

Site 23 is located three miles east of the York junction of Highways 81 and 34 in York County on the Jerry Stahr farm. Jerry has kept this site in continuous corn production. The soil type is a Hastings silt loam with a 0-1 percent slope.

Jerry shredded stalks on April 7, 1994, before ridge planting Golden Harvest 2530 on April 23, 1994.

Nitrogen Management

Jerry included nitrogen rate comparison plots in this field. The plots were eight rows wide, 2542 feet long, and replicated four times. Jerry applied the entire amount of nitrogen as anhydrous on April 5, 1994, except for five pounds which he applied with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 185-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 185 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 6.4 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

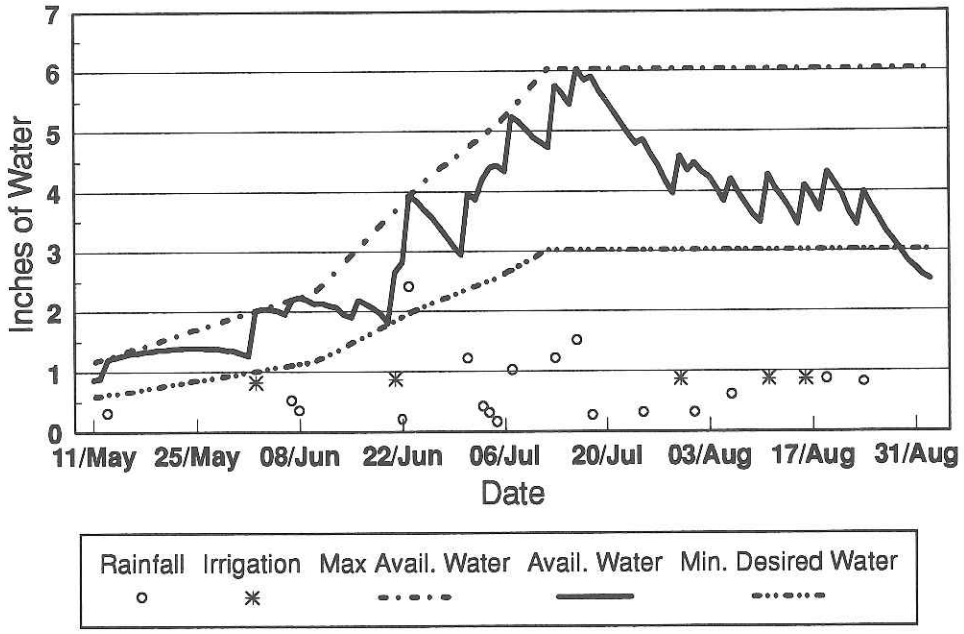
General Fertility	
pH	6.6
OM	2.70%
P	27 ppm
K	342 ppm
Zn	1.04 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	113	163	213
Yield avg. (bu/acre)	204	211	210
Test wt. (lbs/acre)	56	56	56
Moisture (%)	16.8	16.8	16.8

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				105	190		
1991	**Rec**		88	185	155	193		
	50+				205	197		
	-50		14		165	176		
1992	**Rec**	10	19	185	215	175		
	50+		21		265	174		
	-50		34		116	106		
1993	**Rec**		37	185	166	110	Avg. N Applied	Avg. Yield
	50+		36		216	110		
	-50		52		113	204	125	169
1994	**Rec**		43	185	163	211	175	172
	50+		54		213	210	225	173

Irrigation Management

This site was pivot irrigated. Jerry scheduled irrigation in 1994 using soil moisture blocks and the checkbook methods. The field received 12.60 inches of rainfall between May 11 and September 2, 1994 and Jerry applied 4.29 inches of water in five irrigations.



Site 24

Jerry Stahr - York County

General Information:

Site 24 is located one mile east of the York junction of Highways 81 and 34 in York County on the Jerry Stahr farm. Jerry has kept this field in continuous corn production. The soil type is a Hastings silt loam with a 0-1 percent slope.

Jerry shredded stalks in April 9, 1994 and ridge planted Golden Harvest 2530 on April 25, 1994.

Nitrogen Management

Jerry included nitrogen rate comparison plots in this field. The plots were eight rows wide, 1244 feet long, and replicated four times. Jerry applied the entire amount of nitrogen as anhydrous ammonia on April 7, 1994, except for five pounds which he applied with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 185-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 185 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 7.9 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

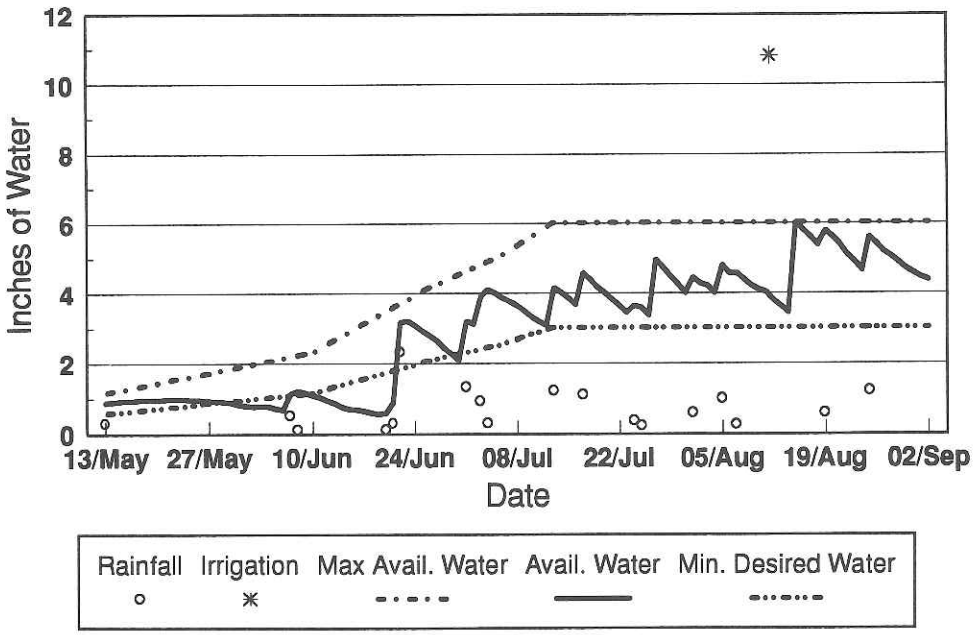
General Fertility	
pH	6.4
OM	2.70%
P	16 ppm
K	357 ppm
Zn	.69 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	89	139	189
Yield avg. (bu/acre)	168	177	177
Test wt. (lbs/acre)	56	56	56
Moisture (%)	15.6	15.3	15.2

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				101	168		
1991	**Rec**		102	185	151	181		
	50+				201	182		
	-50		18		157	173		
1992	**Rec**	10	21	185	207	174		
	50+		30		257	173		
	-50		38		104	139		
1993	**Rec**	10	41	185	154	146	Avg. N Applied	Avg. Yield
	50+		47		204	147		
	-50		70		89	168	113	162
1994	**Rec**	10	68	185	139	177	163	170
	50+		84		189	177	213	170

Irrigation Management

This site was gravity irrigated, watering every row. Jerry scheduled irrigation in 1994 using soil moisture blocks and the checkbook methods. The field received 12.60 inches of rainfall between May 13 and September 2, 1994 and Jerry applied 10.94 inches of water in one irrigation.



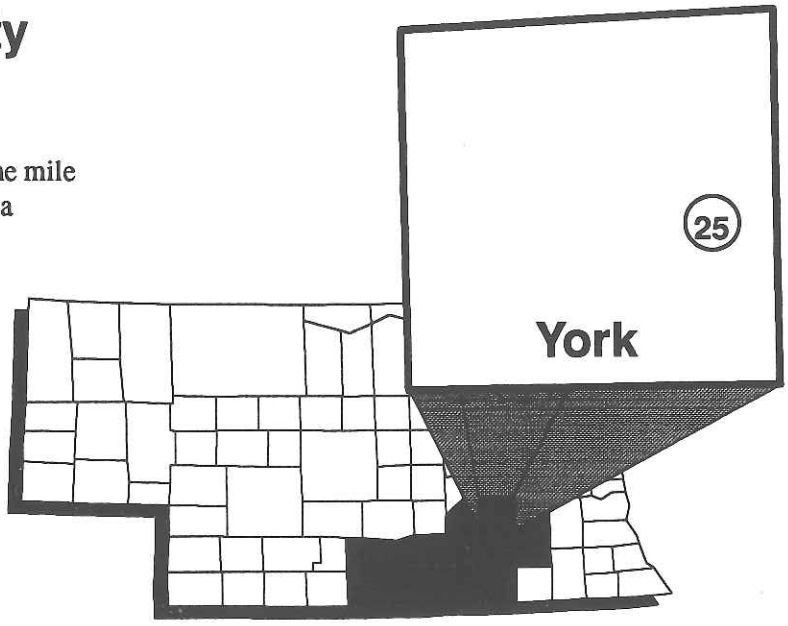
Site 25

Brad Rathje - York County

General Information:

Site 25 is located on the Brad Rathje farm one mile west of Waco in York County. This soil type is a Hastings silt loam with a 0-1 percent slope.

Brad field cultivated at second planting on May 19, 1994. He planted Ciba Seeds 4494.



Nitrogen Management

Brad included nitrogen rate comparison plots in this field. The plots were 12 rows wide, 1065 feet long, and replicated four times. Brad replanted this field on May 19, 1994. He applied 67 pounds of nitrogen using a 10-30-0 liquid formulation at the time of the first planting on April 22, 1994. Brad applied 76 pounds of nitrogen in one cultivation application June 13, using a 28-0-0 liquid. He applied the balance of the nitrogen requirements for the plot on June 20, 1994, also using a 28-0-0 liquid.

The recommended rate of nitrogen was determined using a 170-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 170 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for less than 1.0 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

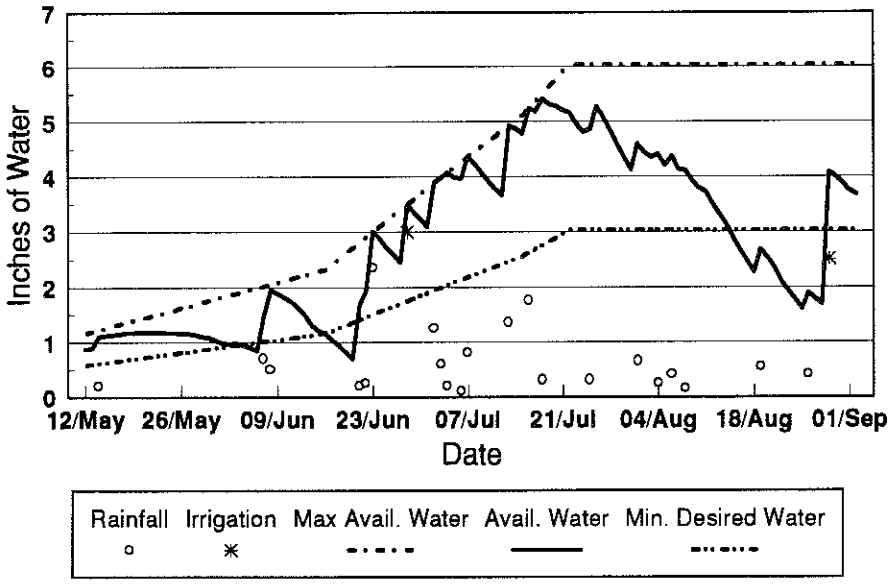
General Fertility	
pH	6
OM	2.90%
P	13 ppm
K	263 ppm
Zn	.97 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	112	162	212
Yield avg. (bu/acre)	176	178	179
Test wt. (lbs/acre)	55	55	55
Moisture (%)	17.6	17.2	17.8

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	5-Year Average	
	-50				135	190		
1990	**Rec**		43	173	185	192		
	50+				235	195		
	-50	3	31		120	169		
1991	**Rec**		52	170	170	171		
	50+		38		220	173		
	-50	2	19		118	187		
1992	**Rec**		39	170	168	184		
	50+		83		218	188		
	-50		30		98	96		
1993	**Rec**	2	30	200	98	97	Avg. N Applied	Avg. Yield
	50+		30		98	99		
	-50		51		112	176	122	164
1994	**Rec**	2	54	200	162	178	172	164
	50+		54		212	179	222	167

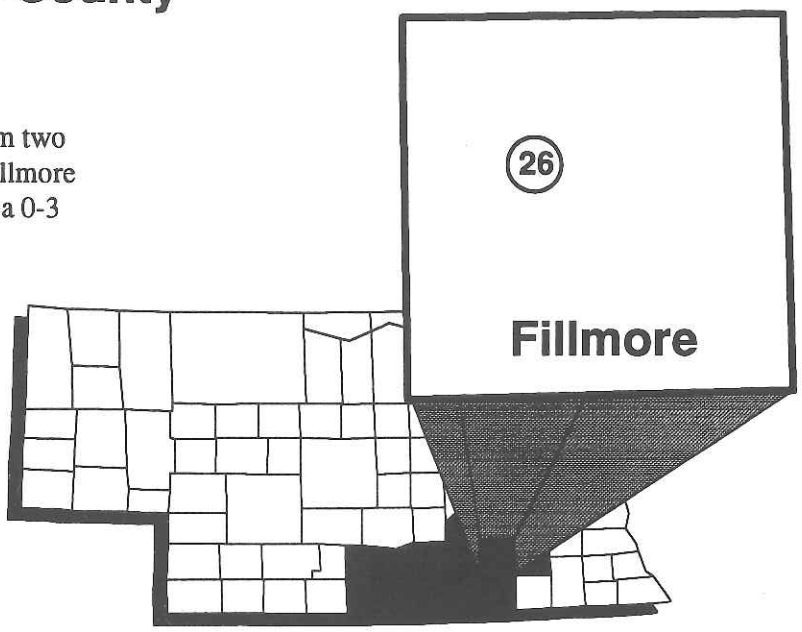
Irrigation Management

This site was gravity irrigated, watering every furrow. Brad used a surge valve. He scheduled irrigation in 1994 using soil moisture blocks and the checkbook methods. The field received 13.05 inches of rainfall between May 26 and September 2, 1994 and Brad applied 5.50 inches of water in two irrigations.



Site 26

Howard Lefler - Fillmore County



General Information:

Site 26 is located on the Howard Lefler farm two miles west and one mile south of Fairmont in Fillmore County. The soil type is a Crete silt loam with a 0-3 percent slope.

Howard shredded stalks on March 10, 1994. He ridge planted Pioneer 3162 on April 18, 1994.

Nitrogen Management

Howard included nitrogen rate comparison plots in this field. The plots were 11 rows wide, 1295 feet long, and replicated four times. Howard applied the entire amount of nitrogen as anhydrous ammonia on December 3, 1993, except for six pounds which he applied with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 180-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 180 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 8.7 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

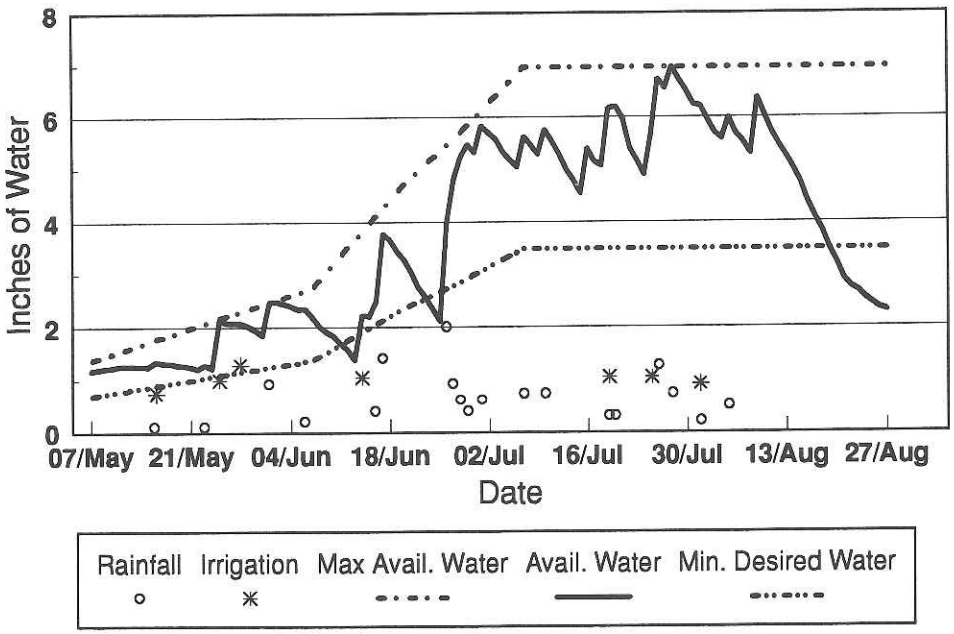
General Fertility	
pH	6.6
OM	3.10%
P	32 ppm
K	522 ppm
Zn	4.48 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	78	128	178
Yield avg. (bu/acre)	184	187	187
Test wt. (lbs/acre)	57	57	57
Moisture (%)	16.7	16.6	16.6

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	3-Year Average	
	-50				87	205		
1992	**Rec**		52	180	137	206		
	50+				187	208		
	-50		49		108	114		
1993	**Rec**		50	180	158	116	Avg. N	Avg.
	50+		66		208	119	Applied	Yield
	-50		70		78	184	91	168
1994	**Rec**	3	74	180	128	187	141	170
	50+		74		178	187	191	171

Irrigation Management

This site was pivot irrigated. Howard scheduled irrigation in 1994 based on soil moisture blocks, and the checkbook methods. The field received 9.70 inches of rainfall between May 7 and September 2, 1994. Howard applied 6.52 inches of water in seven irrigations.



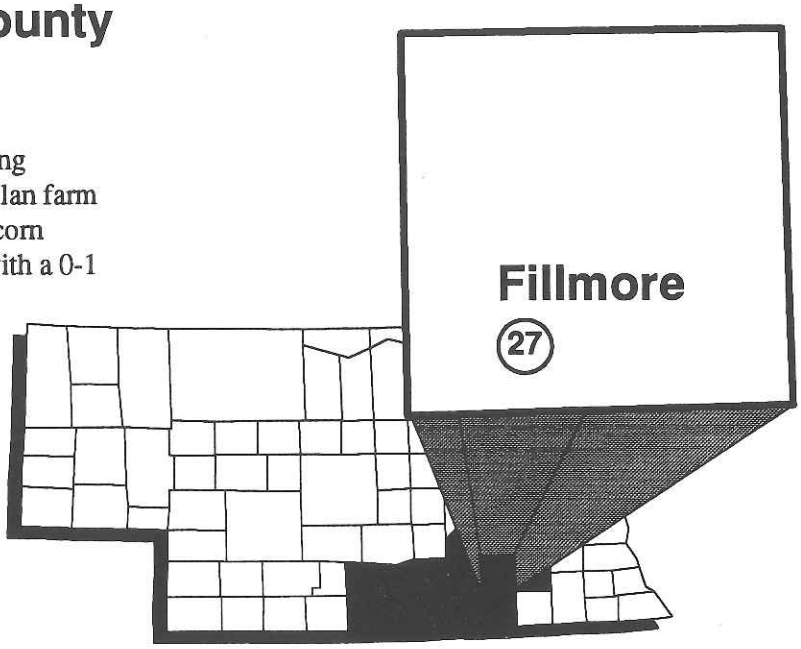
Site 27

Jim Bedlan - Fillmore County

General Information:

Site 27 is located 2½ miles west of the Strang junction of Highways 81 and 74 on the Jim Bedlan farm in Fillmore County. This field is in continuous corn production. The soil type is a Crete silt loam with a 0-1 percent slope.

Jim shredded stalks on October 25, 1993. He ridge planted Pioneer 3394 on April 24, 1994.



Nitrogen Management

Jim included nitrogen rate comparison plots in this field. The plots were eight rows wide, of varied length, and replicated four times. Jim applied the entire amount of nitrogen as anhydrous ammonia on March 20, except for six pounds which he applied with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 180-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 180 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 2.1 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

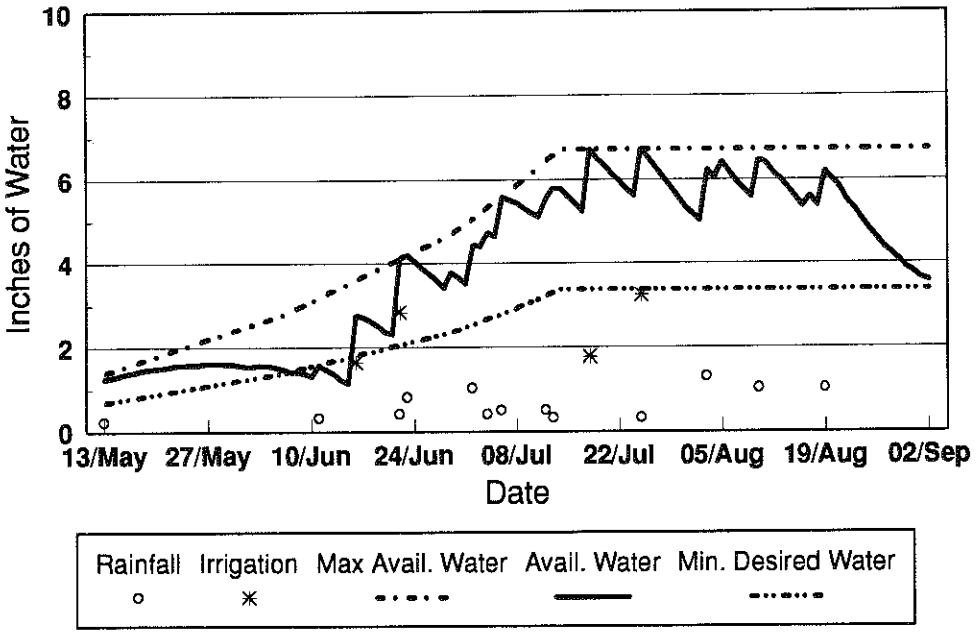
General Fertility	
pH	6.3
OM	3.00%
P	14 ppm
K	576 ppm
Zn	5.81 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	87	137	187
Yield avg. (bu/acre)	182	181	181
Test wt. (lbs/acre)	58	58	57
Moisture (%)	14.2	14.6	14.3

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	3-Year Average	
	-50				70	151		
1992	**Rec**		230	180	120	159		
	50+				170	160		
	-50		66		92	100		
1993	**Rec**	5	65	180	142	110	Avg. N Applied	Avg. Yield
	50+		98		192	107		
	-50		43		87	182	83	144
1994	**Rec**	7	56	180	137	181	133	150
	50+		62		187	181	183	149

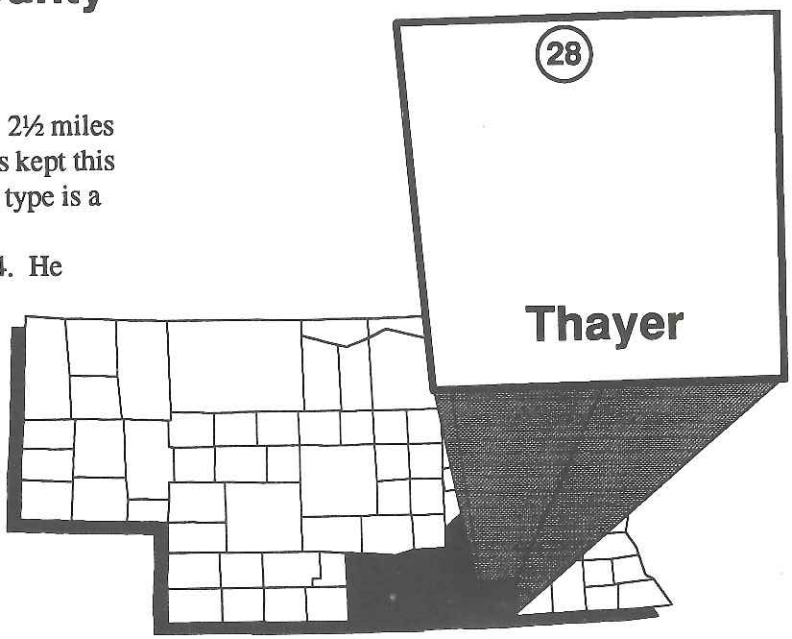
Irrigation Management

This site was gravity irrigated, watering every row and Jim used a surge valve on a portion of the field. Jim scheduled irrigation in 1994 using appearance and feel, moisture blocks, and the checkbook methods. The field received 8.00 inches of rainfall between May 13 and September 2, 1994. Jim applied 9.47 inches of water in four irrigations.



Site 28

Leroy Voss - Thayer County



General Information:

Site 28 is located on the Leroy Voss farm 2½ miles west of Bruning in Thayer County. Leroy has kept this field in continuous corn production. The soil type is a Crete silt loam with a 0-1 percent slope.

Leroy shredded stalks on March 15, 1994. He ridge planted Pioneer 3162 on April 25, 1994.

Nitrogen Management

Leroy included nitrogen rate comparison plots in this field. The plots were eight rows wide, 1201 feet long and replicated three times. On April 25, 1994, Leroy applied a 17-gallon mixture of equal amounts of 28-0-0 and 10-34-0 in a two-by-two band with the planter. He sidedressed anhydrous ammonia on June 7, 1994.

The recommended rate of nitrogen was determined using a 160- bushel yield goal. The rate applied was calculated by subtracting soil and irrigation water nitrate from the nitrogen required for 160 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. Irrigation water nitrate accounted for 4.6 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

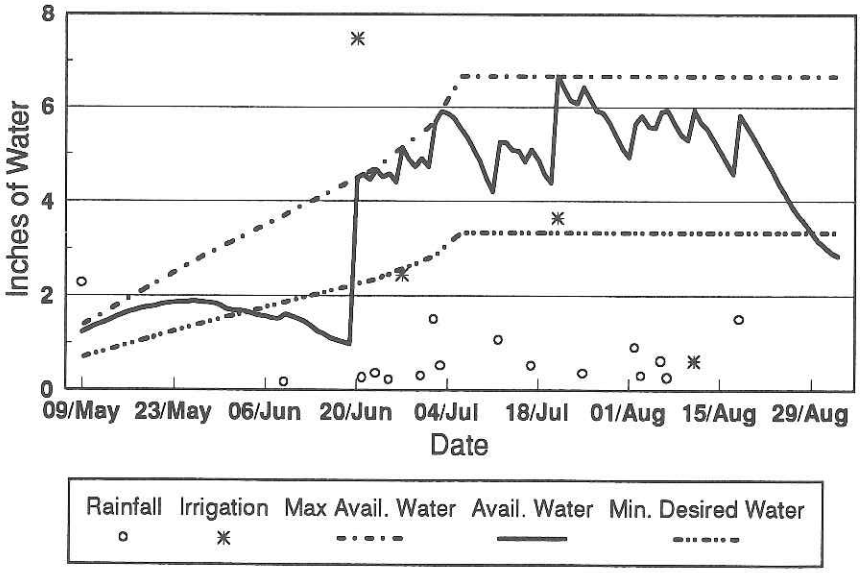
General Fertility	
pH	6.3
OM	2.70%
P	21 ppm
K	349 ppm
Zn	4.38 ppm

Treatment-1994	-50	Rec	+50	Farmer Rate
N rate (lbs/acre)	80	130	180	200
Yield avg. (bu/acre)	176	193	200	197
Test wt. (lbs/acre)	60	60	60	60
Moisture (%)	17.4	17.8	17.9	17.7

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
1991	-50				67	161		
	Rec		59	140	117	173		
	Rec Fall				117	190		
	50+				167	183		
1992	-50		16		101	105		
	Rec	13	52	160	151	142		
	Rec Fall		26		151	129		
	50+		60		201	163		
1993	-50		31		88	92		
	Rec	13	28	160	138	102		
	50+		27		188	105	Avg. N Applied	Avg. Yield
	Farmer Rate		64		210	102		
1994	-50		39		80	176	84	134
	Rec	13	43	160	130	193	134	153
	50+		47		180	200	184	162
	Farmer Rate		46		200	197		

Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Leroy scheduled irrigation in 1994 using soil moisture blocks, the appearance and feel and the checkbook methods. The field received 8.70 inches of rainfall between May 9 and September 2, 1994. Leroy applied 14.17 inches of water in four irrigation applications in 1994.



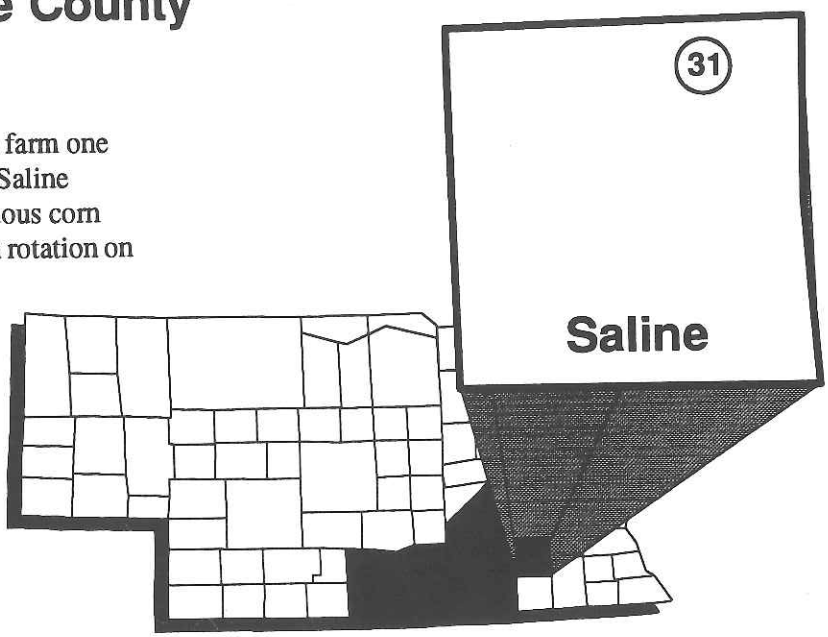
Site 31

Wayne Hansen - Saline County

General Information:

Site 31 is located on the Wayne Hansen farm one mile north of Dorchester on Highway 15 in Saline County. Wayne has kept the plot in continuous corn production, while practicing a corn/soybean rotation on the rest of the farm. The soil type is a Crete silt loam with a 0-1 percent slope.

Wayne ridge planted Mycogen 8240 on April 22, 1994.



Nitrogen Management

Wayne included nitrogen rate comparison plots in this field. The plots were 12 rows wide, 1902 feet long, and replicated four times. Wayne applied the majority of nitrogen as anhydrous ammonia in a preplant application, as well as nine gallons of 10-34-0 solution which he deep placed at the same time.

The recommended rate of nitrogen was determined using a 170-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 170 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 1.1 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

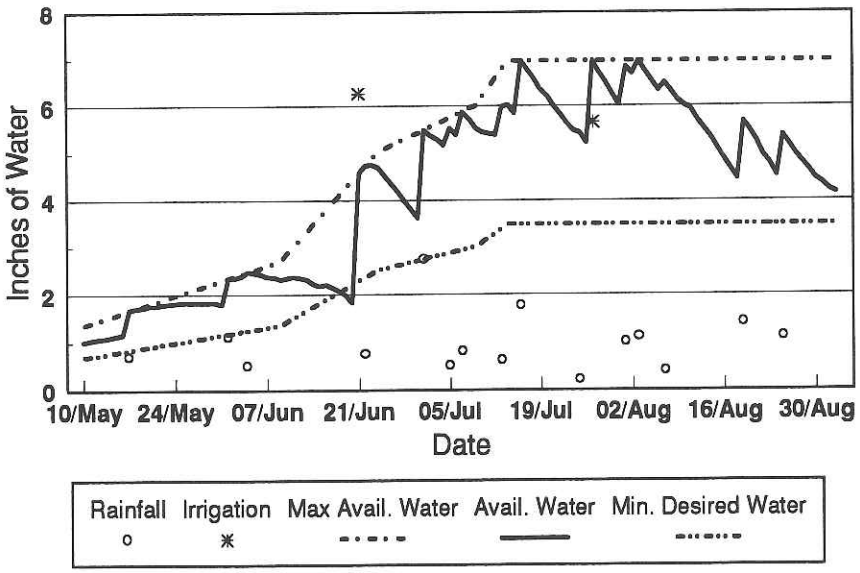
General Fertility	
pH	6.7
OM	2.90%
P	35 ppm
K	315 ppm
Zn	2.12 ppm
S	3 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	88	138	188
Yield avg. (bu/acre)	139	156	165
Test wt. (lbs/acre)	58	58	58
Moisture (%)	14.5	14.5	14.4

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				96	176		
1991	**Rec**		59	170	146	185		
	50+				196	192		
	-50		112		51	99		
1992	**Rec**	4	122	170	101	137		
	50+		147		151	161		
	-50		34		99	80		
1993	**Rec**	4	30	170	149	88	Avg. N Applied	Avg. Yield
	50+		39		199	98		
	-50		58		88	139	84	124
1994	**Rec**	4	51	170	138	156	134	142
	50+		62		188	165	184	154

Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Wayne scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. The field received 14.65 inches of rainfall between May 10 and September 2, 1994. Wayne applied 11.93 inches of water in two irrigations.



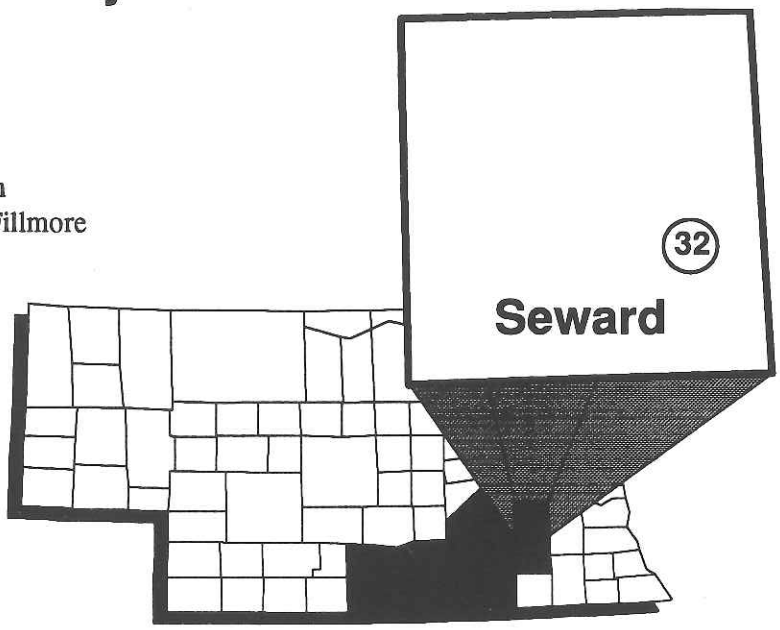
Site 32

Dean Rocker - Seward County

General Information:

The Dean Rocker farm is the location of site 32, 2½ miles east and one mile south of Tamora. This gravity-irrigated farm has been in continuous corn production. The soil type is a Fillmore silt loam with a 0-1 percent slope.

Dean harrowed in the spring before ridge planting Stine 1179 on May 3, 1994.



Nitrogen Management

Dean included nitrogen rate comparison plots in this field. The plots were eight rows wide, 2552 feet long, and replicated four times. He sidedressed the entire amount of nitrogen as anhydrous ammonia on June 13, except for five pounds which he applied with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 180-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 180 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the general plot area. The irrigation nitrogen accounted for 5.1 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

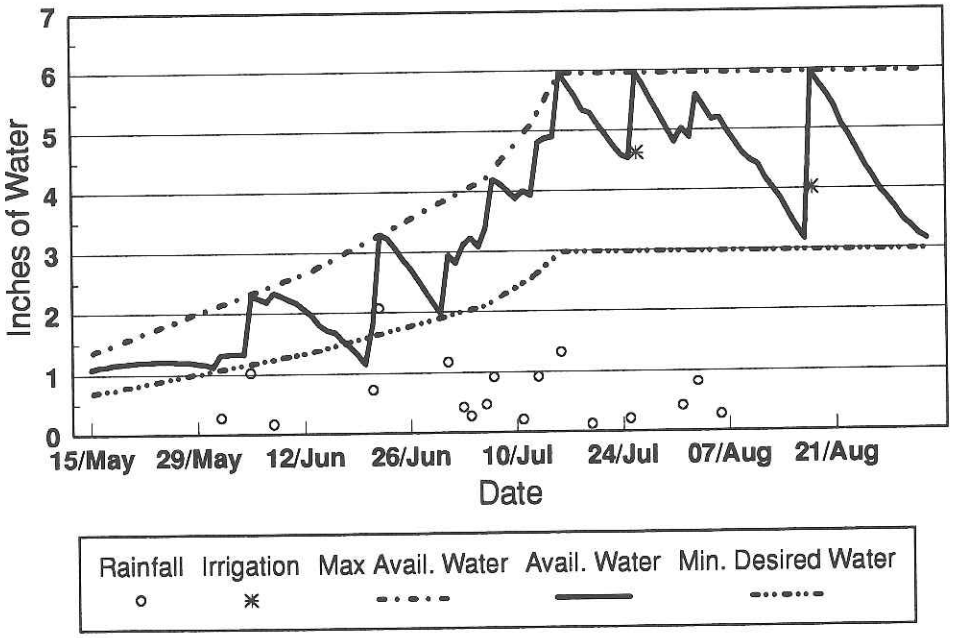
General Fertility	
pH	5.9
OM	2.90%
P	14 ppm
K	427 ppm
Zn	.77 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	50	100	150
Yield avg. (bu/acre)	173	189	191
Test wt. (lbs/acre)	56	56	57
Moisture (%)	15.7	15.5	15.7

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	3-Year Average	
	-50				80	167		
1991	**Rec**		92	180	130	171		
	50+				180	168		
	-50	4	58		92	159		
1992	**Rec**		72	180	142	161		
	65+		156		192	173	Avg. N Applied	Avg. Yield
1993		Soybeans were planted in the plot area in 1993						
	-50				50	173	67	166
1994	**Rec**	16	67	180	100	189	117	174
	65+				150	191	167	177

Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Dean used a surge valve for the first time this year. He scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. This field received 11.45 inches of rainfall between May 15 and September 2, 1994 and Dean applied 8.62 inches of water in two irrigations.



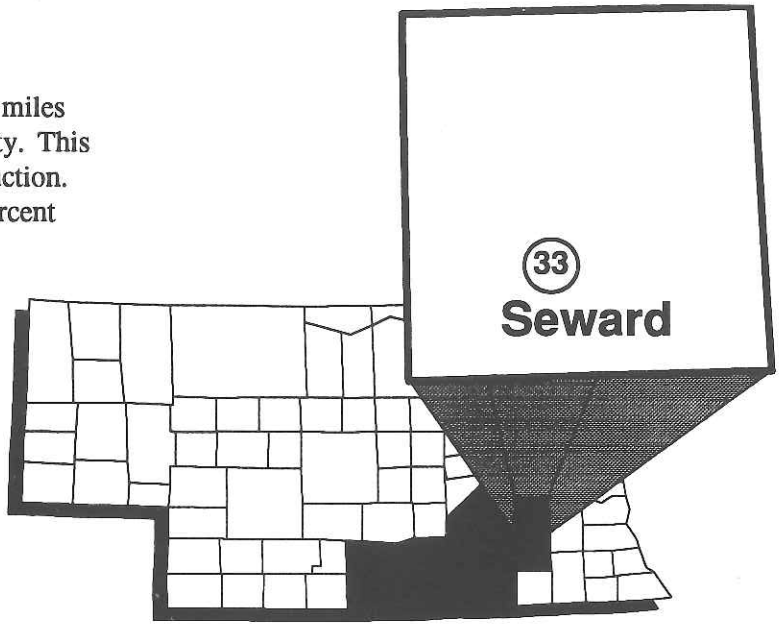
Site 33

Doug Cast - Seward County

General Information:

Site 33 is located on the Doug Cast farm two miles south and one mile east of Utica in Seward County. This gravity-irrigated farm is in continuous corn production. The soil type is a Fillmore silt loam with a 0-1 percent slope.

Doug harrowed and ridge planted NC+ 4616 on May 4, 1994.



Nitrogen Management

Doug included nitrogen rate comparison plots in this field. The plots were eight rows wide, 1670 feet long, and replicated four times. Doug applied the entire amount of nitrogen as anhydrous on April 20, except for five pounds which he applied ammonia with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 180-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 180 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 17.6 ppm nitrate nitrogen in samples drawn in 1991. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

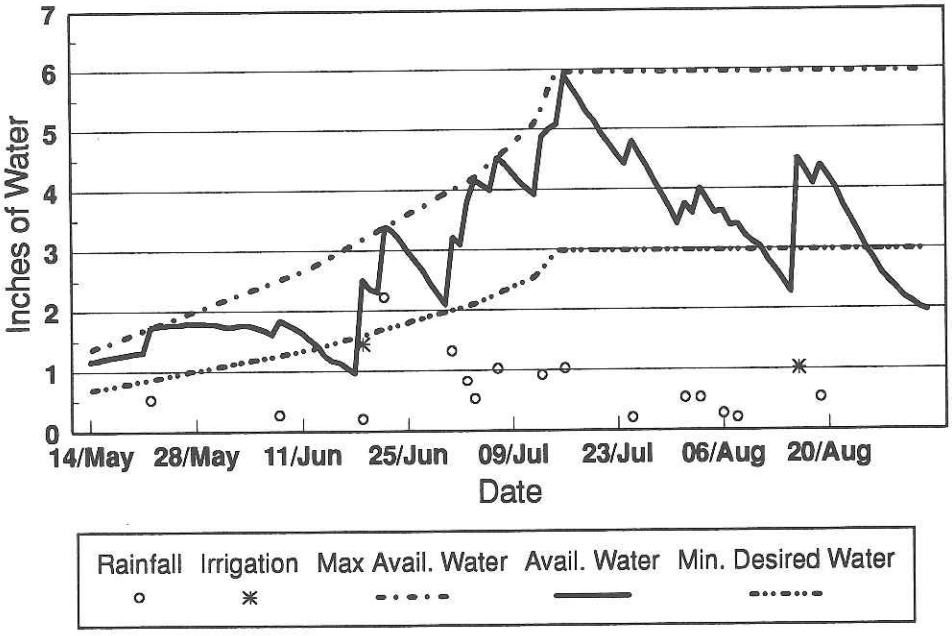
General Fertility	
pH	7
OM	2.00%
P	8 ppm
K	297 ppm
Zn	.94 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	84	134	184
Yield avg. (bu/acre)	155	170	154
Test wt. (lbs/acre)	56	56	56
Moisture (%)	14.9	15	15.4

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				120	161		
1991	**Rec**		71	180	170	168		
	50+				220	169		
	-50		105		0	89		
1992	**Rec**	36	142	180	50	134		
	50+		138		100	153		
	-50		33		106	101		
1993	**Rec**	36	41	180	156	105	Avg. N Applied	Avg. Yield
	50+		48		206	107		
	-50		48		84	155	78	127
1994	**Rec**	36	56	180	134	170	128	144
	50+		67		184	174	178	151

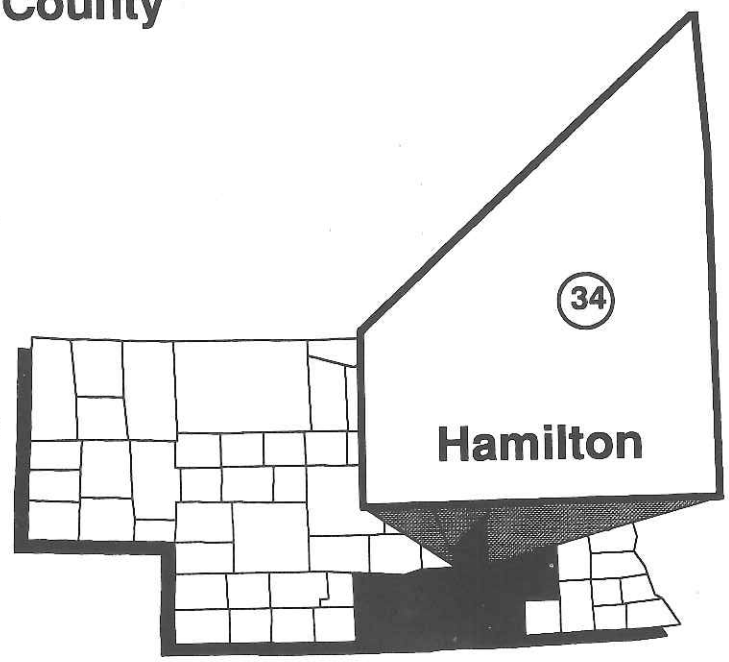
Irrigation Management

This site was gravity irrigated, watering alternate (every other) furrows. Doug scheduled irrigation in 1994 using the appearance and feel and the checkbook methods. This field received 10.80 inches of rainfall between May 14 and September 2, 1994 and Doug applied 2.46 inches of water in two irrigations.



Site 34

The Grain Place - Hamilton County



General Information:

Site 34 is operated by Mike Herman of the Grain Place and it is located 5½ miles north of Aurora in Hamilton County. The soil type is a Holder silt loam with a 0-1 percent slope.

The Grain Place is an organic farm which employs a systems approach to crop production requiring extensive crop rotation. The crop rotation is developed over the complete cycle of the rotation, rather than the expected yield of any given year. The yield potential is obtained through the availability of nutrients, pest cycle disruption and soil erosion cintrol. Water quality is directly affected by this systems approach to crop production.

The goal of this approach is to minimize purchased nutrient and pesticide inputs, primary sources of non-point-source pollution. The current rotation changes plants from grasses to broadleaf. The Grain Place uses plant competition, cultivation and hand rogueing to control weeds and disrupt insect cycles. Corn root worm is not a problem in the fields and legumes in the rotation help build nitrogen levels in the soil.

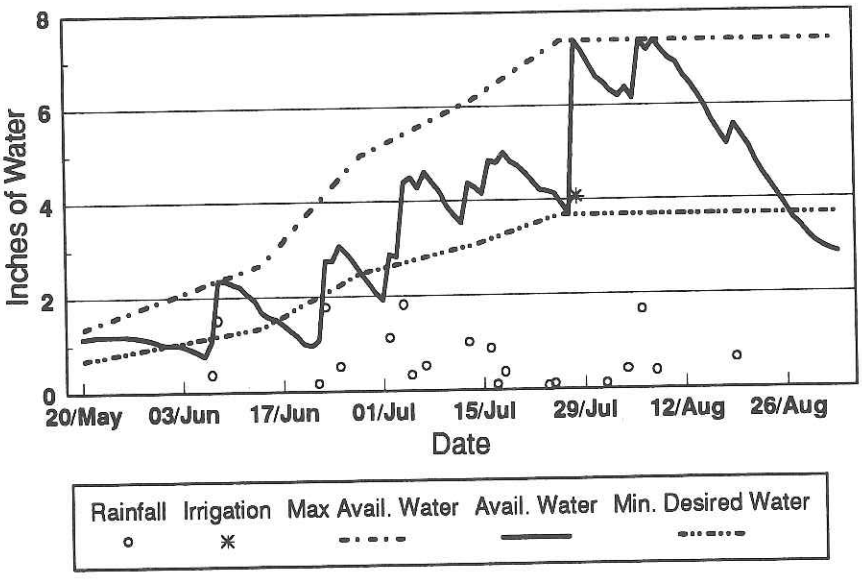
The Grain Place's rotation includes three-year stands of a forage crop, (alfalfa, red clover and grasses) allowing the grasses to become a higher percent of the stand by the third year. This portion of the rotation will help build the soil's health, tilth and nutrient base.

This rotations reduces the number of acres requiring water due to better water retention of the soil and eliminates the need for large amounts of fertilizer. The Grain Place's irrigation practices also include using flow meters, surge valves, moisture blocks, crop water use data and irrigation scheduling to minimize water application without excessively stressing the crop—and hopefully reducing nutrient leaching below the root zone.

The Grain Place uses on-farm manure and screenings from the on-farm processing plant for compost, which is spread on those areas of a given field which traditionally have had lower yields.

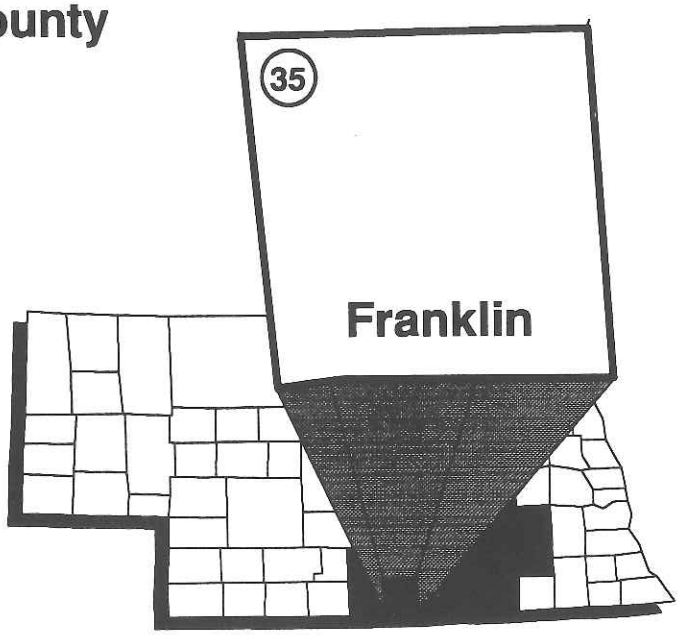
Irrigation Management

The field received 12.7 inches of rain between May 11 and September 2, 1994. Mike applied 4 inches of water in one irrigation on July 28, 1994.



Site 35

Butch Ortgiesen - Franklin County



General Information:

The Butch Ortgiesen farm is the location of site 35, seven miles south and one mile east of Wilcox in Franklin County. The plot is in continuous corn production. The soil type is a Holdrege silt loam with a 0-1 percent slope.

Butch shredded stalks on April 1, 1994 and ridge planted Pioneer 3225 on April 23, 1994.

Nitrogen Management

Butch included nitrogen rate comparison plots in this field. The plots were eight rows wide, of varied length, and were replicated four times. Butch applied anhydrous ammonia preplant on March 23, 1994.

The recommended rate of nitrogen was determined using a 175- bushel yield goal. The rate applied was calculated by subtracting soil nitrogen from the nitrogen required for 175 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation water nitrate accounted for 2.4 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

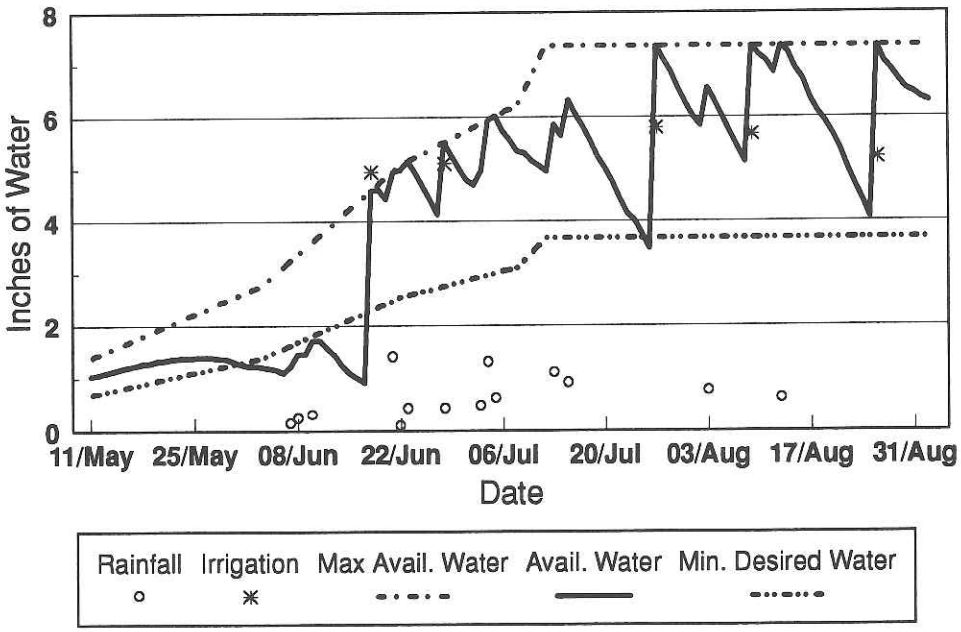
General Fertility	
pH	6.6
OM	2.30%
P	19 ppm
K	482 ppm
Zn	12.69 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	116	166	216
Yield avg. (bu/acre)	158	176	181
Test wt. (lbs/acre)	57	57	57
Moisture (%)	21.3	21.2	20.4

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	3-Year Average	
	-50				111	186		
1992	**Rec**		62	175	161	195		
	50+				211	193		
	-50		27		121	121		
1993	**Rec**		31	175	171	130	Avg. N	Avg.
	50+		56		221	134	Applied	Yield
	-50		42		116	158	116	155
1994	**Rec**		41	175	166	176	166	167
	50+		48		216	181	216	169

Irrigation Management

This site was gravity irrigated, watering every furrow. Butch scheduled irrigation in 1994 using soil moisture blocks, appearance and feel, and the checkbook methods. The field received 8.70 inches of rainfall between May 11 and September 2, 1994. Butch applied 26.73 inches of water in five irrigation applications in 1994.



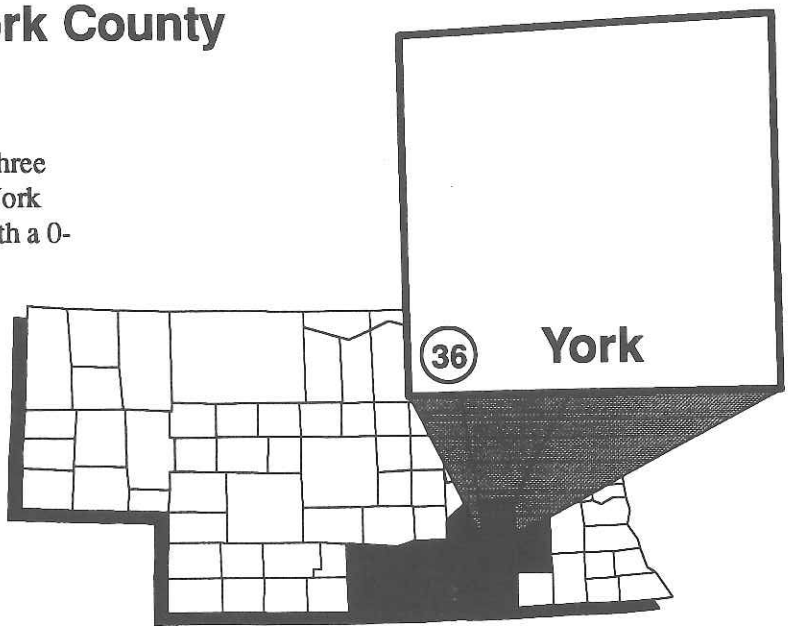
Site 36

Site 36 Brian Janzen - York County

General Information:

Site 36 is located on the Brian Janzen farm three miles south and 3½ miles east of Henderson in York County. The soil type is a Hastings silt loam with a 0-1 percent slope.

Brian shredded stalks on March 30, 1994. He ridge planted Pioneer 3162 on April 21, 1994.



Nitrogen Management

Brian included nitrogen rate comparison plots in this field. The plots were six rows wide, 1283 feet long, and replicated four times. Brian applied the entire amount of nitrogen as anhydrous ammonia on March 22, except for six pounds which he applied with the seed in the form of 10-34-0 liquid starter.

The recommended rate of nitrogen was determined using a 170-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 170 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 2.6 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

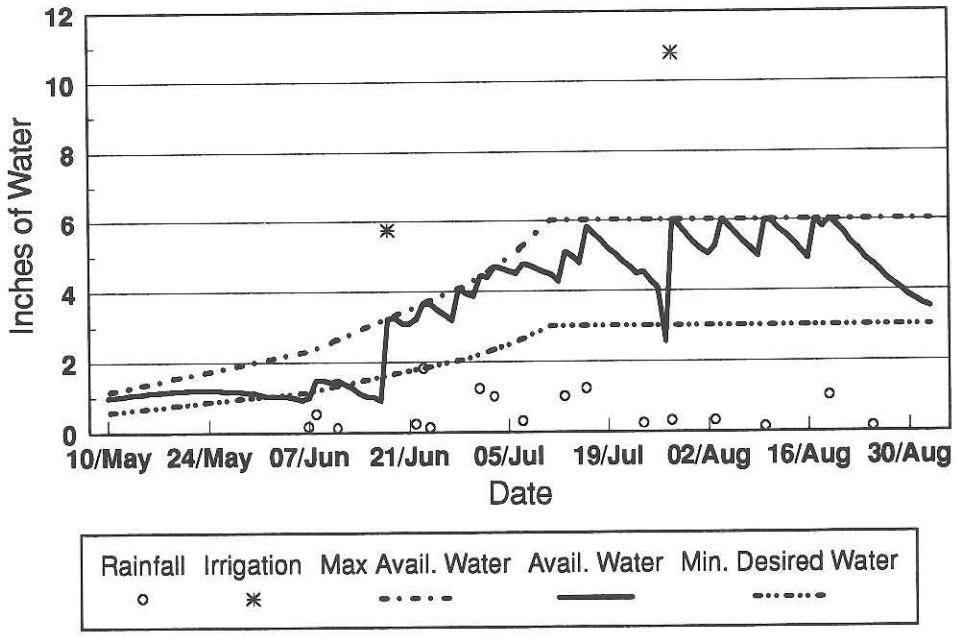
General Fertility	
pH	6.4
OM	2.80%
P	32 ppm
K	496 ppm
Zn	1.12 ppm
S	7 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	82	132	182
Yield avg. (bu/acre)	143	142	149
Test wt. (lbs/acre)	56	56	56
Moisture (%)	19.1	19.4	19.7

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	3-Year Average	
	-50				130	175		
1992	**Rec**		37	170	180	178		
	50+				230	177		
	-50		41		130	117		
1993	**Rec**		57	170	180	121	Avg. N Applied	Avg. Yield
	50+		82		230	120		
	-50		63		82	143	114	145
1994	**Rec**		73	170	132	142	164	147
	50+		94		182	149	214	149

Irrigation Management

This site was gravity irrigated, watering every furrow. Brian scheduled irrigation in 1994 using soil moisture blocks and the checkbook methods. The field received 9.55 inches of rainfall between May 10 and September 2, 1994 and Brian applied 16.55 inches of water in two irrigations.



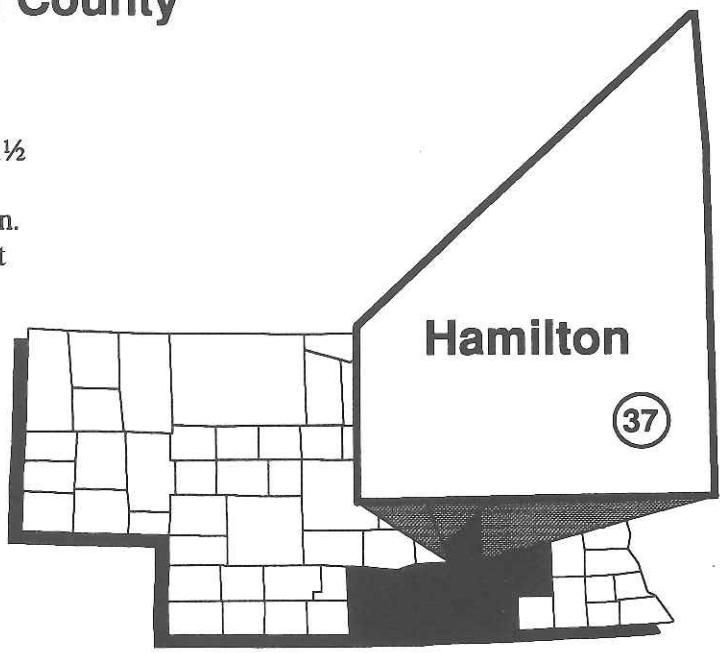
Site 37

Deon Goertzen - Hamilton County

General Information:

Site 37 is located on the Deon Goertzen farm 1½ miles south of the I-80 Hampton exit in Hamilton County. This field is in continuous corn production. The soil type is a Crete silt loam with a 0-1 percent slope.

Deon shredded stalks in March 1994. He ridge planted Asgrow 899 on April 24, 1994.



Nitrogen Management

Deon included nitrogen rate comparison plots in this field. The plots were 8 rows wide, 1482 feet long, and replicated four times. Deon applied the entire amount of nitrogen as anhydrous ammonia in a preplant application. Deon's yields were lower than expected in 1994 due to 5 to 10 percent green snap from a July 1 wind storm.

The recommended rate of nitrogen was determined using a 190-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 190 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the 1993 recommended rate strips. The irrigation nitrogen accounted for 7.1 ppm nitrate nitrogen in samples drawn in 1994. Irrigation water credit was calculated by multiplying the ppm nitrate by two. This was conservative and was based on a yearly application of nine inches of water.

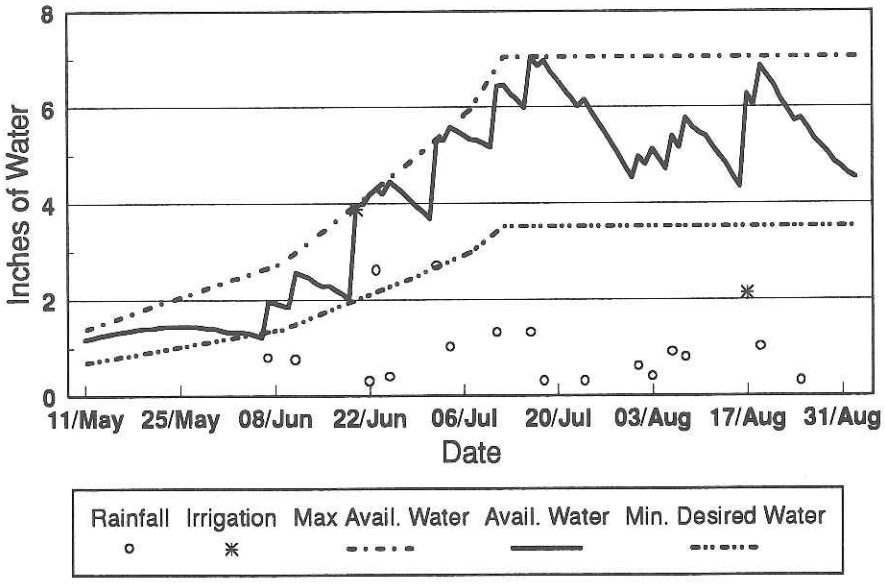
General Fertility	
pH	6.2
OM	2.90%
P	15 ppm
K	431 ppm
Zn	.54 ppm

Treatment-1994	-50	Rec	+50
N rate (lbs/acre)	76	126	176
Yield avg. (bu/acre)	154	174	180
Test wt. (lbs/acre)	56	56	56
Moisture (%)	17.2	17.3	18.1

Year	Treatment	Water N (lbs/a)	Soil Res. (lbs/a)	Expected Yield (bu/a)	N applied (lbs/a)	Yield (bu/a)	4-Year Average	
	-50				115	170		
1991	**Rec**		85	190	165	175		
	50+				215	179		
	-50		85		67	129		
1992	**Rec**	15	120	190	117	145		
	50+		129		167	164		
	-50				65	114		
1993	**Rec**	15	75	190	115	117	Avg. N Applied	Avg. Yield
	50+				165	123		
	-50		47		76	154	81	142
1994	**Rec**	15	80	190	126	174	131	153
	50+		111		176	180	181	162

Irrigation Management

This site was gravity irrigated, watering every row. Deon scheduled irrigation in 1994 based on the appearance and feel and the checkbook methods. The field received 15.65 inches of rainfall between May 11 and September 2, 1994 and Deon applied 6.01 inches of water in two irrigations.



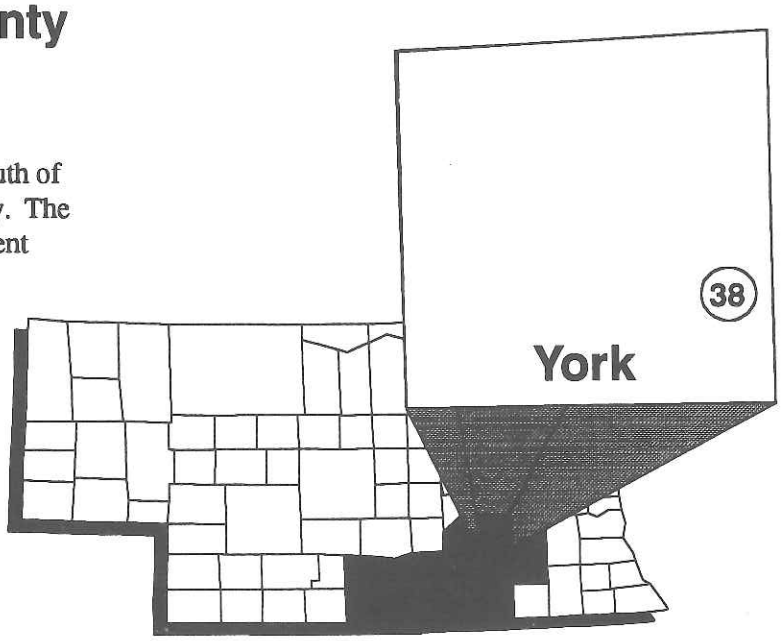
Site 38

Ron Uffelman - York County

General Information:

Site 38 is located three miles east and 2¼ south of Waco on the Ron Uffelman farm in York County. The soil type is a Hastings silt loam with a 0 - 1 percent slope.

Ron rototilled on April 19, 1994 and planted Pioneer 3162 on April 20, 1994.



Nitrogen Management

Ron included nitrogen rate comparison plots in this field. The plots were six rows wide, 1400 feet long, and replicated four times. Ron applied 4000 gallons per acre of swine slurry in the fall of 1993. This application accounted for 88 pounds of nitrogen available in the first year. He applied 50 pounds of nitrogen as anhydrous on April 5, 1994. He split-applied the remainder of the nitrogen requirements with the cultivator on May 29 and June 13, 1994 using a 28-0-0 formulation.

The recommended rate of nitrogen was determined using a 200-bushel yield goal. The rate applied was calculated by subtracting soil and irrigation nitrogen from the nitrogen required for 200 bushels of corn. The soil nitrate was measured in four-feet deep soil samples taken from the general plot area.

General Fertility	
pH	5.3
OM	2.90%
P	76 ppm
K	479 ppm
Zn	1.08 ppm

Treatment-1994	Rec	50	100
N rate (lbs/acre)	0	50	100
Yield avg. (bu/acre)	243	244	245
Test wt. (lbs/acre)	58	58	58
Moisture (%)	18.1	17.9	18.2

Irrigation Management

This site was gravity irrigated, watering every other furrow. Irrigation was scheduled in 1994 using soil moisture blocks and the checkbook method. The field received 10.80 inches of rainfall between May 6 and September 2, 1994. This field was irrigated from a reuse pit and a flow meter was not used.

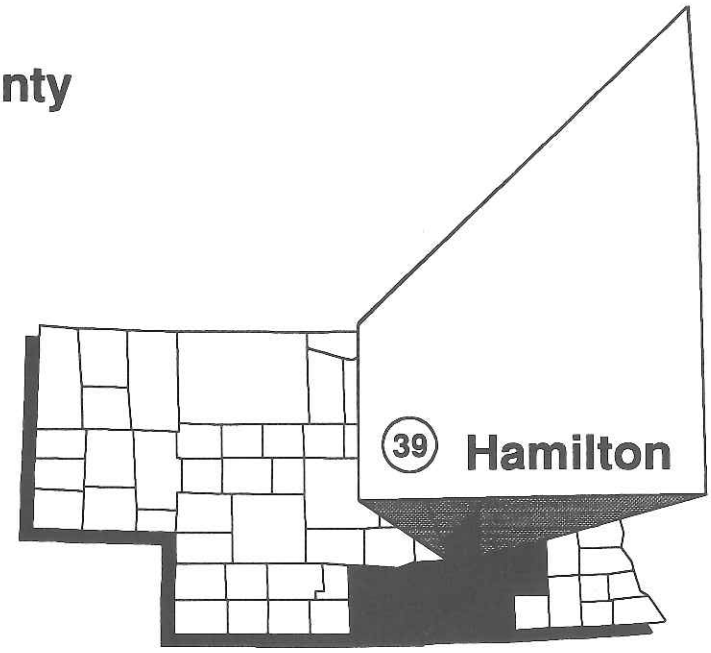
Site 39

Deryl Bish - Hamilton County

General Information:

The Deryl Bish site is located four miles west and ½ mile north of Giltner in Hamilton County. This field is in continuous corn production. The soil type is a Hastings silt loam with a 0-1 percent slope.

Deryl shredded stalks prior to ridge planting Golden Harvest 2530 on April 22, 1994.



Nitrogen Management

Deryl included nitrogen rate comparison plots with and without a nitrification inhibitor in this field. The plots were six rows wide, 2544 feet long and replicated four times. Deryl applied anhydrous ammonia in the fall of 1993. Deryl's yields were below his expected yield on this field due to 29 percent greensnap.

The recommended rate of nitrogen was determined using a 200-bushel yield goal. The rate applied was calculated by subtracting soil nitrogen from the nitrogen required for 200 bushels of corn. The soil nitrate was measured in two-feet deep soil samples. There was no irrigation water credit given.

Treatment		Moisture Content	Yield
40-	180	18.3	169
	180 + N-Serve	18.3	170
Rec	220	18.3	165
	220 + N-Serve	18.2	167
Plot Average		18.2	168

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

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