# Water Watch

**A newsletter for Upper Maquoketa Watershed and Northeast Iowa Demonstration Project areas**


**Project News**

## Manure as a crop nutrient source demonstrations continue

*by John Rodecap, Iowa State University Extension project coordinator, Maquoketa Watershed Project*

The crop nutrient value of manure and its management is of interest to farmers and all citizens. With less bedding used in livestock production, the nitrogen and phosphorus concentrations in most manure sources are greater than a few years ago.

Because manure has relatively high concentrations of nitrogen, phosphorus and potassium available for crop production, manure is valued as a crop production resource by producers. For these same reasons proper management of manure has become an environmental concern.

"Manure Happens, Take Credit" is a phrase that summarizes the interest of livestock producers in northeast Iowa where 32 on-farm manure field demonstrations have been conducted since 1994. Eight demonstrations, on the farms of cooperators Mike Knipper, Dennis Mashek, Loras Hoeger, Pat Maloney, Bill Oberbroeckling and Enoch Hanson, were completed this year with the assistance of Northeast Iowa Demonstration Project staff to refine manure management and nutrient use for crop production. The replicated manure and nitrogen (N) treatments were applied in fields that had not received manure in recent years to reduce the carry-over effects of previous manure application.

Manure nutrient contributions were determined by calibrating the manure spreading rate and by analyzing manure samples to determine nutrient content for crop production. Recent research indicates all the nitrogen is available the first year from swine liquid manure. However, this has not been documented in other manure sources. The first-year contribution was 131 pounds of N averaged across the eight demonstrations, with a range from 81 to 225 pounds of N per acre.

A new treatment in 1999 was to apply the same amount of commercial N as the first year N contribution from manure to replicated plots within the demonstration area. The corn yields from commercial N treatments averaged 160 bushels per acre compared to 152 bushels per acre for the manure-only treatment. The stalk nitrate analysis at the end of the growing season was 1,471 parts per million (ppm) and 1,340 ppm of nitrate nitrogen, respectively.

Corn yields and residual nitrate nitrogen in the cornstalks from the

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**Table 1. Corn yields and residual cornstalk nitrate from eight manure* management demonstrations, 1999.**

| Treatments | Corn Yield bu/A | Cornstalk nitrate N ppm** |
|---|---|---|
| No manure, no N | 134 | 553 |
| Manure, no N | 152 | 1,340 |
| Manure, 50 lbs/A N | 153 | 1,245 |
| Manure, 100 lbs/A N | 160 | 2,354 |
| Comm'l N at manure N rate | 160 | 1,471 |

*Manure sources were dairy, swine and beef.

**Optimum residual nitrate nitrogen in the cornstalk at the end of the season is 700 to 2,000 ppm.


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## Manure continued

eight demonstration sites are shown in table 1.

Those same manure management demonstrations have been conducted on 24 other cooperating farms from 1994 through 1998, as shown in table 2.

These demonstrations confirm that manure is a significant resource for crop production. The source, quantity, method of application and uniformity of field coverage are all factors that need to be evaluated when determining if and how much additional nitrogen should be spread on manured fields. The 32 demonstrations in the past six years show that applying more than 50 pounds per acre of commercial nitrogen is not economically justified when using typical manure application rates.

**Maquoketa Project.** Ten producers in the Arlington–Strawberry Point area will host similar but more extensive demonstrations next year: David Moorman, Tom Hayes, David and Richard Venteicher, Randy and Rodney Hamlett, Darrell Rosburg, Marvin Heims, Laverne Jones and Ron Carpenter, Larry Hoefer and Kevin Perrinjaquet, Northeast Iowa Community College and Verle Jones.

Replicated phosphorus rates will be included (on adjacent non-manure plots) in the crop year 2000 demonstrations, including commercial phosphorus applied at the rate contributed from manure.

Nine of these cooperators have applied manure on their demonstration areas this fall with first-year nitrogen contributions for the 2000 crop estimated to range from 102 to 286 pounds of nitrogen per acre. The average manure nitrogen contribution is 171 pounds per acre. The phosphorus applied in the manure ranges from 74 to 792 pounds per acre with the average phosphorus contribution of 240 pounds per acre.

Phosphorus management, especially on fields receiving manure, is an important issue as more concern is expressed each year about the hypoxia zone in the Gulf of Mexico. Phosphorus and nitrogen feed the algae plants that eventually die, and the decomposition removes enough oxygen from the water that fish populations cannot survive in those waters.

The good news is that refined manure and commercial nutrient management will result in more net income per acre on manure fields and will protect water quality at the same time.

**Table 2. Corn yields and residual cornstalk nitrate N from 24 manure management demonstrations, 1994-1998.**

| Treatments | Corn yield bu/A | Cornstalk nitrate N ppm |
|---|---|---|
| No manure, no N | 132 | 590 |
| Manure, no N | 144 | 2,037 |
| Manure, 50 lbs/A N | 149 | 2,883 |
| Manure, 100 lbs/A N | 149 | 4,228 |

# Legume nitrogen contribution available in economic crunch

*by John Rodecap, ISUE project coordinator, MWP*

Soybean acreage increased in 1999 due in part to government loan rates. The cash value per bushel of corn and beans is low. The bottom line profit per acre has been squeezed. Ag suppliers have reported less than normal fertilizer applied for crop year 2000 and the soil has less than normal moisture reserves going into the winter. How do we cope and plan for crop year 2000?

One alternative is to refine crop nutrient use based on good soil tests, especially on fields testing optimum or higher for phosphorus and potassium or where manure is applied. Another is to refine nitrogen (N) use based on past experiences and use of the nitrogen contribution from manure and legumes.

Since 1993, Northeast Iowa Demonstration Project (NEIDP) staff have assisted 10 cooperators to evaluate their corn production following the previous soybean crop to determine the most profitable nitrogen fertilizer rates to use. In addition to yield results, the post-maturity cornstalk nitrate nitrogen test has been used to measure the residual nitrogen left in the plant after the crop has been harvested. Joe Wingert, Arlington, was the 1999 cooperator in the Maquoketa watershed.

Cooperators in previous years were mostly from the Postville area. However, Jule Brown, Strawberry Point, was one of three cooperators in 1998.

The results of these demonstrations are consistent with Iowa State University (ISU) recommendations that N use for corn following soybeans can be reduced by at least one pound for every bushel of soybeans produced the previous year. In most of the

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## Legume nitrogen cont.

demonstrations, a 90-pound per acre N application has proven adequate. Results for 1999 and for all 10 demonstrations conducted since 1993 are shown in table 1.

The single variable in the demonstration has been the rate of nitrogen applied. The profit in dollars per acre includes the cost of nitrogen at 20 cents per unit and the yield response in corn at $2.40 per bushel.

The cornstalk nitrate test measures the amount of nitrate nitrogen ($NO_3$) in the corn plant after it matures. Low stalk nitrate N levels (less than 250 parts per million, or ppm) indicate that additional N would have been likely to increase yields. The marginal range (250-700 ppm) indicates a level very close to the minimal amount needed by the crop, but grain yield may not be reduced. The optimum rate (700-2,000 ppm) indicates that N availability was close to the rate needed by the plant, while levels in excess of 2,000 ppm indicate a high probability that there was more N than needed.

**Maquoketa Project.** The same corn-following-soybeans N rates (0 to 150 lbs/A) will be used in three field demonstrations (Gary Soules, Joe Wingert and Jule Brown) in crop year 2000. In addition, one- and two-year crop removal and no phosphorus treatments will be included in replicated plots within all three field demonstrations. Two of the sites have soils that test very high while one site will be located on a soil that tests low in phosphorus.

**Table 1. Corn yields for 1999 and 1993-99 average, corn-following-soybeans response to nitrogen.**

| Treatment | 1993-98 | 1999 | 1997-99 | | 10 sites 1993-99 | |
|---|---|---|---|---|---|---|
| lb/A N | Ave. yield | Yield | Stalk $NO_3$ | Stalk $NO_3$ | Yield | Profit |
| | bu/A | bu/A | ppm | ppm | bu/A | $/A |
| 0 | 150 | – | – | – | 148 | 0 |
| 30 | 159 | 137 | – | – | 157 | 16 |
| 60 | 167 | 159 | 42 | 1,176 | 166 | 31 |
| 90 | 169 | 163 | 164 | 2,422 | 168 | 30 |
| 120 | 172 | 172 | – | – | 172 | 34 |
| 150 | 172 | 174 | 484 | 4,261 | 172 | 28 |

**Table 2. First-year corn following alfalfa**

| Treatment | 1995-98 averages | 1992-98 averages | |
|---|---|---|---|
| lb/A N | Stalk $NO_3$ ppm | Yield, bu/A | Profit, $/A |
| 0 | 1,194 | 152 | 0 |
| 30 | – | 150 | -11 |
| 60 | 2,230 | 152 | -12 |
| 90 | – | 154 | -13 |
| 120 | 2,827 | 154 | -19 |
| 150 | – | 153 | -28 |

**Corn following alfalfa** demonstrations were conducted on seven cooperating farms by NEIDP staff since 1992. The results from seven years of variable replicated nitrogen rates are reported in table 2.

There was no response to additional N, there was only an increasing loss in profit (N at 20 cents per unit and corn at $2.40 per bushel) as the amount of applied N was increased.

For more information on NEIDP field demonstrations from 1992 to 1999 or demonstrations planned for crop year 2000, contact the ISUE Maquoketa Watershed Project staff, Fayette, phone 319-425-3233.