Nitrate Leaching Comparison Between High NRG-N and 28% UAN. Arise Research & Discovery, Inc. Martinsville, Illinois.

Offsite movement of applied fertilizer nitrogen is an environmental as well as an economic concern. Nitrogen movement into surface or groundwater is potentially harmful and gives agriculture a bad name. Additionally, nitrogen paid for to feed a crop is wasted when leached away. It would be a great advantage to producers and the environment if nitrogen fertilizer could be formulated to reduce such loss.

Arise Research and Discovery, an independent research company, has constructed a facility to measure nitrate movement into tile lines as well as surface movement in moving water. The soil series is a Cowden silty clay loam. Plots or "bays", which measure 12 feet wide by 30 feet long, can hold 4-30 inch rows of corn. Buried 4 feet under the surface of each bay is a tile line which empty into a 36 inch vertical pipe, where a bucket is placed to catch water draining from the tile. This water can then be collected and analyzed for nitrate concentration at each tile-drainage event. The bays are surrounded on the sides by metal walls buried into the soil to prevent contamination from outside the bay. The ground within the bays is on a slight slope so that rainwater will run down the bay into surface water collectors. The vertical pipes at the end of the bays extend above the surface such that surface water will not enter the pipes where the tiles drain. This is the third year of this experiment. The previous two years showed an average 40% less nitrate leaching loss with High NRG-N compared to 28% UAN.

Treatments evaluated are in the following chart.

Trt.	Rate/A Nitrogen	Timing
1.	10 gal/A High NRG-N	Pre-plant broadcast and incorporated
	20 gal/A High NRG-N	Side-dress with cultivation 22 days after planting (Corn V6)
2.	10 gal/A 28% UAN	Pre-plant broadcast and incorporated
	20 gal/A 28% UAN	Side-dress with cultivation 22 days after planting (Corn V6)
3.	17 gal/A 28% UAN	Pre-plant broadcast and incorporated
	33 gal/A 28% UAN	Side-dress with cultivation 22 days after planting (Corn V6)
4.	No nitrogen check	

Each treatment was replicated three times. Treatments 1 and 2 apply the same volume, 30 gal/A, and approximately the same rates of nitrogen per acre. Treatment 3 applies 50 gal/A of 28%, which would be a typical use rate of 150 lb of N per acre. Thus, treatment 1 and 2 are applying only 60% of the normal rate, which would be a normal rate for High NRG-N. Treatment 4 applies no nitrogen for comparison. Nitrogen was the only fertilizer applied in the experiment. In the previous fall, there was application of 100 lb/A each of 11-52-0 and 0-0-60 over the entire experiment.

The first nitrogen application was on May 17 and the corn was planted two days later. The corn hybrid used was Great Lakes GL6146. There were only four tile water collections. Rainfall amounts between collection dates is shown in the following table.

Rainfall totals between tile drainage collections
Arise Research & Discovery. Martinsville, IL - 2004

First application: May 17

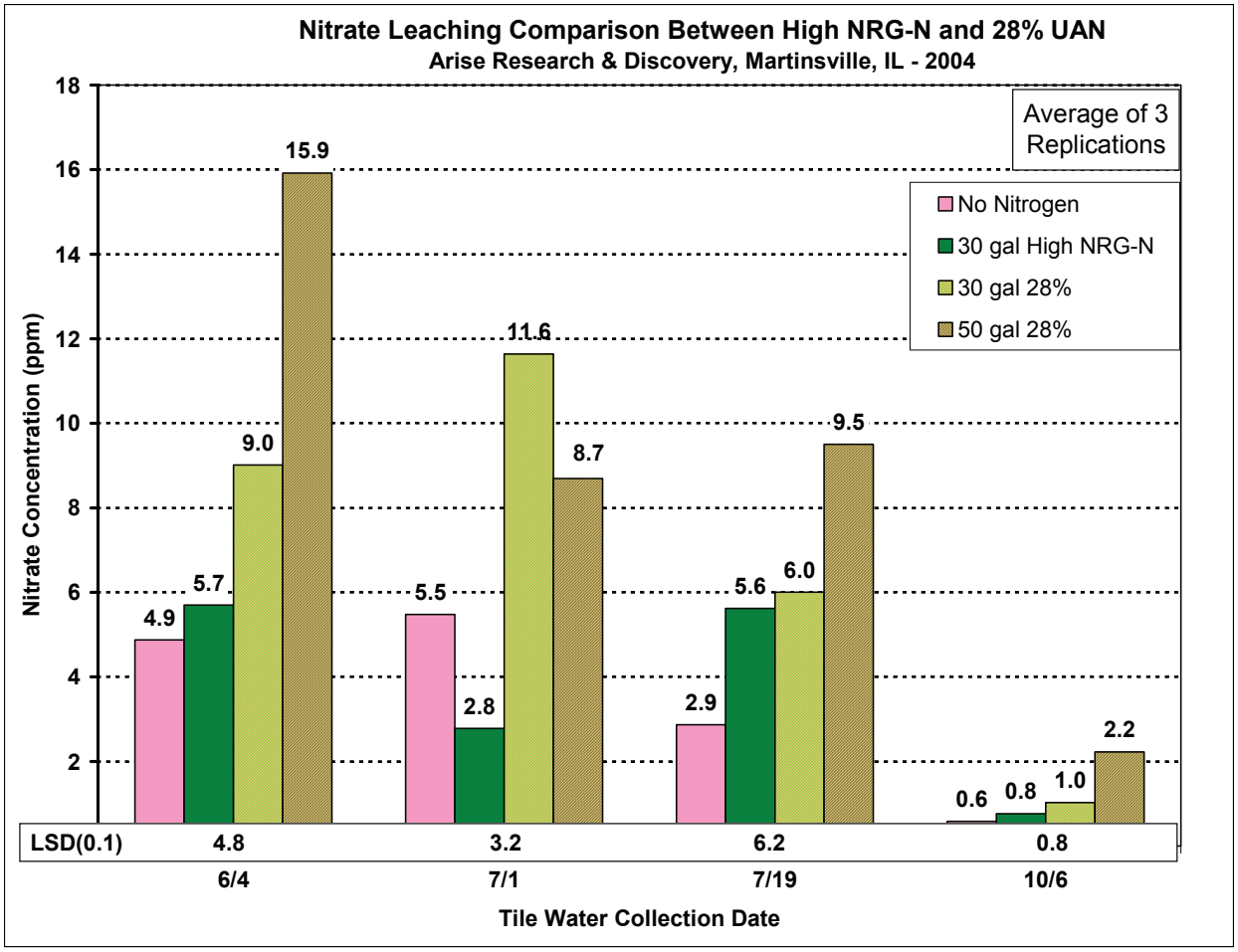
	rainfall (inches)	collection date
May 17 - June 4	4.30	June 4
(side-dressed June 10)		
June 11 - June21	3.15	July 1
July 3 - July 16	6.50	July 19
July 22 - October 6	6.55	October 6

The following pictures explain the plot layout and tile water collection.

Nitrate leaching collection system. Tile under the plot drains into the collection basin at the front. The basin is normally kept covered.

Looking down into the collection basin where tile output is collected in a bucket for nitrate analysis.

Average nitrate level in tile water from the different treatments appears in the following chart.



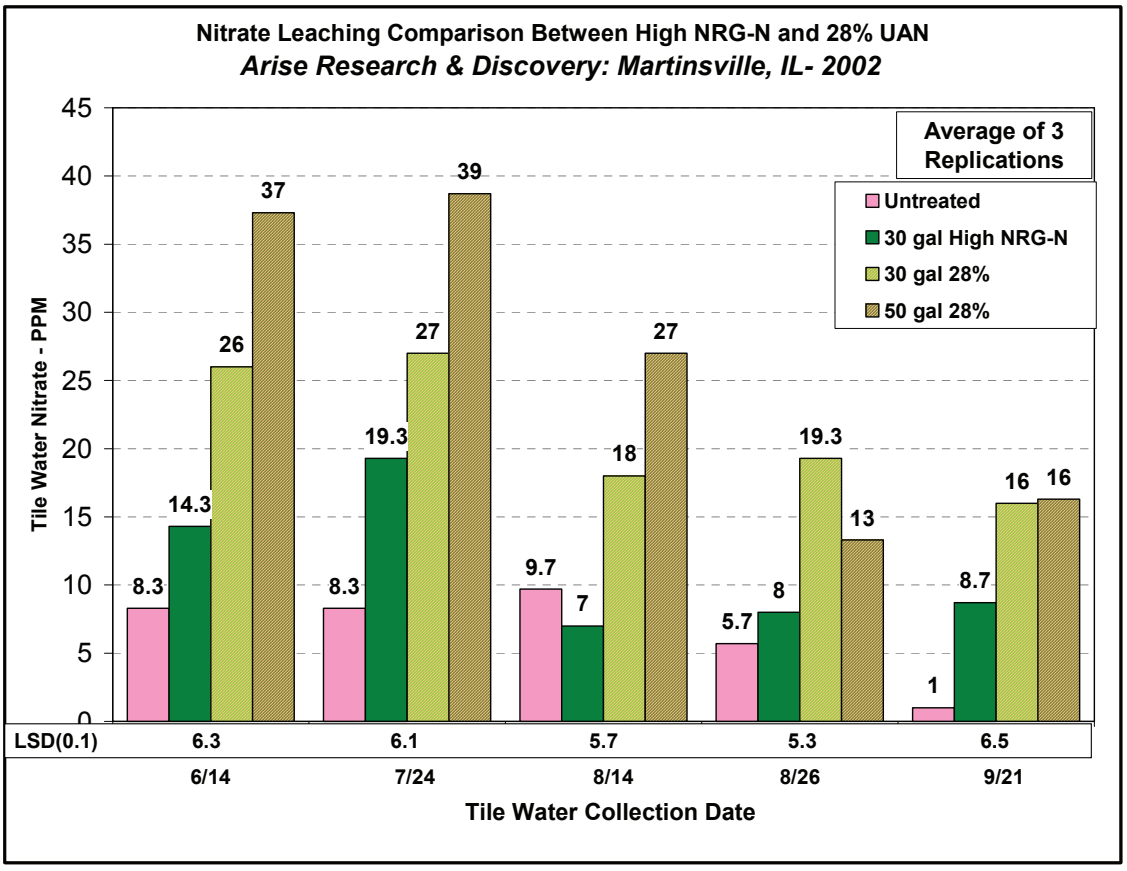
- Nitrate loss through leaching into tile drainage was lower with High NRG-N than with either the equal or normal rates of 28% UAN.
- Nitrate loss levels were substantially lower in 2004 compared to the previous two years. It is felt that this is because the yields obtained in 2004 were so high compared to previous years. Higher than normal yields were seen through the Midwestern corn belt due to favorable growing conditions through the season, and the corn crop made more efficient use of applied nitrogen and less was lost to leaching.

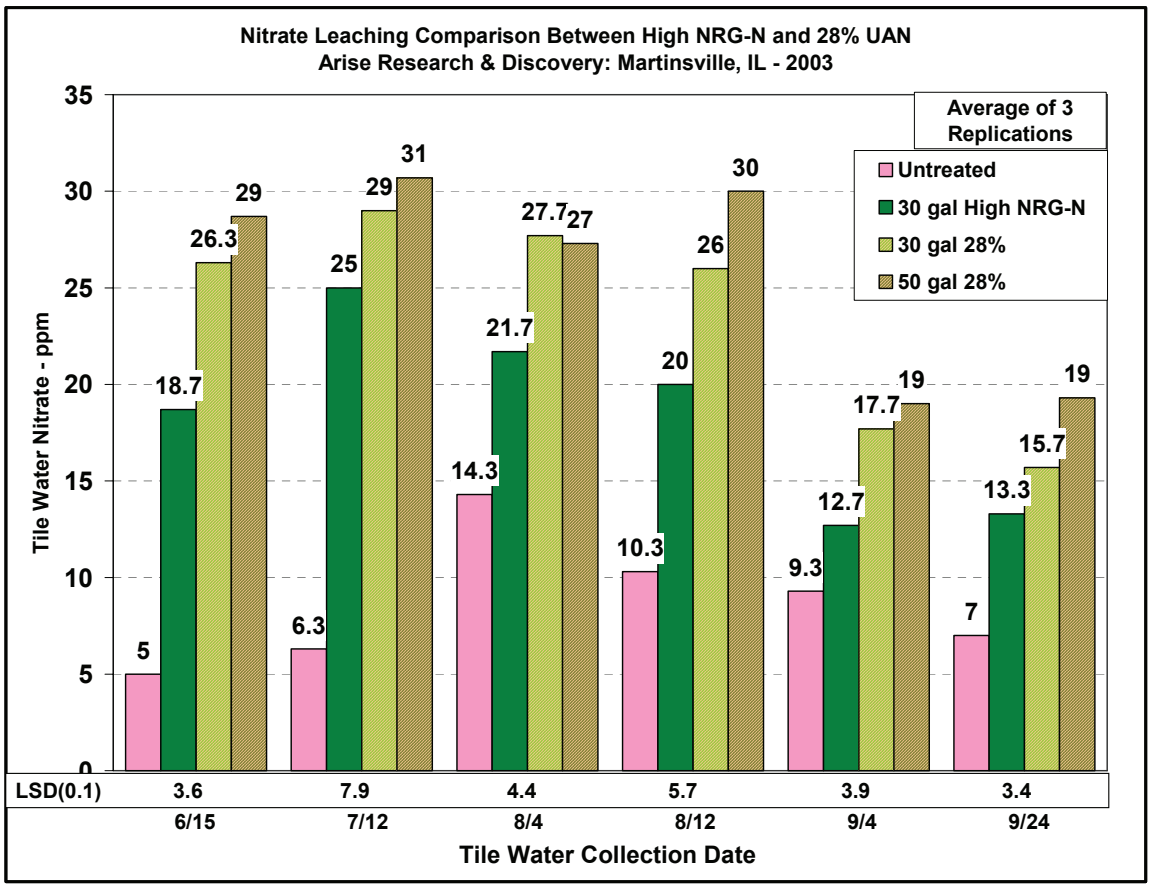
A table showing total nitrate loss and corn yields over the three years of the experiment follows.

Nitrate Leaching and Corn Yield Comparisons Between High NRG-N and 28% UAN *Arise Research & Discovery. Martinsville, IL 2002-2003*								
	Total tile nitrates (ppm)				Corn Yield (Bu/A)			
Nitrogen treatment	2002	2003	2004	3 yr avg	2002	2003	2004	3 yr avg
30 gal High NRG-N	57.3	111.4	14.9	**61.2**	177.4	138.1	228.0	**181.2**
30 gal 28% UAN	106.3	142.4	27.7	**92.1**	160.6	126.7	223.9	**170.4**
50 gal 28%	132.7	155.0	36.3	**108.0**	165.7	136.7	224.8	**175.7**
No Nitrogen	33.0	52.2	13.8	**33.0**	73.6	92.4	124.0	**96.7**
LSD(0.05):	23.5	23.2	8.8	18.6	15.1	15.5	13.8	14.3
LSD(0.1):	18.7	18.5	7.0	15.4	12.0	12.3	10.9	11.9

- Highest yield and lowest nitrate loss was from application of High NRG-N. In fact, nitrate loss with High NRG-N was 34% less than the equal rate of 28% UAN, and 43% less than the normal use rate of 28% UAN.
- These results show that formulation differences with High NRG-N involving organic flavonol chelation of nitrogen enable more of the applied nitrogen to stay where it is applied. This partially explains why High NRG-N is effective at rates lower than conventional nitrogen.

Addendum: tile leaching graphs for 2002 and 2003:




Nitrate Leaching Comparison Between High NRG-N and 28% UAN
Arise Research & Discovery: Martinsville, IL - 2003
Average of 3 Replications
Untreated
30 gal High NRG-N
30 gal 28%
50 gal 28%
Tile Water Nitrate - ppm
35
30
25
20
15
10
5
0
5
18.7
26.3
29
6.3
25
29
31
14.3
21.7
27.7
27
10.3
20
26
30
9.3
12.7
17.7
19
7
13.3
15.7
19
LSD(0.1)
3.6
7.9
4.4
5.7
3.9
3.4
6/15
7/12
8/4
8/12
9/4
9/24
Tile Water Collection Date