Water Matters

Issue 12, June 2019

LOWER LOUP NATURAL RESOURCES DISTRICT

Critical Nitrogen Report Sent to Operators

Each spring, for irrigated corn and potatoes in Area 28, the LLNRD has assessed how well nitrogen (N) was used the previous year (2018 Extra N) and recommends the amount of N to apply the current year (2019 N Rec). The report to the right is an example.

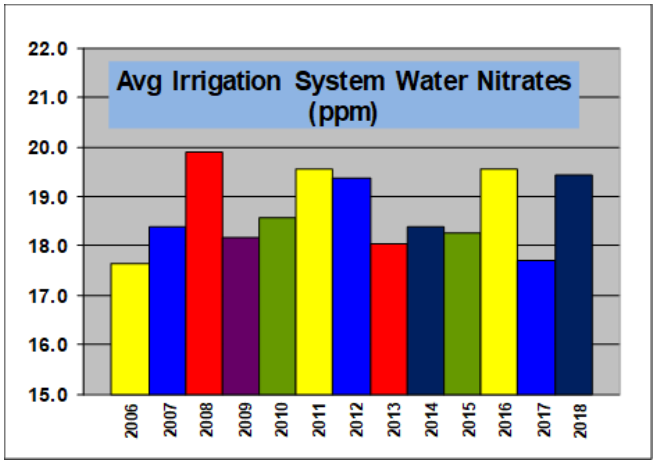
2019 N Recommendations for Roy W. Fieldings — Friday, March 8, 2019

2018 CROP	2019 CROP		EY (bu/ac)	Soil NO3 (ppm)	OM (%)	Irr (")	Irr NO3 (ppm)	Irr N (#/ac)	Legume Credit (# N/ac)	Manure (# N/ac)	2018 Extra N (#/ac)	2019 N Rec (#/ac)
Field/Irrigation System			**Mom's Gravity**						**G-215439**			
CORN	CORN		266	4.0	1.0	6	24.8	27	0		-72	245
SOYBEANS	CORN		266	3.0	1.0	6	24.8	27	35			219
Field/Irrigation System			**Hill Pivot**						**G-384907**			
CORN	CORN		226	3.5	2.0	9	33.5	55	0		12	152
Field/Irrigation System			**South Pivot**						**G-592078**			
SOYBEANS	CORN		209	6.0	2.2	6	34.2	38	35			95
CORN	CORN		209	3.0	2.2	6	34.2	38	0		47	151
Field/Irrigation System			**John's Pivot**						**IS183**			
SOYBEANS	CORN		253	2.0	1.4	8	30	44	35			184
CORN	CORN		253	1.0	1.4	8	30	44	0		-8	225
Field/Irrigation System			**Jane's**						**IS701**			
CORN	CORN	N	255	4.0	1.1	5	37.6	35	0		-35	223
CORN	CORN	S	255	8.0	1.1	5	37.6	35	0		-35	193

Generally, the N Rec indicates the upper application limit. It also benchmarks a point from which to make regulatory program decisions. They are determined by a University of Nebraska calculation that uses expected yield to determine N needed, then deducts sources of N from the soil, organic matter, irrigation water, etc.

In the example, the N Rec varies by 150 lbs/ac between fields. Historically, this farmer varies the rate by 20 lbs/ac. The negative numbers in the 2018 Extra N column indicate that he is applying less N than recommended and is raising very good corn in the 200 to 280 bu/ac range. In 2 cases, he has applied more N than needed.

Of the 350 irrigated corn fields in Area 28, 150 had too much N in 2018. For those fields the average over-application was 30 lbs/ac. Potato fields had more. Below is a chart indicating that the concentration of nitrates in the irrigation water exceeds limits and is not declining. Commercial N is the main source. In cases of frequent overuse of N, a method to limit it is being considered.



Inside this issue:

The LLNRD Nitrogen Management Area 28 runs from Columbus to Palmer on the south side of the Loup River

Fields with frequent overuse of nitrogen are identified in Area 28

Commercial Nitrogen application has increased by over 20% since 2006 in Area 28

Please do not exceed nitrogen recommendations

See more inside!

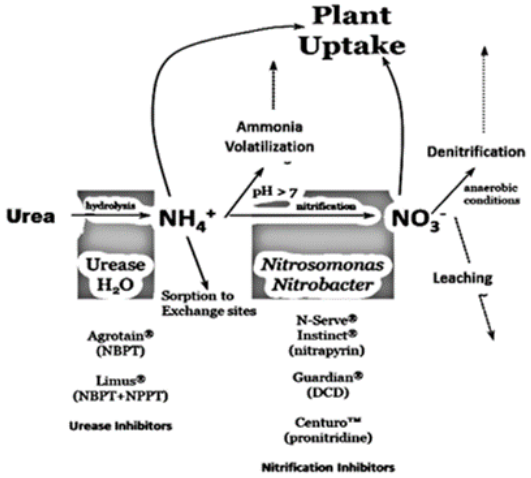
Nitrogen Inhibitors for Improved Fertilizer Use Efficiency

Following is a short version of an article from the University of Nebraska's 2019 Crop Production Proceedings. For the complete article, please see CropWatch.unl.edu.

Urease inhibitors block the activity of the enzyme urease and are often used on the nitrogen fertilizers called urea when it is broadcast and left unincorporated. This fertilizer is subject to volitization losses of nitrogen. Products with known efficacy for inhibiting urease activity are N-(n-butyl) thiophosphoric triamide (NBPT) and N-(n-propyl) thiophosphoric triamide (NPPT). These active ingredients are found in products with trade names of Agrotain™ (NBPT) and Limus™ (NBPT & NPPT). There are also other products that contain NBPT, since it is no longer patent-protected.

Nitrogen inhibitors temporarily reduce populations of *Nitrosomonas* and *Nitrobacter* bacteria in soil. These compounds protect against both denitrification and leaching by retaining fertilizer N in the ammonium form.

Products with known efficacy for inhibiting nitrification are dicyandiamide (DCD), nitrapyrin, and pronitradine. Nitrapyrin has long been sold as N-Serve™ and Instinct™, and pronitradine has recently come into the market with the trade name Centuro™. Nitrapyrin and DCD are not patent protected and may be found in a variety of products.



Nitrogen loss pathways and management options to reduce risk of N loss

Nitrification inhibitors, like urease inhibitors, will break down over time and will no longer be effective.

If an active ingredient is not listed above, there is no research experience with the product or it has been found to be ineffective in research studies.

Wheeler County Township Nitrates May Mean New Controls

Nitrate readings up to 38.3 parts per million (ppm) in a Wheeler County township could result in the creation of the Lower Loup NRD's first water quality sub-area.

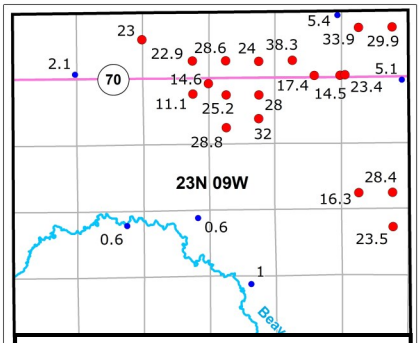
The high nitrate readings, well above the federal standard of 10 ppm, in Township 23 North, Range 9 West, could lead to creation of a Phase II management area in that township. Phase II management would include a requirement for flow meters on irrigation wells, certification classes for all nitrogen applicators, no fall or winter fertilizer applications on sandy soils, annual soil and water samples, and annual reporting.

Year	Area 29 Median Nitrate (ppm)
2014	22.0
2015	17.7
2016	7.9
2017	7.7
2018	23.0

The LLNRD Board of Directors is expected to consider creating a Phase II sub-area in the township at their June 27, 2019, meeting.

Groundwater wells have exceeded 6.5 ppm nitrate for 4 years in a row as shown in the lower left table. The area to the north of proposed Sub-Area 29 is already part of an expanded groundwater management area in the Upper Elkhorn NRD.

Recent modifications to the District's Groundwater Management Rules and Regulations allow for the creation of Groundwater Quality Sub Areas.



Wells in Wheeler County Township 23 N, Range 09 W, show high nitrate levels

Cover Crops Reduce Nitrogen Leaching and Use

Rye cover crops planted after corn or soybeans can reduce soil nitrates and the potential for leaching nitrates to the groundwater. Tile drains in Iowa and Michigan, with and without a cover crop, indicate less nitrate is lost from those with cover crops. Crediting nitrogen from a cover crop is based on the amount of biomass produced and its crude protein content.

In a recent study over 3 years on a pivot-irrigated sand field near Fullerton, soil nitrates in a 0-36" increment were reduced by 10 lbs/ac each year that a cover crop was present. In a study currently underway near Clay Center, nitrates in the top 8" of soil was significantly reduced where cover crops were grown.

In the corn belt east of Nebraska, subsurface drains are sometimes used to drain water from the soil for improved crop growth. Water from the drains can be analyzed for nitrates from the crop above. Near Ames, Iowa, and averaged over 4 years, the rye cover crop reduced flow-weighted NO3 concentrations by 59% and loads by 61%. At Lamberton, Minnesota, in a 3-year study, nitrates lost from a subsurface drain were reduced by 13% when a rye cover crop existed, as compared to when one did not.

Nitrogen that is not lost to downward movement of water could end up in the green material grown on the surface. The amount of nitrogen on the surface is a result of the crude protein and the tonnage of that material. Young plants and legumes have a higher crude protein content. Rye that is bolted has less crude protein. The nitrogen in these sources has the potential to replace commercial fertilizer. Table 1 above shows that 1 1/2 tons of a young rye cover crop has the potential to decrease commercial application by 20 lbs. Inclusion of Vetch increases that. Rye that has produced a seed head may actually require more nitrogen fertilizer to begin with. Because the coarse material is low in protein and nitrogen, the release of nitrogen is slowed. It will eventually be released as the organic matter breaks down, thus application of nitrogen after the row crop emerges can be reduced. Lab analysis and measuring tonnage is the most accurate way to determine nitrogen contribution.

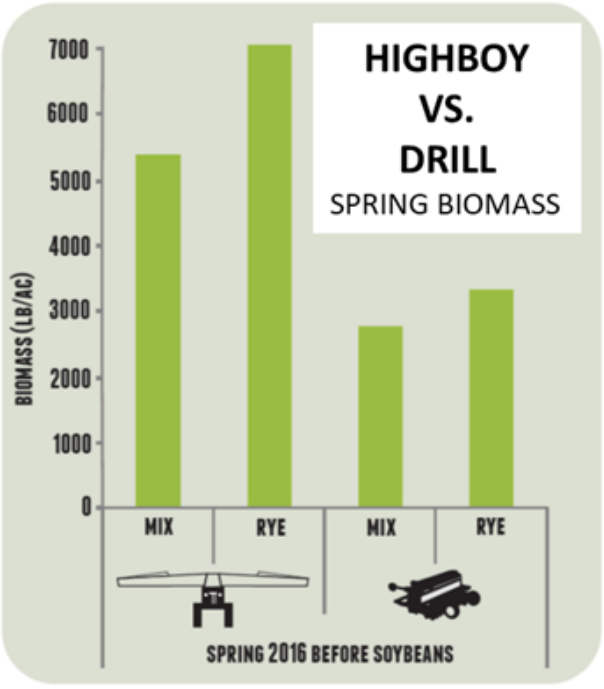
Generally, the earlier a cover crop is planted in the fall, the more it will produce. In the diagram to the left, a highboy used for seeding into tasseled corn produced nearly twice as much as compared to a drilled cover crop after harvest. EQIP pays a maximum $34/acre for a multiple species planting and requires 6-8" of cover crop growth before it is terminated.

Estimating plant-available nitrogen release from cover crops

Table 1.—Nitrogen fate after rapid phase of cover crop decomposition is completed.

Cover crop (%N in DM)	Growth stage	Biomass DM	Cover crop N uptake	N fate: N in soil organic matter	N fate: Plant-available N (PAN) NH_4-N + NO_3-N
		(lb/a)	(lb/a)	(lb/a)	(lb/a)
Common vetch (3% N)	vegetative	3,000	90	40	50
Cereal rye (2% N)	stem elongation	3,000	60	40	20
Cereal rye (1% N)	heading	8,000	80	107	-27

Credit: Dan M. Sullivan, Extension soil scientist, and Nick D. Andrews, small farms Extension agent; Oregon St. Univ.



Credit: Iowa Learning Farms | Practical Farmers of Iowa
Iowa State University Extension and Outreach

WATER MATTERS

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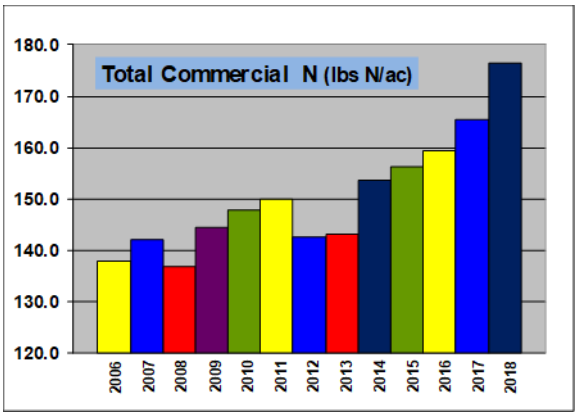
Record Yields Have Not Reduced Groundwater Nitrate

Groundwater nitrates in Area 28 are about twice as high as the 10 ppm federal limit. The chart below indicates an increase in the application of commercial nitrogen (N) to corn in Area 28.

The 2018 corn yield was a new record at about 215 bu/ac across Area 28. Although high yields are good, the increase in yield goals and the increase in commercial N applications puts more N at risk to enter the groundwater. Lab analysis confirms that commercial N is the source of most of those nitrates.



The chart above right shows that the lbs of N that it takes to produce a bushel of corn is declining in Area 28. This calculation considers all sources of N, including soil and irrigation water. Because the amount of irrigation and soil N were down in 2018 and yield was up, the best nitrogen efficiency ever was attained at 1.2 lbs N/bu. The actual amount of N in a bushel of corn is somewhere around 0.7 to 0.9 lbs, so even at 1.2 lbs N/bu, there is still room for improvement. Reducing and delaying commercial N application later into the year with chemigation may do that.