Strategies for Meeting N Requirements of Wheat with New Fertilizers and Fertilizer Additives

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Research Questions

Nitrogen fertilizer is usually the single most expensive input used in wheat production. Losses of N can be substantial through leaching and denitrification, particularly in the Red River Valley region. This project seeks to answer the question: Can nitrogen stabilizing technologies improve nitrogen efficiency and allow for greater flexibility in the timing of N application, without the risk of serious N loss to the environment? Though this was a single season project, it continues research that had been conducted for two previous seasons.

Results

The research conducted included several factors (rates, sources and timing of application of N); a rather complex trial to summarize in this space. Yields in general were very high; 2016 was a phenomenal year for yield and apparently for soil N mineralization as evidenced by the very high yields in the unfertilized checks at Red Lake Falls (RLF) and Casselton (see table in annex). Differences in yield and protein were small when comparing sources of N at the same rate and timing. Spring applications tended to be only slightly better for yield and protein than the fall applications of the same fertilizer type and rate. Averaged over locations, the 100% rate of ESN numerically had the highest yield and protein. At RLF, the addition of Agrotain to the treatments receiving UAN at the 6 leaf stage improved the effectiveness of this treatment. At the Ada location, ESN tended to provide greater yields and protein at most timings and rates compared to urea alone. This site had the coarsest textured soil, so leaching potential was greatest, which may explain the reason for the relatively better response of ESN. The results obtained this season will be further analyzed with the results of previous seasons along with the weather data in order to develop a better understanding of how weather impacts the responses of these N sources and timings. Nevertheless, generally it appears that the results from this season were similar to those obtained in previous seasons.

Application and Use

It is difficult to make recommendations from a single year of data, even with the results of three locations. The data do suggest that there is only a very small added value in some of the more expensive fertilizer sources that “stabilize” nitrogen. Relative to the additional cost, in most cases the added value may not always cover the extra cost of these inputs. One factor that will impact the returns to these products over urea alone is the premium/discount of the protein at the elevator. With the very high yields obtained this season, a moderate discount/premium may be enough to make the use of ESN in a site with high potential for nitrogen loss (like Ada) profitable.

Materials and Methods

Experiments were established in three locations, Casselton, Ada and Red Lake Falls, in 2016. There were 24 treatments total: ESN in the fall (all fall applications were made after the soil temperature had dropped below 50 degrees); urea in the fall; part ESN part urea compared to all ESN in the fall and in the spring; ESN in the fall compared to urea plus Instinct in the fall, and a control treatment of no added N. Rates of nitrogen were also included. Yield and grain protein were measure at harvest.

Economic Benefit to a Typical 500 Acre Wheat Enterprise

Given the fact that the results discussed here were from a single year of experimentation, we are not able to calculate an economic benefit to the farmer with any confidence. In some environments, the use of nitrogen extending technology may actually cost more than can be covered by the added value of either the yield or the protein. Given the high yields this year, it appears that some profit from the use of ESN and perhaps Instinct could have be obtained, provided that there is at least a modest protein premium/discount at the elevator.

Related Research

The research that we have been conducting that deals with predicting the need for extra nitrogen and nitrogen timing is complementary to this research. We are also conducting research with ESN in wheat and corn, with different timings of application in the fall.

Recommended Future Research

A more complete analysis of the three years of data is needed in order to better understand what type of environments stabilized nitrogen will be profitable.

Publications

Feland, C. and J. Ransom. 2016. Impact of nitrogen type, timing, and additives on grain protein in hard red spring week. Abstract of presentation at the Nitrogen Use Efficiency Conference, Boise, Idaho, August 2016. Calli Feland won first prize for the poster she presented.

Appendix

N Rate	Timing	Fertilizer	Protein				Yield			
			Casselton, ND	Ada, MN	RLF, MN	Combined	Casselton, ND	Ada, MN	RLF, MN	Combined
			g kg-1				bu/ac			
0%	NA	None	12.3	11.7	10.9	11.6	70.9	53.6	72.6	69.1
50%	October	ESN	13.3	11.9	11.2	12.1	79.3	81.3	86.5	82.4
75%	October	ESN	14.0	11.9	12.0	12.7	81.8	82.7	104.9	90.2
100%	October	ESN	14.3	12.7	12.6	13.2	78.7	90.8	96.5	88.7
50%	October	Urea	13.4	11.8	11.4	12.2	81.0	80.8	92.7	84.8
75%	October	Urea	13.6	12.4	12.0	12.7	76.9	85.8	100.5	87.7
100%	October	Urea	13.9	12.5	12.4	13.0	79.7	83.6	102.4	88.6
100%	October	75:25	14.3	12.8	12.6	13.2	82.4	94.4	107.5	94.7
100%	October	50:50	14.5	12.8	12.5	13.3	83.9	85.3	102.0	90.4
75%	October	U + Instinct	13.6	12.3	11.6	12.5	82.9	77.0	98.4	86.1
100%	October	U + Instinct	13.4	12.9	12.8	13.0	75.2	88.4	101.5	88.4
50%	Spring	100% ESN	14.0	12.2	12.3	12.8	83.0	80.8	95.5	86.0
75%	Spring	100% ESN	13.9	12.9	12.3	13.1	81.4	91.7	100.4	91.1
100%	Spring	100% ESN	14.3	13.5	13.4	13.7	82.8	97.1	112.1	97.3
50%	Spring	100% Urea	13.5	12.1	11.3	12.3	80.1	91.1	89.8	87.0
75%	Spring	100% Urea	14.3	12.5	12.5	13.1	78.8	89.4	102.1	90.4
100%	Spring	100% Urea	14.2	13.0	12.5	13.2	85.7	84.6	101.5	90.3
100%	Spring	75:25	14.2	13.3	12.6	13.4	82.6	90.3	102.8	92.0
100%	Spring	50:50	14.5	13.4	12.8	13.6	76.5	88.4	105.7	90.2
75%	Spring	Urea + Instinct	14.4	12.9	12.0	13.1	86.4	91.5	97.0	91.6
100%	Spring	Urea + Instinct	14.2	13.0	12.7	13.3	84.9	93.1	103.5	93.6
100%	Spring	50:50 at 6 leaf	14.2	13.1	11.9	13.1	81.1	88.8	103.9	91.2
100%	Spring	50% UAN +A	14.3	13.3	12.9	13.5	79.9	90.3	108.4	92.9
200 lb N	Spring	Urea	14.6	13.6	13.4	13.9	81.0	91.5	111.5	94.7
	LSD 0.05		0.9	0.5	0.4	0.4	7.0	12.2	8.4	6.1