Minnesota Wheat Research and Promotion Council
CROP YEAR 2013 RESEARCH REPORTING FORM
Form Due November 15, 2013

1. PROJECT TITLE **Improving N-use Efficiency in Spring Wheat**

2. PRINCIPAL INVESTITAGATOR (S)

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4. REPORT DATE
November 2013

5. REPORTING PERIOD
January 2012 to November 2013

6. TERMINAL REPORT ___X_____ **PROGRESS REPORT** _____

7. AMOUNT OF GRANT: $27,620

8. PUBLICATIONS: None

9: EXECUTIVE SUMMARY

Research Question:

Can nitrogen use efficiency of fertilizer N be improved by timing of N application or with the use of products developed to reduce N losses?

Results:

During 2013 experiments were established later in the spring than in 2012 due to excess moisture and a prolonged winter. Associated with heavy rain early in the growing season were periods of waterlogging in some of the locations. This should have been favorable for the loss of nitrogen that might have been in the nitrate form during this period. Yields were relatively good, especially at Prosper and Roseau. At all locations, yields improved with increasing N application rates, regardless of the additive or if split. The additives/splits, however, did not substantially improved grain yields over the urea alone. Grain protein, on the other hand, tended to be higher with the split application of UAN + Agrotain Plus and when ESN was used. Even though conditions appeared to be favorable for N loss, the treatments that were designed to reduce this loss did not consistently show a yield benefit over the urea alone. Nitrogen levels declined rapidly in the spring (data from NW22 location, see Figure 1). Nitrapyrin (Instinct) delayed the loss of nitrogen in the soil only slightly. A more detailed analysis of these data along with an examination of soil nitrogen levels, once those samples have been fully analyzed, is planned before a new round of testing of these materials/approaches is proposed.

Application/Use:

Additional research is needed to determine the profitability of the various treatments included in this experiment and before a useful recommendation can be made.

Materials and Methods:

Experiments were planted in four locations (we did not include the data from NW22 in this report, however). Experiments consisted of a factorial combination of N fertilizer rates with different nitrogen additives/timings (see Table 1 for the full listing). "Prosper" was the variety used at all locations. Soil nitrogen form and availability was measured several times during the first two months of the growing season from the higher N rate treatments. These samples were analyzed for ammonium and nitrate concentration (data not shown). Yield, test weight and protein were measured at harvest.

Economic Benefit to a Typical 500 Acre Wheat Enterprise:

These data show that there is no economic benefit from over-applying nitrogen (the 100lb rate yielded nearly the same as the 140 lb rate). Furthermore, the yield increases from the additives tested probably did not pay for the added cost of these treatments. Protein was enhanced, however, with the split application when Agrotain Plus as included with the UAN and with the ESN treatment. At current protein premiums/discounts, however, the noted increases probably will not help to make these treatments profitable during a season like 2013.

10: RELATED RESEARCH None

11: RECOMMENDED FUTURE RESEARCH

Though there was some useful information generated from this year's research, additional data are needed before a firm recommendation can be made. Selected treatments should be further tested in an expanded series of testing, both on-farm and on-station.

12: APPENDIX

Table 1. Effect of nitrogen management on yield (bu/a) of spring wheat, three locations, 2013.

Treatment	Prosper	Argyle	Roseau	Ave
60 lbs N as urea preplant	75.9	53.2	61.2	63.4
100 lbs N as urea preplant	79.0	55.4	72.0	68.8
140 lbs N as urea preplant	81.3	53.0	74.2	69.5
60 lbs N as urea plus Agrotain preplant	73.2	57.3	68.0	66.2
100 lbs N as urea plus Agrotain preplant	80.8	58.2	71.0	70.0
140 lbs N as urea plus Agrotain preplant	85.7	60.9	82.6	76.4
60 lbs N as urea plus Instinct preplant	73.1	56.9	69.6	66.5
100 lbs N as urea plus Instinct preplant	77.8	54.4	72.3	68.2
140 lbs N as urea plus Instinct preplant	78.5	51.9	76.1	68.8
60 lbs N as SuperU, broadcast and incorporated	77.2	54.6	66.4	66.1
100 lbs N as SuperU, preplant	77.6	61.9	71.5	70.3
140 lbs N as SuperU, preplant	82.8	64.7	78.7	75.4
30 lbs N as urea preplant, 30 lbs N as UAN at 4/5 lf stage	80.8	59.1	66.6	68.8
50 lbs N as urea preplant, 50 lbs N as UAN at 4/5 lf stage	79.1	56.1	66.9	67.4
70 lbs N as urea preplant, 70 lbs N as UAN at 4/5 lf stage	85.1	58.9	75.3	73.1
30 lbs N as urea preplant, 30 lbs N as UAN + Agrotain plus at 4/5 lf stage	74.8	54.4	67.4	65.5
50 lbs N as urea preplant, 50 lbs N as UAN + Agrotain plus at 4/5 lf stage	81.3	57.1	71.1	69.8
70 lbs N as urea preplant, 70 lbs N as UAN + Agrotain plus at 4/5 lf stage	84.8	57.3	80.0	74.0
60 lbs N as ESN urea preplant	74.0	55.6	56.8	62.1
100 lbs N as ESN urea preplant	81.1	59.7	68.3	69.7
140 lbs N as ESN urea, preplant	84.1	50.5	69.5	68.0
42 lbs N as urea preplant and 18 lbs ESN with the seed at planting	67.2	51.3	65.6	61.4
70 lbs N as urea preplant and 30 lbs ESN with the seed at planting	82.3	60.5	71.9	71.6
98 lbs N as urea preplant and 42 lbs ESN with the seed at planting	77.2	57.5	72.7	69.1
42 lbs N as urea preplant and 18 lbs urea with the seed at planting	72.2	53.5	66.2	64.0
0 N Instinct applied and incorporated prior to planting	53.5	43.2	48.0	48.2
0 lbs N	52.7	42.7	43.3	46.2
180 lbs N as urea, incorporated at planting	87.2	65.4	77.1	76.6
Mean	77.1	55.9	68.9	67.3
CV	8.4	14.6	9.2	
LSD 0.05	9.1	11.5	9.2	

Table 2. Effect of nitrogen management on protein percent of spring wheat, three locations, 2013.

Treatment	Prosper	Argyle	Roseau	Ave
60 lbs N as urea preplant	13.0	11.2	10.9	11.7
100 lbs N as urea preplant	13.6	11.9	11.4	12.3
140 lbs N as urea preplant	14.7	12.6	12.8	13.4
60 lbs N as urea plus Agrotain preplant	13.0	11.4	11.3	11.9
100 lbs N as urea plus Agrotain preplant	13.8	11.5	11.4	12.2
140 lbs N as urea plus Agrotain preplant	14.4	13.1	12.4	13.3
60 lbs N as urea plus Instinct preplant	13.5	11.4	11.9	12.3
100 lbs N as urea plus Instinct preplant	13.6	12.1	12.5	12.7
140 lbs N as urea plus Instinct preplant	14.5	12.8	13.0	13.4
60 lbs N as SuperU, broadcast and incorporated	13.0	11.2	11.3	11.8
100 lbs N as SuperU, preplant	13.6	12.0	12.2	12.6
140 lbs N as SuperU, preplant	14.1	13.2	13.1	13.5
30 lbs N as urea preplant, 30 lbs N as UAN at 4/5 lf stage	13.6	12.0	12.1	12.6
50 lbs N as urea preplant, 50 lbs N as UAN at 4/5 lf stage	12.8	12.9	11.9	12.5
70 lbs N as urea preplant, 70 lbs N as UAN at 4/5 lf stage	14.2	13.5	13.8	13.8
30 lbs N as urea preplant, 30 lbs N as UAN + Agrotain plus at 4/5 lf stage	12.7	11.9	12.4	12.3
50 lbs N as urea preplant, 50 lbs N as UAN + Agrotain plus at 4/5 lf stage	13.2	13.4	12.6	13.1
70 lbs N as urea preplant, 70 lbs N as UAN + Agrotain plus at 4/5 lf stage	13.9	13.5	13.7	13.7
60 lbs N as ESN urea preplant	13.2	12.1	11.4	12.2
100 lbs N as ESN urea preplant	13.9	13.0	13.1	13.3
140 lbs N as ESN urea, preplant	14.7	13.8	13.5	14.0
42 lbs N as urea preplant and 18 lbs ESN with the seed at planting	12.0	11.5	11.9	11.8
70 lbs N as urea preplant and 30 lbs ESN with the seed at planting	14.1	13.0	12.3	13.1
98 lbs N as urea preplant and 42 lbs ESN with the seed at planting	14.3	13.8	12.7	13.6
42 lbs N as urea preplant and 18 lbs urea with the seed at planting	12.8	12.1	11.4	12.1
0 N Instinct applied and incorporated prior to planting	11.9	11.6	11.4	11.6
0 N	11.7	11.1	10.9	11.2
180 lbs N as urea, incorporated at planting	14.7	13.5	13.7	14.0
Mean	13.5	12.4	12.2	12.7
CV	4.4	5.9	7.0	
LSD 0.05	0.8	1.0	1.2	

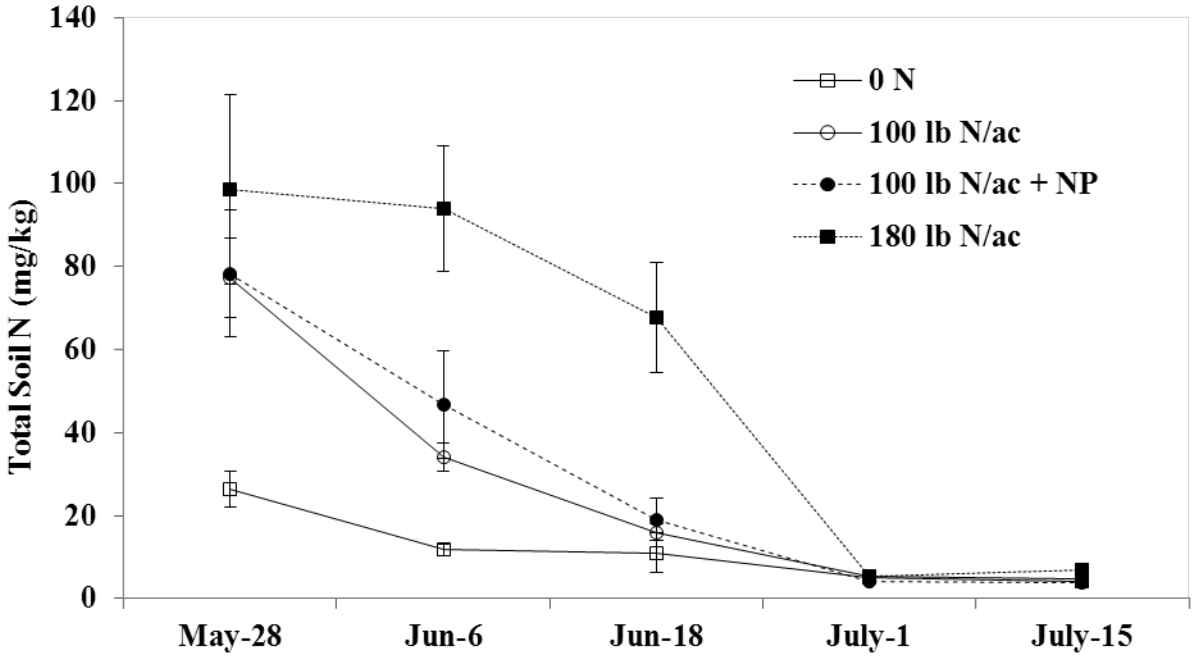

Fig 1. Effect of N-fertilizers on total inorganic N (NH_4^+-N + NO_3^--N) at 0-30 cm soil profile throughout the spring-wheat growing season (2013). NP: nitrapyrin.