

ANNUAL REPORT

PROJECT NO: BJKX58

TITLE: Tailoring nitrogen recommendations by variety: winter wheat response to fertilizer application timings

PERSONNEL: Dr. Juliet Marshall, Dr. Kurt Schroeder

ADDRESS: 1776 Science Center Dr, Suite 205, Idaho Falls, ID, 83402; 208-529-8376;
jmarshall@uidaho.edu

ACCOMPLISHMENTS: This data represents the second year of a three-year study. The third (funded) study was planted this fall 2015. The hypothesis was that with improvements in plant genetics and the genetic diversity of introduced cultivars, we can improve economic efficiency of production by reducing and/or refining nitrogen application not only to the hard red winter wheat market class, but to specific varieties. The objective is to test differential response to fertilizer application and to develop recommendations that specifically address varietal response in our diverse environments (Moscow, Walla Walla and Aberdeen). We also want to improve nitrogen use efficiency and target a range of grain protein across all varieties and environments. The specific objectives are:

- I) Improve nitrogen application recommendations of currently grown varieties to reduce N losses associated with preplant application.
- II) Improve our ability to target a range of grain protein.
- III) Determine varietal response of different fertilization regimes.

Main plot: Nitrogen rate (six replications)

1. 60% preplant / 40% tillering application of required nitrogen
2. 40% preplant / 60% tillering application of required nitrogen
(tillering application was split to half at tillering and half two weeks later)

Subplot was variety (six varieties at each location). Sub-sub plot was topdress nitrogen application at flowering, with three topdress rates of 40, 60 or 80 lbs of N

From the 2014-2015 (2-yr, 2 locations) Combined analysis:

Initial results from combined analysis (Moscow and Aberdeen) indicate that there were no significant main plot effects (60/40 or 40/60 main treatments) on plant height or yield. In both years, yield did not change if total fertilizer was applied 60% preplant or 40% preplant. If yields do not improve with 60% of fertilizer applied preplant, then shifting higher rates of fertilizer application to (40/60%) later in the growing season could potentially reduce nitrogen losses by leaching or volatilization over the winter by timing nitrogen application more closely with plant use.

Yields in Moscow in 2014, and Moscow and Aberdeen in 2015 were lower than expected due to drought and environmental stress.

2015 Results in Aberdeen:

There were no significant differences in yield, test weight, spring stand, plant height, lodging (no

lodging was observed in 2015) between the 40/60 and 60/40 split in preplant fertilizer. In 2015, actual yields (118 bu/A) were significantly below expected yields (160 bu/A, at 2.5 lbs N/bu = 400 lbs N/A), indicating that the nitrogen applied exceeded yield needs. Yield in Aberdeen in 2014 averaged 171 bu/A, which exceeded the calculated expected yield by 11 bu/A.

Topdress application of N at flowering did not impact grain protein in 2014. At this time, protein and quality data are not available for 2015 until further processing is achieved. In 2014, topdress applications of 40, 60, or 80 lbs of N at flowering did NOT statistically increase grain protein in any winter variety.

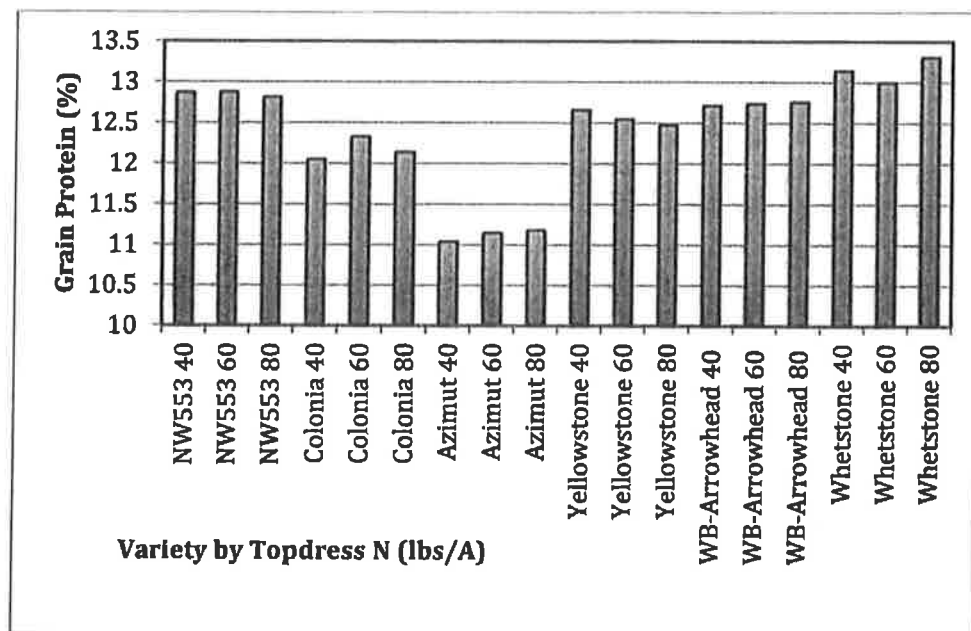
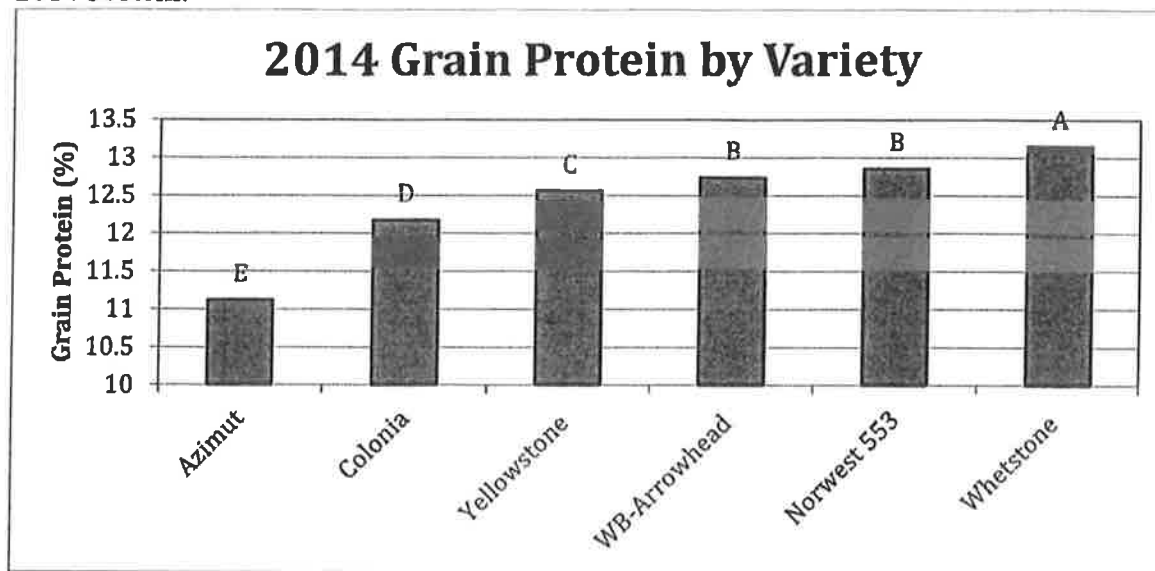
There were significant differences between varieties in yield, test weight, plant height, heading date, and lodging but not for plant stand in 2015.

Variety	Yield (bu/A)	Combine Test Wt	Spring stand (%)	Heading date (Julian)	Height (in)
Norwest 553	118.8	54.7	99.8	145.9	31.8
Colonia	116.2	49.2	100.0	149.0	34.7
Azimut	112.6	50.6	99.9	144.6	30.1
Yellowstone	125.8	57.9	100.0	144.8	38.2
WB-Arrowhead	126.5	57.1	99.8	145.1	37.3
Whetstone	108.1	56.3	99.8	140.8	34.5
LSD (0.05)	8.7	0.7	0.3	0.8	1.3
CV	14.7	2.5	0.4	1.0	6.8
P-value	0.0002	<.0001	0.3638	<.0001	<.0001

Treatment (main N fert)	Yield (bu/A)	Combine Test Wt	Spring stand (%)	Heading date (Julian)	Height (in)
40/60	118.1	54.4	99.9	145.0	34.4
60/40	117.9	54.1	99.9	145.1	34.4
LSD (0.05)	7.0	0.6	0.1	0.3	0.7
CV	14.7	2.5	0.4	1.0	6.8
P-value	0.96	0.1039	0.0083	0.6249	0.9535

Treatment Topdress N	Yield (bu/A)	Combine Test Wt	Spring stand (%)	Heading date (Julian)	Height (in)
40lbs	117.3	54.2	99.9	144.9	34.5
60lbs	118.5	54.3	99.9	144.8	34.5
80lbs	118.2	54.3	99.8	145.4	34.4
LSD (0.05)	6.2	0.5	0.2	0.5	0.9
CV	14.7	2.5	0.4	1.0	6.8
P-value	0.9178	0.9562	0.4495	0.0552	0.9607

2014 Protein:



2015 Results in Moscow:

Drought in Moscow in 2014 and 2015 significantly reduced expected yields. While yields were improved in 2015, they were not at historical averages.

There were no significant differences in yield, and plant height, lodging (no lodging was observed in 2015) between the 40/60 and 60/40 split in preplant fertilizer. In 2015, actual yields (87 bu/A) were significantly below expected yields but were better than 2014. Topdress N applications were reduced over those applied in 2014 to reflect lower yield potential and to reduce phytotoxicity.

Variety	Yield (bu/A)	Test Weight (lb/bu)	Height (in)
Keldin	98.4 a	60.0	35
Arrowhead	95.8 a	60.0	36
LCS Colonia	84.2 b	53.0	33
Norwest 553	82.7 bc	58.6	30
LCS Azimut	79.1 bc	50.9	29
Boundary	78.9 c	57.6	34
LSD (0.05)	5.2	0.6	ns
P-value	<0.0001	<0.0001	<0.0001
CV	12.8	2.4	5.8

Fertility rate	Yield (bu/A)	Test Weight (lb/bu)	Height (in)
60/40	87.4	56.5 b	33
40/60	85.6	56.9 a	33
LSD (0.05)	ns	0.4	ns
P-value	0.2065	0.0239	0.4313

Top dress	Yield (bu/A)	Test Weight (lb/bu)	Height (in)
0 #N	86.6	56.8	33
40 #N	85.5	56.8	33
60 #N	87.4	56.6	33
LSD (0.05)	ns	ns	ns
P-value	0.585	0.4556	0.2616

PROJECTIONS: The results of this research will be published in a peer-reviewed journal upon completion of the third year, and will be used to refine and update protein recommendations for winter wheat varieties in Idaho. Future trials on topdressing at flowering for protein response in winter wheat will be restricted to fields with low initial nitrogen concentrations (that may also result in reduced yields). When N concentrations meet requirements for yield (as in Aberdeen in 2014), there was no grain protein response to additional top dress N rates. When yields are expected to exceed initial estimates, may be concern for topdressing to meet protein goals of hard winter wheat, but even when those conditions occurred in 2014 in Aberdeen, there was no response to additional N at flowering.

PUBLICATIONS: none