"CELIA" WINTER TRITICALE AND "STEPHENS" SOFT 'WHITE WINTER WHEAT RESPONSE TO NITROGEN FERTILIZER IN 1997

Mylen Bohle, Russ Karow, Ernie Marx and Steven R. James

Abstract

Responses of "Celia" winter triticale, and "Stephens" soft white winter wheat responses to nitrogen fertilizer rates were tested at the Central Oregon Agricultural Research Center (COARC) at Madras, Oregon in the 1996-97 crop year. The plot harvester was not adjusted properly for triticale, affected yield significantly, and may have affected other variables. With increasing rates of Nitrogen, up to 160 lb/a , "Stephens" significantly increased yield, protein content, test weight, height, grain N uptake, and grain protein yield. "Celia" also increased yield, protein content, grain N uptake, and grain protein yield up to 160 lb/a N; test weight increased up to 120 lb/a N., while height leveled off with 80 lb/a N. Higher rates of N delayed heading date for both "Celia" and "Stephens" by one day. There was no lodging for either "Celia" or "Stephens". The 1000 kernel weight increased for "Stephens" up to the 120 lb/a N rate and then leveled off, while the 1000 kernel weight for Celia only increased up to the 80 lb/a N rate. As N rates increased up to 80 lb/a, seeds per pound decreased, while harvested seed for future planting rates increased..

Introduction

More acreage is devoted to soft white winter wheat in central Oregon than any other cereal grain crop. Winter triticale is a "new" feed grain crop with high yield potential. Interest in triticale is growing for both grain and forage purposes. The grain is excellent for livestock feed, especially in swine and poultry rations. Triticale is also being utilized for human food. "Celia" winter triticale has the ability to outyield barley and is less prone to lodging or disease. "Celia" also has superior test weight in comparison to other triticale varieties. A nitrogen fertilizer rate trial was initiated in crop year 1994-1995 to compare yield, quality, and agronomic response by "Celia" and "Stephens". This is the third year of a three year study. Information gathered will allow better production practice decision making. The Oregon Grains Commission is gratefully acknowledged for partially funding this trial

Materials and Methods

"Celia" winter triticale and "Stephens" soft white winter wheat were planted on October 11, 1996, at 30 seeds ft^2 with a plot cone-type planter. The design was a randomized complete block, two factorial design with three replications. Row spacing was 8 inches and plot size was 5 ft x 20 ft.

A soil sample was taken to bedrock (two feet deep) in early March 7, 1997.. The soil analysis was performed by Agri-Check laboratory, and soil test results are in Table 1. The previous crop was Kentucky bluegrass for seed. It was assumed that 20 pounds of nitrogen had been taken up

by the plants at the time of sampling. The plots were individually fertilized by hand with 40 lb S /a (gypsum source) and 0, 40, 80, 120, and 160 lb N /a of nitrogen per acre (ammonium nitrate nitrogen fertilizer) on March 28, 1997. Irrigation was with solid set sprinkler lines and applied as needed. No chemical herbicide was applied due to low weed populations.

Plant height and lodging scores were recorded before harvest. Seventy-five square feet were harvested on August 21, 1997. The plot combine was not adjusted properly for triticale, subsequently many heads were run through the combine un-threshed. Grain was cleaned, test weights and 1,000 kernel weights measured, and protein contents determined with a whole grain infrared analyzer by the state-wide cereal variety testing team in Corvallis, Oregon.

Grain nitrogen uptake (recovery), grain protein yield, seeds per pound, and future seeding rates were calculated. The MSTAT statistical program was used to analyze the data. Protected least significant differences (PLSD's) are used in the mean separations.

The grain yield, test weight, protein content, grain nitrogen uptake, and grain protein yield data are presented on a 10, 10, 12, 11 and 11 percent moisture basis, respectively. Grain yield is presented on a 60 pound bushel basis. The future seeding rate was calculated from seeds per pound, based on 30 seeds per square foot.

Results and Discussion

The results for grain yield, protein content, test weight, height, lodging, and heading date (days from January 1) are presented in Table 2. Results for grain nitrogen uptake (recovery), grain protein yield, 1,000 kernel weight, seeds per pound, and future seeding rates are presented in Table 3.

"Stephens" soft white winter wheat was significantly higher yielding than Celia winter triticale. The most important reason was the improper adjustment of the plot harvester. This may have affected other variables measured as well. Both, "Stephens" and "Celia" yield, increased significantly up to the the 160 lb/a N rate. The yields show that the top N rate did not optimize yield or protein content. Yield for "Stephens", peaked at 107.8 bu/a and was still increasing at the high N rate. There was no lodging which also indicates that N rates din not exceed optimal levels. Soil nitrogen mineralization rates were not measured, but must have been fairly low, as the "Celia" and "Stephens" 0 lb/a N rate yielded 23.5 and 40.4 buia, respectively. There were significant yield increases with each 40 lb/a increment of N..

Averaged across N rates, protein content increased significantly with increasing rates of N up to 160 lb/a N. There were no significant variety x N rate differences. The trends seen in the variety x N rate data are similar to those seen in other work, but differences were non-significant when averaged across varieties. Though "Stephens" and "Celia" responded similarly, "Stephens" always had a higher protein content than "Celia" at the same N rate. "Celia" and "Stephens" also responded similarly in that their protein contents decreased significantly, as yield increased with the first 40 units of N added. Then with the next 40 units (80 units total) of N, protein contents increased, significantly, but were the same as the check (0 lb/a N rate).

Previous research has shown that soft white wheat with protein contents of 10.5% protein would have been adequately fertilized for "Stephens". Maximum protein concentration of Stephens was 9.3%, indicating that additional N fertilizer could have been applied. A similar rule for triticale has yet to be established.

"Celia" and "Stephens" responded the same, with no change in test weight, as nitrogen rates increased from 0 lb/a to 40 lb/a. As the rate increased to 80 lb/a N, test weight for "Celia" did not change, but test weight for "Stephens", increased significantly. With an additional 40 lb/a N (120 lb/a N), both varieties test weights increased significantly. Then with the last additional 40 units of N, the test weight for "Stephens" increased, "Celia" did not change

Grain N uptake (recovery) and grain protein yield were increased up to the 160 lbN/a rate for both varieties.

Plant height was increased with increasing N rates up to the 80 lb/a N rate. There were significant differences between the plant height of the two varieties. The heading date for "Celia" was one day earlier than "Stephens". The two high N rates did significantly delay heading compared to the lower rates.

The difference in 1000 kernel weight was significant for varieties and N rate, with no interactions. "Stephens" had higher 1,000 kernel weight than did "Celia". There was a trend to increase 1000 kernel weight up to 120 lb/a nitrogen, but was only significant up to the 80 lb/a N rate. Seeds per pound, a calculated number with an inverse relationship to 1000 kernel weight, was different between the two varieties, with "Celia" having a higher number of seeds per pound. The seeds per pound decreased up to the 80 lb/a N rate and then leveled off. Future planting rates of lb/a (using 30 seeds per ft') has an inverse relationship to seeds per pound. "Stephens" had a much higher future seeding rate than did "Celia". They both responded similarly as nitrogen rates increased. Future seeding rates increased as nitrogen rates increased up to 80 lb/a and then the seeding rate leveled off.

Table 1. Soil test results, March 12, 1997, COARC, Madras, Oregon.

Soil Depth (inches)	pH	P2O5 (ppm)	K2O (ppm)	NO, (lb/a3)	NH, (lb/a3)
0 -12	7.1	29	442	18	17
12-24	7.7	10	272	14	13

Table 2. "Celia" winter triticale and "Stephens" soft white winter wheat yield, protein content, test weight, height, lodging, and heading date (days from January 1) response to nitrogen fertilizer, 1997, COARC, Madras, Oregon.

Treatment	Yield (bu/a)	Protein (%)	Test Weight (lb/bu)	Height (inches)	Lodging (0-9)	Heading Date (1/1 = 1)
Variety						
Stephens	78.0	8.4	58.0	28.9	0	149
Celia	40.3	7.4	57.8	31.5	0	148
N Rate (lb/a)						
0	32.0	7.5	57.1	26.0	0	148
40	48.5	7.2	57.0	29.8	0	148
80	61.0	7.6	57.8	31.7	0	149
120	72.1	8.4	58.7	31.3	0	150
160	82.2	8.8	59.0	32.0	0	150
Variety/N Rate						
Stephens						
0	40.4	8.1	56.8	24.3	0	149
40	66.2	7.7	56.7	28.3	0	149
80	77.9	8.1	58.0	30.3	0	149
120	97.7	8.7	59.1	30.3	0	150
160	107.8	9.3	59.6	31.0	0	150
Celia	23.5	6.9	57.4	27.7	0	147
0						
40	30.8	6.6	57.3	31.3	0	147
80	44.2	7.0	57.5	33.0	0	148
120	46.5	8.1	58.3	32.3	0	150
160	56.5	8.3	58.4	33.0	0	150
Mean	59.2	7.9	57.9	30.2	0	149
Variety						
PLSD 0.10	S	S	S	S	NS	S
PLSD 0.05	S	S	NS	S	NS	NS
N Rate						
PLSD 0.10	2.5	0.25	0.4	0.8	NS	0.9
PLSD 0.05	3.1	0.30	0.5	1.0	NS	1.2
Variety/N Rate						
PLSD 0.10	3.6	NS	0.5	NS	NS	NS
PLSD 0.05	4.3	NS	0.6	NS	NS	NS
CV%	4	3	1	3	0	1

Table 3. "Celia" winter triticale and "Stephens" soft white winter wheat grain N uptake, grain protein yield, 1,000 kernel weight, seeds per pound, and future seeding rate (based on 30 seeds per square foot) response to nitrogen fertilizer, 1997, COARC, Madras, Oregon.

Treatment	Grain N Uptake (lb/a)	Grain Protein Yield (lb/a)	1,000 Kernel Weight (g)	Seeds Per Pound	Future Seeding Rate (lb/a)
Varietv					
Stephens	69.2	398	57	7,933	165
Celia	31.8	183	50	9,071	144
N Rate (lb/a)					
0	25.5	147	52	8,721	150
40	37.2	214	52	8,759	150
80	49.0	282	55	8,343	157
120	64.0	368	55	8,298	158
160	76.8	441	54	8,389	157
Variety/N Rate					
Stephens					
0	34.1	196	55	8,227	159
40	53.2	306	55	8,185	160
80	65.6	377	58	7,767	168
120	88.4	509	59	7,690	170
160	104.9	603	58	7,795	168
Celia	17.0	98	49	9,214	142
0					
40	21.3	122	49	9,333	140
80	32.5	187	51	8,920	147
120	39.5	227	51	8,907	147
160	48.6	280	51	8,983	146
Mean	50.5	290	54	8,502	154.5
Variety					
PLSD .10	S	S	S	S	S
PLSD .05	S	S	S	S	S
N Rate					
PLSD .10	2.9	17	0.9	139	2.6
PLSD .05	3.5	20	1.1	169	3.2
Variety/N Rate					
PLSD .10	4.1	23	NS	NS	NS
PLSD .05	4.9	28	NS	NS	NS
CV%	6	6	2	2	2