SEEDING RATE EFFECT ON WINTER TRITICALE AND SOFT WHITE WINTER WHEAT IN 1998

Mylen Bohle, Russ Karow, Ernie Marx, and Steve James

Abstract

Response of 'Celia' winter triticale and 'Stephens' soft white winter wheat to seeding rates, was tested at the Central Oregon Agricultural Research Center (COARC), at Madras, Oregon, in the crop year 1997-1998. Highest yield (136.3 bu/acre) achieved by Celia, was at 30 seeds ft^2, but there was no statistical difference between 16 to 40 seeds per ft^2. Highest yield (155.0 bu/acre) achieved by Stephens, was at the seeding rate of 16 seeds per ft^2, though there were no statistical differences between 8 and 20 seeds per ft^2. With increased seeding rates, there was a trend for protein content to decrease for Celia up to 30 seeds per ft^2, though only significantly to 16 seeds per ft^2; and increase for Stephens up to 20 seeds per ft^2. Celia experienced no lodging, while as seeding rates increased, the lodging of Stephens increased. Lodging may have caused the yield decreases at the higher seeding rates. There was no significant difference for grain nitrogen uptake, protein yield, and 1000 kernel weight for the response of Celia to seeding rates. Grain nitrogen uptake and protein yield of Stephens increased up to 16 seeds per ft^2; there were no differences for 1000 kernel weight. Increasing seeding rates, increased heads per meter row or heads per ft^2 for both Stephens and Celia. Conversely, heads per seed planted and florets per spike were decreased. Stephens had significantly greater ability to tiller, while Celia had greater ability to produce significantly great numbers of fertile florets per spike. Seeding rates had no effect on seeds per pound or future seeding rates. The trial is the first year results of a two year study.

Introduction

Most cereal acreage is devoted to soft white winter wheat in Central Oregon. Winter triticale is a "new" cereal 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 and disease. Celia also has superior test weight in comparison to other triticale varieties. There is less cultural information available for triticale. A seeding rate trial was initiated in October 1997, to compare yield, quality, and other agronomic responses of Celia winter triticale and Stephens soft white winter wheat. Information generated will allow better production practice decision making

Materials and Methods

Celia winter triticale and Stephens soft white winter wheat were planted on October 10, 1997, at 4, 8, 16, 20, 30, and 40 seeds per square foot with a plot cone-type planter. The pounds per acre seeding rates are given in Table 1. The design was randomized complete block, two factorial design, with four replications. Row spacing was eight inches and plot size was 5 ft x 20 ft, with approximately 5 ft x 15 ft feet harvested. The trial was irrigated as needed with solid-set lines.

A soil sample was taken to bedrock (two feet deep) in early March of 1998. Soil analyses were performed by Agri-Check Laboratory, Hermiston, Oregon, and soil test results are listed in Table 2. The previous crop was "fallow", preceded by Kentucky bluegrass for multiple years. It was assumed that approximately 20 lb/acre nitrogen was taken up by the plants at the time of sampling. The trial was fertilized with 159 lb./a N, 78 lb/a P2O5, and 54 lb/a S (387 lb/a of 16-20-0-14 and 285 lb/a of 34-0-0) on April 16, 1998.

Table 1. Seeding rate in pounds per acre based on seeds per square foot for Celia winter triticale and Stephens soft white winter wheat planted for the seeding rate trial at COARC Madras, OR, on October 10, 1997.

Variety	4 Seeds	8 Seeds	16 Seeds	20 Seeds	30 Seeds	40 Seeds
Celia	20	40	80	100	149	199
Stephens	21	41	83	104	155	207

Table 2. Soil test results from February 22, 1998, COARC, Madras, OR.

Soil Depth (inches)	pH	P (Ppm)	K (Ppm)	NO3 (lb/a)	NH4 (lb/a)
0-12	7.3	35	484	54	11
12-24	7.4	13	320	77	8

Results and Discussion

The results for grain yield, protein content, test weight, height, lodging, and heading date are presented in Table 3. The results for grain N uptake, grain protein yield, 1000 kernel weight, heads per meter row, heads per square foot, heads per seed planted, and fertile florets per spike are presented in Table 4. The results for seeds per pound, and future seeding rate in pounds per acre for 4, 8, 16, 20, 30, and 40 seeds per square foot are presented in Table 5.

Stephens soft white winter wheat was significantly higher yielding than Celia winter triticale, at seeding rates of 4 to 20 seeds per ft^2, while Celia was significantly higher yielding at the 30 and 40 seeds per square foot seeding rate. This significant yield decrease by Stephens was probably caused by the lodging problems that Stephens had at the higher seeding rates.

The low seeding rate (4 seeds ft^2) produced the highest protein content for Celia (10.8 percent). There was a trend for decreasing levels, but not significantly so beyond 16 seeds per square foot. Stephens produced its' highest protein content with the 20 seeds per square foot seeding rate. The protein content of Stephens (10.8%) was the same for 4, 8, and 16 seeds per square foot, significantly increased at the 20 seeds per square foot seeding rate, and then there was no significant difference at higher seeding rates.

The overall difference in plant height was approximately one inch, significantly taller for Stephens. There were no statistical differences among seeding rates or varieties x seeding rates.

There were significant differences between the two varieties for lodging. 'Celia' had absolutely no lodging across all seeding rates. With increased seeding rates, 'Stephens'

lodging increased from 0 percent, up to 60 percent with the highest seeding rate. This lodging probably affected grain yield, and may have affected other agronomic factors such as grain protein content, test weight, and 1000 kernel weight.

The only significant difference for heading date was between the varieties. Seeding rate did not affect heading date.

There was no difference in grain N uptake between seeding rates for Celia. Stephens had highest the grain N Uptake at seeding rates of 16 and 20 seeds ft^2, lowest at 30 and 40 seeds ft^2, and intermediate levels at 4 and 8 seeds ft^2. Grain N uptakes were significantly different, Stephens had greater ability to take up grain N than Celia.

Stephens had significantly heavier kernel weights. Seeding rates did not significantly affect 1000 kernel weight.

Heads per meter row, or heads per ft^2, were significantly higher for Stephens than Celia. There was a definite trend among varieties to have higher head counts with increased seeding rates. Differences within varieties were not significant.

For heads per seed planted, at every seeding rate, Stephens was significantly higher than Celia. Within the variety, as seeding rate increased, there were not always significant increases in heads per seed planted, but there was a positive trend. There was an inverse relationship between heads per seed planted, versus to heads per meter row or heads per square foot. Stephens ability to tiller, and produce more heads than Celia, is at the rate of 199, 151, 160, 170, 188, and 172 percent at the respective seeding rates of 4, 8, 16, 20, 30, and 40 seeds per square foot. The ability to tiller was probably even greater as the number of plants were not counted. Comparison was made to the seeds planted, not actual plants.

Though 'Celia' has less ability to tiller than Stephens, Celia makes up for this difference, with its ability to produce a larger number of fertile spikelets per spike. The two varieties responded the same in that with increasing seeding rates, there was decreasing numbers of spikelets per spike. But, Celia had 234, 242, 249, 251, 241, and 253 percent greater spikelets per spike, compared to Stephens, at equal seeding rates. The average was 245 percent greater spikelets per spike, over all seeding rates.

There were only significant varietal differences for seeds per pound. Seeding rates had no statistical effect on seeds per pound. The calculated future seeding rate based on seeds per pound, is presented as a comparison to the original seed rate and as reference information. The seeding rates (pounds per acre) used for planting the trial were heavier than those generated by the harvested seed for future seeding rates.

This is the first year of a two year trial comparing Celia winter triticale to Stephens soft white winter wheat. The purpose of the trial was to generate more cultural production information for winter triticale. In the process, other previous unknown information on `Stephens' has been generated. Though intriguing, it is not wise to base changes in production practice on only one year of data. The trial will be repeated in 1999.

Acknowledgements

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Table 3. The effect of seeding rate on the yield, protein, test weight, height, lodging, and heading date of Celia winter triticale and Stephens soft white winter wheat planted at the CORAC, Madras on October 10, 1997.

	Yield (bu/a)	Protein (%)	Test wt. (lb/bu)	Height (in.)	Lodging (%)	Heading date (1/1 = 1)
Variety						
Celia	130.0	10.0	56.2	42.8	0	160
Stephens	140.2	11.0	60.3	41.6	23	159
Seed Rate (Seeds/ft^2)						
4	130.6	10.8	58.1	42.6	0	159
8	135.7	10.6	58.3	42.8	5	159
16	142.0	10.3	58.6	42.3	5	159
20	141.2	10.5	58.4	42.0	9	159
30	131.5	10.4	58.0	41.9	20	159
40	129.6	10.4	58.1	41.8	30	159
Variety x Seed Rate						
Celia						
4	119.3	10.8	55.9	42.5	0	160
8	124.9	10.4	55.9	43.0	0	160
16	129.0	9.9	56.3	42.8	0	160
20	134.6	9.8	56.5	42.8	0	160
30	136.3	9.7	56.2	43.0	0	160
40	135.9	9.7	56.5	43.0	0	160
Stephens						
4	141.9	10.8	60.3	42.8	0	158
8	146.6	10.8	60.6	42.5	10	158
16	155.0	10.8	60.9	41.8	10	158
20	147.8	11.3	60.4	41.3	18	158
30	126.7	11.1	59.8	40.8	40	158
40	123.4	11.0	59.7	40.5	60	158
Mean	135.1	10.5	58.2	42.2	11	159
Variety						
PLSD .10	S	S	S	S	S	S
PLSD .05	S	S	S	S	S	S
Seed Rate						
PLSD .10	7.1	NS	0.3	NS	10	NS
PLSD .05	8.6	NS	NS	NS	12	NS
Variety x Seed Rate						
PLSD .10	10.1	0.4	0.5	NS	15	NS
PLSD .05	12.1	0.5	0.6	NS	18	NS
CV%	6	3	1	3	107	0

Heading date = days from January 1.

Table 4. The effect of seeding rate on Celia winter triticale and Stephens soft white winter wheat grain N uptake, grain protein yield, 1000 kernel weight, heads per meter row, heads per ft^2, heads per seed planted, and florets per spike, planted at COARC, Madras on October 10, 1997.

	Grain N Uptake (lb/ac)	Grain protein yield (lb/ac)	1000 kernel wt. (g)	Heads per meter row	Heads Per ft2	Heads per seed planted	Spikelets Per spike
Variety							
Celia	136.9	781	42.4	104	47.3	3.9	29.9
Stephens	161.3	919	48.4	179	81.6	6.9	12.2
Seed Rate (Seeds/ft^2)							
4	148.2	845	44.7	120	54.4	13.6	23.2
8	151.5	863	46.0	132	59.8	7.5	22.4
16	155.0	883	46.4	137	62.1	3.9	22.0
20	156.8	894	46.3	144	65.6	3.3	20.3
30	142.8	814	44.8	154	70.0	2.3	19.7
40	140.4	800	44.4	165	74.8	1.9	18.7
Variety x Seed Rate							
Celia							
4	135.0	770	43.5	80	36.5	9.1	32.7
8	136.6	778	42.7	105	47.5	5.9	31.7
16	134.9	769	42.5	105	47.7	3.0	31.4
20	138.4	789	43.7	107	48.5	2.4	29.1
30	138.5	790	41.1	107	48.8	1.6	27.9
40	138.3	788	40.9	121	55.1	1.4	26.8
Stephens							
4	161.5	921	45.8	159	72.3	18.0	13.8
8	166.4	949	49.3	159	72.2	9.0	13.1
16	175.1	998	50.2	168	76.5	4.8	12.6
20	175.2	999	48.9	182	82.6	4.1	11.6
30	147.2	839	48.5	201	91.3	3.1	11.6
40	142.4	812	47.9	208	94.6	2.4	10.6
Mean	149.1	850	45.4	142	64.5	5.4	21.1
Variety							
PLSD .10	S	S	S	S	S	S	S
PLSD .05	S	S	S	S	S	S	**S**
Seed Rate							
PLSD .10	8.0	45	NS	14	6.5	0.7	1.1
PLSD .05	9.6	55	NS	17	7.8	0.9	1.4
Variety x Seed Rate							
PLSD .10	11.3	64	NS	NS	NS	1.0	NS
PLSD .05	13.6	78	NS	NS	NS	1.2	NS
CV%	6	6	6	12	12	16	6

Table 5. The effect of seeding rate on Celia winter triticale and Stephens soft white winter wheat seeds per pound, and future seeding rates of 4, 8, 16, 20, 30, and 40 seeds per ft^2, in pounds per acre, planted at COARC, Madras, Oregon on October 10, 1997.

	Seeds per Pound	Seed Rate 4/ft2	Seed Rate 8/ft2	Seed Rate 16/ft2	Seed Rate 20/ft2	Seed Rate 30/ft2	Seed Rate 40/ft2
Variety				--lb/acre--			
Celia	10,719	16.3	32.6	65.2	81.4	122.1	162.9
Stephens	9,405	18.6	37.2	74.4	93.0	139.5	186.0
Seed Rate (Seeds/ft^2)							
4	10,187	17.2	34.3	68.6	85.7	128.7	171.5
8	9,924	17.7	35.3	70.7	88.3	132.5	176.6
16	9,857	17.8	35.6	71.3	89.1	133.6	178.1
20	9,877	17.8	35.5	71.0	88.8	133.2	177.6
30	10,217	17.2	34.4	68.9	86.1	129.1	172.2
40	10,310	17.1	34.1	68.2	85.3	127.9	170.5
Variety x Seed Rate							
Celia							
4	10,452	16.7	33.4	66.8	83.5	125.3	167.0
8	10,638	16.4	32.8	65.6	82.0	123.0	164.0
16	10,671	16.3	32.7	65.4	81.7	122.5	163.4
20	10,400	16.8	33.6	67.1	83.8	125.7	167.6
30	11,046	15.8	31.6	63.2	79.0	118.5	158.0
40	11,106	15.7	31.5	62.9	78.6	118.0	157.3
Stephens							
4	9,922	17.6	35.2	70.4	88.1	132.1	176.1
8	9,209	18.9	37.9	75.8	94.7	142.0	189.3
16	9,042	19.3	38.6	77.2	96.5	144.7	192.9
20	9,354	18.8	37.5	75.0	93.8	140.7	187.6
30	9,388	18.6	37.3	74.6	93.2	139.8	186.4
40	9,515	18.4	36.8	73.5	91.9	137.8	183.8
Mean	10,062	17.4	34.9	69.8	87.2	130.8	174.4
Variety							
PLSD .10	S	S	S	S	S	S	S
PLSD .05	S	S	S	S	S	S	S
Seed Rate							
PLSD .10	NS	NS	NS	NS	NS	NS	NS
PLSD .05	NS	NS	NS	NS	NS	NS	NS
Variety x Seed Rate							
PLSD .10	NS	NS	NS	NS	NS	NS	NS
PLSD .05	NS	NS	NS	NS	NS	NS	NS
CV%	5	6	6	6	6	6	6

Seed Rate = Future seeding rate in pounds per acre