

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

1. PROJECT TITLE <p style="text-align: center;">Optimum Seeding Rates for Diverse HRSW Varieties</p>	
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3. REPORT DATE 11/15/2013	5. REPORTING PERIOD 01/01/2013 – 11/15/2013
6. TERMINAL REPORT _____ PROGRESS REPORT <input checked="" type="checkbox"/>	
7. AMOUNT OF GRANT \$62,000	
8. PUBLICATIONS None to date.	

9: EXECUTIVE SUMMARY

Research Question: Yield of HRSW is affected by many agronomic practices starting with choice of the cultivar, the planting date, and seeding rate. Previous research has shown that optimum seeding rates differ for individual cultivars. This research looks into the relationship between a set of traits, including semi-dwarf stature and day-length sensitivity, of individual cultivars, planting date, and seeding rate, and proposes to develop models that supersede individual cultivars and looks to explain how a group of genetically similar varieties responds to seeding rate.

Results: Of the four locations established in 2013, Hallock, Crookston, and Prosper had significant effects from main effects and significant interactions. The Perley location had very little treatment effect, though will be further investigated to see how trends with seeding rate compare to other locations. Across all treatments within a location, Crookston averaged 93 bu/ac yield, Prosper 71 bu/ac, Hallock 108 bu/ac, and Perley 86 bu/ac.

The number of stems per plant responded with a quadratic plateau, with the lowest seeding rates resulting in greater number of tillers per plant compared to the higher seeding rates (Table 2). This reinforces the developmental plasticity of wheat through tillering when conditions allow. The data will be looked at in more detail to investigate if a cultivar X rate interaction was present, to potentially quantify different rates of tillers among varieties as each level of seeding rate through the research.

Table 3 has results for the interaction of cultivar X seeding rate at Prosper, ND, 2013 for grain yield. Data analysis was just begun and we are beginning with the more detailed modeling analysis. However the data clearly demonstrates that individual cultivars responded differently to seeding rates. While cultivar Vantage at Prosper, ND, responded nearly linearly with increased yields as the seeding rate increased, Sabin clearly showed a quadratic response.

With four locations to fully analyze and model, the results from this year look to be compelling based on initial statistical analysis, significant effects, and interactions that were resultant.

Application/Use: Seed size in the 12 wheat cultivars from this research varied from a 500 kernel weight of 13.6 grams to 19.4 grams. If a producer planted the cultivar with a 500 kernel weight of 13.6 grams at 1.5 bushels/acre as is common, the seeding rate would be 1.5 million seeds per acre. For the cultivar with a 500 kernel weight of 19.4 g, planted at 1.5 bushels/acre, the final seeding rate would be 1.0 million seeds per acre. Though wheat has developmental plasticity and will tiller more when needed, it will not be able to compensate completely for a less than optimal stand to maximize grain yield. The aim to develop optimum seeding rate recommendations for individual varieties based on the varieties genetic make-up for simple inherited traits like day length sensitivity, planting date, and latitude is therefore warranted.

Materials and Methods: Four field locations were established in 2013 at Hallock, Crookston, and Perley, MN and Prosper, ND. Locations were chosen at different latitude lines, with Hallock being the validation site for Crookston and Perley being the validation site for Prosper. Crookston was a randomized complete block design (RCBD) with a split-split plot restriction with planting date as whole plot, HRSW cultivar as the split plot, and seeding rate as the split-split plot. Hallock, Perley, and Prosper were RCBD with HRSW cultivar as the whole plot and seeding rate the split plot. Planting date at Crookston were separated by three weeks. A second planting date was planted at Prosper, though through planter error the seed was disbursed unevenly, resulting in the planting date being scrapped. HRSW cultivar was twelve cultivars split into six groups of two from known QTL associations (Table 1). Seeding rate had five levels at 600,000, 1,000,000, 1,400,000, 1,800,000, and 2,200,000 seeds/acre. The data collected were stand count, head count, height, lodging, and grain yield components. Stand counts at 1-3 leaf stage and head counts just before harvest were measured from a 3 ft length in two rows, and used to calculate the number of tillers per plant.

Economic Benefit to a Typical 500 Acre Wheat Enterprise: With December wheat prices at \$6.88 per bushel, a producer growing Vantage using the Prosper, ND, 2013 yield results (Table 3) could expect increased profit from choosing the optimum seeding rate. Vantage yielded 67.0 bu/ac at 1.4 million seeds/acre and 71.6 bu/ac at 2.2 million seeds/acre. If a producer planted Vantage at a population of 2.2 million instead of 1.4 million on 500 acres he could expect a gross profit of \$15,824 per 500 acres.

10: RELATED RESEARCH

11: RECOMMENDED FUTURE RESEARCH

For 2014 this research will be replicated in six locations. The northern sites will again be Hallock and Crookston, MN, the middle sites Perley, MN and Prosper, ND, and the southern sites Kimball and Lamberton, MN. The Hallock, Perley, and Kimball locations will be verification sites and will have cultivar and seeding rate as factors. The Crookston, Prosper, and Lamberton sites will be main sites with planting date, cultivar, and seeding rate as factors. 2014 will be the final year of research for this trial unless future circumstances indicate value from a third year of research.

12: APPENDIX

Table 1. The HRSW cultivars included in research.

Group	Cultivar	Day length Sensitivity	Rht1	Rht2
1	Albany	+	+	-
	Faller	+	+	-
2	Knudson	-	+	-
	Samson	-	+	-
3	Briggs	+	-	-
	Vantage	+	-	-
4	Sabin	-	-	-
	Oklee	-	-	-
5	Kelby	-	-	+
	Kuntz	-	-	+
6	Marshall	-	-	+
	Rollag	-	-	+

Table 2. Effect of seeding rate on tillers per plant at Hallock, Perley, Crookston, and Prosper, 2013.

Rate	Location			
	Hallock	Perley	Prosper	Crookston
seeds/acre	-----tillers/plant-----			
600,000	3.9 a	3.3 a	3.6 a	2.7 a
1,000,00	2.8 b	2.1 b	2.4 b	1.9 b
1,400,00	2.1 c	1.7 c	2.0 c	1.5 c
1,800,00	1.8 d	1.5 cd	1.6 d	1.3 d
2,200,00	1.4 e	1.2 d	1.4 d	1.1 e

Table 3. Effect of HRSW cultivar and seeding rate on yield at Prosper, ND, 2013.

Variety	Seeding Rate				
	600,000	1,000,000	1,400,000	1,800,000	2,200,000
	-----bu/ac-----				
Albany	80.4	82.0	84.9	. ^z	.
Briggs	59.5	66.9	68.7	76.4	74.3
Faller	70.6	72.1	75.1	74.3	79.6
Kelby	55.3	62.6	60.9	65.4	66.7
Knudson	68.6	72.2	75.9	77.7	75.9
Kuntz	55.4	63.8	63.1	67.0	72.2
Marshall	63.9	65.8	67.6	70.1	74.3
Oklee	67.8	68.0	75.2	74.4	74.2
Rollag	60.3	64.6	66.6	68.2	68.4
Sabin	70.2	72.3	77.1	76.7	73.6
Samson	65.3	69.4	73.2	74.1	71.5
Vantage	60.3	65.2	67.0	67.3	71.6

^z Results are missing due to irregular seed.