

Seeding Rate Study 2016/17

WSU Bread Lab
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The correct seeding rate for small grains in the maritime environment of northwestern Washington has been an unanswered question for area grain growers. The Plant Breeding Program of the WSU Bread Lab has been planting wheat at approximately 100 lbs/acre, but even that has been a “best guess” of what the optimum seeding rate should be. In the fall of 2016 we conducted a third winter wheat seeding rate study using 26 seeds per square foot as the base rate, as recommended by the Washington State Crop Improvement Association (WSCIA) for high precipitation areas. Seven of the region’s commonly produced hard and soft winter wheats were planted at five different seeding rates, replicated four times and grown under common agronomic practices.

Seeding rate, based on seeds per square foot, is calculated as follows:

- 1) Determine the seeds/pound of your current seed lot;
 - a) Count the number of seeds in one pound of seed or
 - b) Count 1000 seeds, weigh and convert to seeds/pound. Using Cara winter wheat (1000 seeds = 37.6 grams) as an example:
 $(1000 \text{ seeds}/37.6 \text{ grams}) \times (454 \text{ grams}/\text{pound}) = 12,074 \text{ seeds}/\text{pound}$
- 2) If you know your desired seeding rate in seeds/square foot, convert your current seed lot to adjust for the seed size:
 $(26 \text{ seeds}/\text{sq. ft.}) \times (43,560 \text{ sq. ft.}/\text{acre}) \times (1 \text{ pound}/12,074 \text{ seeds}) = 93.8 \text{ pounds}/\text{acre}$
- 3) To determine seeds/ sq. ft. based on your current seeding rate:
 $(93.8 \text{ pounds}/\text{acre}) \times (12,074 \text{ seeds}/\text{pound}) \times (1 \text{ acre}/43,560 \text{ sq. ft.}) = 26 \text{ seeds}/\text{sq. ft.}$

In the field, it is easiest to check a drill’s seeding rate by converting seeds/sq. ft. to seeds/linear foot of drill row as follows:

- 1) To convert seeds/sq. ft. to one linear foot of drill row:
 $(\text{drill’s row width in inches}) \times (1 \text{ foot}/12 \text{ inches}) \times \text{desired seeds}/\text{sq. ft.} = \text{seeds per linear foot, i.e.}$
 $(6 \text{ inches}) \times (1 \text{ foot}/12 \text{ inches}) \times (26 \text{ seeds}/\text{sq. ft.}) = 13 \text{ seeds per linear foot}$

The table below shows the varieties used in the seeding rate study, 1000 kernel weight (KWT) and the yields harvested (highest in bold) at the various seeding rates:

Variety	Mkt class*	1000 KWT grams	2016/17 Yield (bu/ac) at seeding rate percentage of 26 seeds/sq. ft.					CV %	LSD@ 5%**
			60%	80%	100%	120%	140%		
4 reps									
Bobtail	SWW	39.5	168a	165a	172a	175a	174a	17.7	45.6
Cara	WC	41.4	145a	147a	153a	142a	148a	14.7	32.6
Colonia	HRW	49.0	192a	176a	193a	173a	195a	13.1	36.9
Madsen	SWW	49.5	134a	140a	131a	141a	138a	18.7	38.6
Norwest 553	HRW	46.7	169a	163a	166a	120a	174a	16.7	41.9
Skagit 1109	HRW	45.5	158a	159a	164a	167a	172a	14.3	35.4
W4	HRF	49.4	150a	147a	153a	135a	151a	15.7	34.9

*WC = Winter Club, HRW = Hard Red Winter, SWW = Soft White Winter, HRF = Hard Red Facultative

** grain yields with the same letter within a variety are not significantly different

The results of the 2016/17 winter wheat seeding rate study indicate that for the varieties trialed, generally speaking the higher seeding rate resulted in the greatest grain yield. However, at a 90% confidence level, none of the grain yield differences within a variety were statistically different. In this example a seeding rate of approximately 120 lbs/ac (31-32 viable seeds per square foot) to 140 lbs/ac (36-37 viable seeds per square foot) achieved the greatest grain yield for most varieties.

Variety	2016/17 Average value of combined seeding rates*	
	Test Wt. (bu/ac)	Protein %
4 reps		
Bobtail	58.5	10.2
Cara	55.9	10.2
Colonia	60.4	10.8
Madsen	59.3	10.1
Norwest 553	61.7	11.0
Skagit 1109	61.8	11.5
W4	58.2	11.1

*No significant differences in 2016/17 for test weight or protein within a variety ($\alpha=5\%$), regardless of seeding rate.

The seed size of a variety can change dramatically from year to year (see table below) based on the environmental conditions where it was produced. It is important to determine the seed size of each variety one uses when calibrating a planter in order to obtain the optimal seeding rate and achieve maximum yields.

	Seed Weight (grams)/1000 seeds		
	2014/15	2015/16	2016/17
Bobtail	40.0	39.1	39.5
Cara	37.6	33.0	41.4
Colonia	46.0	43.2	49.0
Madsen	37.2	36.2	49.5
Norwest 553	39.2	40.4	46.7
Skagit 1109	58.4	36.2	45.5
W4	33.6	42.0	49.4

The table below shows the seeding rate percentage (based on 26 seeds/sq. ft. = 100%) that achieved the greatest grain yield within a variety from each year of this three year study.

	Seeding rate percentage		
	2014/15	2015/16	2016/17
Bobtail	140	120	120
Cara	140	140	100
Colonia	60	120	140
Madsen	100	120	120
Norwest 553	120	120	140
Skagit 1109	100	120	140
W4	120	140	100

Generally speaking, greater grain yield at a lower seeding rate may be indicative of a variety's tillering ability. Varietal differences in tillering capabilities are often more pronounced when soil moisture or nutrients are limited. Varieties that tiller well benefit from a lower seeding rate by having more moisture and nutrients available per plant than would be available at higher seeding rates. In our maritime climate, moisture is rarely the limiting factor and grain yield per acre is usually greater with more plants per square foot. It appears that a variety's grain yield can be reduced by the 140% seeding rate, depending on the environmental conditions of that year. Future studies should include studying the grain yield response to even greater seeding rates.

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For additional information contact Steve Lyon (slyon@wsu.edu).

For additional variety testing results visit:
<http://thebreadlab.wsu.edu/western-washington-variety-trials/>.

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