

Spring Small Grain Seeding Rate Study

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Introduction

A study was initiated in 2001 to evaluate the response of several spring grain varieties to seeding rate. Winter cereals have been shown to compensate for low plant populations by increased tillering with minimum affect on grain yield. Tillering is generally limited in the shorter growing season experienced for spring cereals. Most spring grain yield is attributed to the main stem and first tiller. Late tillering following frost damage in the Klamath Basin frequently results in immature grain at harvest. In 2001, a seeding rate experiment conducted on organic soil at Lower Klamath Lake (LKL) evaluated the response of two varieties each of spring barley, oats, and wheat to four seeding rates. The study was expanded in 2002 to include sites at the Klamath Experiment Station (KES) and LKL and to include an additional wheat variety and six additional barley varieties.

Procedures

KES

The trial at KES was conducted on Poe fine sandy loam soil in a field where spring cereals were grown under dryland conditions in 2001. Eight barley, two oat, and three wheat varieties were planted at seeding rates of 10, 20, 30, and 40 seeds/ft² in a factorial design arrangement with four replications. Individual plots were 4.5 ft wide (9 rows at 6-inch spacing) and 20 ft long. Seed

was planted at 1-inch depth with a Kincaid (Kincaid Equipment Manufacturing) plot planter on April 24. Harvested areas were 14.5 by 4.5 ft following trimming of borders.

Plots were fertilized with 50 lb N, 63 lb P₂O₅, and 41 lb S/acre banded at planting and 50 lb N/acre sprayed on as solution 32 on June 10. Weeds were controlled with Weedmaster[®] (Dicamba + 2,4-D, BASF) at 1 pt/acre, applied with a ground sprayer on May 31. Irrigation was applied with solid-set sprinklers arranged in a 40- by 40-ft pattern in accordance with crop needs.

During the growing season, the date to achieve 50 percent heading, plant height, and number of seed heads per acre were determined for each plot. Grain was harvested with a Hege (Hans-Ulrich Hege) plot harvester on August 28. Yields were determined for each replication and adjusted to 10 percent moisture content. Test weights were also determined for each replication. Data were statistically analyzed using SAS software.

LKL

The LKL site was on Algoma silt loam soil in a continuous grain rotation. Grain was planted as described for the KES site on May 14. Fertilizer included 70 lb N/acre shanked in before planting as anhydrous ammonia and 50 lb N, 63 lb P₂O₅, and 41 lb S/acre banded at planting. Weed control was achieved with a tank mix of 2,4-D (Agrilience,

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LLC) and Express[®] (tribenuron-methyl, E.I. DuPont de Nemours and Co.). The field was flooded during winter to replenish soil moisture and received two irrigation applications during the growing season with an overhead linear move system. Grain was harvested as above with a Hege plot harvester on September 16. Data were collected as at KES and analyzed statistically using SAS software.

Results and Discussion

KES

Yields were somewhat erratic with wide ranges between seeding rates in some of the varieties, resulting in high experimental error and limiting statistical inferences. Among barley varieties, highest yields were observed for 1202 and Xena (Table 1). These varieties also had the highest percentage of plump kernels. Averaged over all varieties, the 30 seeds/ft² produced maximum yields while the lowest seeding rate had the lowest yield. However, Millenium and Statehood achieved their highest yields at the lowest seeding rate. Sara produced the lowest yield and test weight among the barley varieties. Baronesse and Sara were the most responsive varieties to increased seeding rates. Their yields increased from 2,820 and 2,150 lbs/acre at 10 seeds/ft² to 5,060 and 5,040 lb/acre at 40 seeds/ft², respectively. Seeding rates did not affect test weights, plant height, or days to 50 percent heading.

Ajay and Cayuse oats produced similar yields and test weights and were less responsive to seeding rate than most of the barley varieties. Optimum seeding rate for both oat varieties was 30 seeds/ft². A similar result was observed in the 2001 trial at LKL. Ajay is a short-stature variety while Cayuse is quite tall

and is prone to lodging when conditions are present for this problem. Lodging was not observed in KES trials in 2002. Ajay was the latest maturing line among all varieties. Plant height and maturity were not affected by seeding rate.

All three wheat varieties produced very low yields at 20 seeds/ft². This anomaly was also observed for Yecora Rojo in the 2001 trial but not for Alpowa. Hank and Yecora Rojo yields did not respond to seeding rates except for the low yield at 20 seeds/ft². Test weights increased with increasing seeding rate in Yecora Rojo but not in Alpowa or Hank. Plant height and maturity were not affected by seeding rate. Yecora Rojo was about 1 ft shorter than Hank and Alpowa.

LKL

Frequent frosts at the LKL site resulted in low yields and test weights in this trial and in commercial fields. Higher seeding rates offset frost injury quite effectively in some of the barley varieties (Table 2). With the exception of Sprinter, all barley varieties produced their lowest yield at the lowest seeding rate. Xena, Baronesse, Statehood, and 1202 were similar in yield and in yield response to higher seeding rates. Acceptable test weights were observed in each of these varieties except at the lower seeding rates. Both 1202 and Xena responses in yield and test weight were similar to results observed at the LKL site in 2001.

During boot stage, when heading date observations were being made, heavy aphid infestations were noted in some of the plots. Sara, Sprinter, Millenium, Nebula, and Statehood barley were extensively infested at all seeding rates. Xena, Baronesse, and 1202 were relatively free of infestation

except at the highest seeding rate. This infestation was considered to be above an economic threshold at the time. Some crops in the area were treated for control. The field where the trial was conducted was not treated. The wheat and oat varieties were not infested. Undoubtedly, aphid damage had some effect on performance of barley varieties in this trial.

Millenium and Nebula produced lower yields than Xena, Baronesse, Statehood, and 1202, but did experience yield improvement at higher seeding rates. Test weights of Millenium and Nebula were not improved much by the increase in seeding rate. Sprinter and Sara were unable to compensate for frost and aphid damage to yield and test weight through increased seeding rate.

Ajay and Cayuse oats were similar in yield to the 2001 results. Seeding rate had little affect on yield or test weight for Ajay. Cayuse achieved the highest yield at 20 seeds/ft² as in 2001. Cayuse had higher test weights than Ajay in this trial but not in 2001.

Frost injury was greatest in the wheat varieties. Increasing seeding rates resulted in some yield improvement in all three varieties, but Yecora Rojo yields were less than 1 ton/acre at all rates. None of the treatments achieved the standard test weight of 60 lb/bu. These results are in general agreement with commercial experience with wheat in the LKL area over many years and confirm the risk involved with producing wheat in this area.

Summary

Standard seeding rates used for commercial crops are typically about 30 seeds/ft² in most areas in the region. Higher rates are often used in areas prone to frequent frosts. Results

observed in this study over 2 years in LKL and in 2002 at KES provide additional experience for several commonly grown varieties of spring cereals. Xena and 1202 barley appear to be suited to both mineral and organic soils. The 30-seeds/ft² rate was optimum for yields at both sites in 2002 and at LKL in 2001. They were among the most responsive varieties to seeding rate of all varieties evaluated. Sara produced the lowest barley yields at both sites in 2002. Higher seeding rates improved test weights for barley varieties at LKL. There appeared to be a varietal preference for aphids that infested the LKL site and aphid damage may have been more important than frost injury in affecting yield and test weight performance of barley varieties.

Ajay and Cayuse oats were less responsive to seeding rate than barley varieties. At KES, oat yields were similar to yields of the highest yielding barley variety. Lower yields were obtained for Ajay and Cayuse than for several barley varieties at LKL.

Wheat yields were equal to the highest barley yields at KES. Except for the low yields observed at the 20-seeds/ft² rate, seeding rate had little affect on yield of wheat varieties at KES. Frost damage at LKL was more severe for wheat than oat or barley varieties. This was consistent with experience over many years in the area.

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Table 1. Performance of barley, oat, and wheat varieties in a seeding rate study, Klamath Experiment Station, Klamath Falls, OR, 2002.

Variety or line	Seeding rate	Yield	Test weight	Height	50% heading
		lb/acre	lb/bu	in	Julian
Barley					
1202	Mean	5250	53	37	182
Xena	Mean	4930	54	34	181
Nebula	Mean	4510	47	26	182
Millenium	Mean	4480	52	37	177
Sprinter	Mean	4470	51	30	183
Statehood	Mean	4300	49	35	177
Baronesse	Mean	3970	54	32	182
Sara	Mean	3870	45	43	177
Mean	10	4030	51	34	
	20	4200	51	35	
	30	5010	52	34	
	40	4660	50	34	
Wheat					
Alpowa	Mean	5270	63	36	181
Hank	Mean	4910	60	33	178
Yecora Rojo	Mean	5260	60	23	178
Mean	10	5740	59	29	
	20	3140	61	32	
	30	5650	61	31	
	40	5960	61	31	
Oat					
Ajay	Mean	5250	38	35	187
Cayuse	Mean	5170	39	44	184
Mean	10	4980	38	39	
	20	4500	39	39	
	30	5900	41	40	
	40	5470	37	39	

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Table 2. Performance of barley, oat, and wheat varieties in a seeding rate study, Lower Klamath Lake, Klamath Falls, OR, 2002.

Variety or line	Seeding rate	Yield	Test weight	Height	50% heading
		lb/acre	lb/bu	in	Julian
Barley					
1202	Mean	4080	49	29	192
Xena	Mean	4130	48	29	192
Nebula	Mean	3150	40	23	193
Millenium	Mean	3170	43	29	190
Sprinter	Mean	2300	35	22	197
Statehood	Mean	4120	45	31	190
Baronesse	Mean	4120	48	28	192
Sara	Mean	2030	45	38	190
Mean	10	2200	41		
	20	3260	44		
	30	3930	46		
	40	4150	47		
Wheat					
Alpowa	Mean	1790	55	29	192
Hank	Mean	2510	53	27	188
Yecora Rojo	Mean	1320	55	21	189
Mean	10	720	51		
	20	1650	54		
	30	2240	55		
	40	2890	57		
Oat					
Ajay	Mean	3180	32	24	199
Cayuse	Mean	3620	37	30	192
Mean	10	3160	35		
	20	3630	34		
	30	3200	34		
	40	3600	35		