Response of Oat Varieties to Seeding Rate and Nitrogen Fertilizer

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Developing recommendations for optimum seeding rate and nitrogen (N) fertility for oat production is essential to maximize grain yield and quality and economic returns. However, due to variation in environments and varieties, these recommendations are difficult to determine. The objective of this research was to evaluate the effects of N fertilizer rates and seeding rates on plant development and economic performance of three oat varieties in central North Dakota.

The study was conducted at the Carrington Research Extension Center during the 1998 and 1999 growing seasons. Soil N levels (soil test NO_3-N + spring-applied urea) were calculated for yield goals of 80, 110, and 140 bushels/acre. Varieties Jerry, AC Assiniboia, and CDC Boyer were planted at seeding rates of 0.75, 1.00, and 1.25 million pure, live seeds/acre on April 30, 1998 and May 17, 1999. The N and seeding rates bracketed the normal yield goal and plant population for the Carrington area. The three varieties planted are of almost entirely different genetic backgrounds and represent early (Jerry), medium (CDC Boyer), and late (AC Assiniboia) maturities.

The combined, two-year analysis of variance showed statistically significant differences for year, cultivar, and the year x cultivar interaction for almost all parameters measured (Table 1). Population effects were significant for all variables except whole oat protein percent, percent plump kernels, and groat percent. The effect of N was only significant for lodging and whole oat protein concentration. The difference between years may be explained by the difference in planting date and the contrasting precipitation in the two years (the 1998 season was exceptionally dry, while 1999 was relatively wet).

Averaged over the two years, AC Assiniboia lodged less than Jerry and CDC Boyer, yielded more, and produced generally higher-quality grain. Grain yield of the varieties was similar in 1998, but increased dramatically for AC Assiniboia in 1999 while decreasing in Jerry and CDC Boyer. Kernel weight among cultivars and years showed a similar trend to yield. The superior performance of AC Assiniboia in the more humid 1999 season may be due to a relatively higher level of crown rust resistance. Increasing plant population tended to reduce days to heading and height. Higher populations also resulted in more lodging, higher yield, and improved grain quality. Higher N rates resulted in higher lodging scores and whole oat protein concentrations, but did not significantly affect the other parameters measured. The lack of response to N in 1998 may have been due to the dry growing conditions, while high subsoil N may have precluded a response in 1999.

Conclusions

Yield and test weight increased with population, but not with N rate. Increased seeding rates may be a viable tool to achieve higher economic returns.

Contrasting cultivars responded in a similar fashion to the treatments imposed, suggesting that these results may be extrapolated over a fairly wide range of germplasm.

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Table 1. Main effects of seeding rate and N rate on agronomic and quality traits of three oat varieties.

Treatment	Days to Heading	Lodging Score	Height	Grain Yield	Test Weight	250 Kernal Weight	Whole Oat Protein	Plump Kernels	Groat
		1-9[1]	inches	lbs/acre	lbs/bu	grams	%	%	%
Variety									
Jerry	56	4.9	37	2696	36.3	6.57	12.7	89.4	73.9
AC Assiniboia	60.5	1.4	39	3603	36.3	8.49	12.8	96.2	79.4
CDC Boyer	59.5	3.1	41	3059	34.3	8.07	12.5	95.9	77.4
LSD (0.05)	0.2	0.2	1	92	0.3	0.16	<0.1	0.6	0.3
Seeding Rate (million pure live seeds/acre)									
0.75	58.8	2.9	40	2885	36.6	7.61	12.6	93.5	76.9
1	58.8	3.2	39	3162	36.8	7.72	12.6	93.9	76.8
1.25	58.5	3.3	38	3311	37	7.81	12.7	94	77
LSD (0.05)	0.2	0.2	1	92	0.3	0.16	NS	NS	NS
N Rate (lbs total N/acre for yield goals of 80, 110, and 140 bushels/acre)									
110	58.6	2.9	39	3147	36.8	7.72	12.4	93.9	76.9
152	58.7	3.1	39	3147	36.8	7.75	12.7	94	76.9
193	58.6	3.3	39	3066	36.7	7.66	12.9	93.6	76.9
LSD (0.05)	NS	0.2	NS	NS	NS	NS	<0.1	NS	NS
Year									
1998	61.8	1.1	35	3070	36.8	7.87	13.2	94.2	79.1
1999	55.6	5.2	43	3168	34.5	7.56	12.1	93.5	74.7
LSD (0.05)	0.6	0.2	3	NS	0.7	0.23	0.1	NS	0.6

[1] 1 = erect, 9 = flat; [2]NS=non-significant difference