Project Title: Wheat Seed Quality Effects on Wild Oat Herbicide Performance

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Objective: Determine to what extent spring wheat seed quality factors influence the effects of reduce herbicide rates on wild oat control, wheat yield, and economic returns.

Results:

This experiment consisted of five rates of Achieve (0, 1/8X, 1/4X, 1/2X, and 1X) superimposed on four cropping systems that varied in competitive ability. The four cropping systems consisted of 1) small, low protein seed, without GA 2) small, high protein seed with GA 3) large, low protein seed without GA and 4) large, high protein seed with GA. In the accompanying tables, seed TRT designation "low" refers to the combination of low protein seed without GA, while the seed TRT designation "high" refers to the combination of high protein seed with GA treatment.

Seeds of differing protein levels were produced by growing 'Nick' soft white spring wheat under two different nitrogen regimes during the previous year. Seed from each nitrogen regime was then separated into two seed size classes. The seed size classes were obtained by passing bulk, unprocessed seed over 7/64, 6/64 and 5/64 inch sieves. Seed retained on the 7/64 inch sieve were considered large and those which passed through 6/64 inch sieve but were retained on 5/64 inch sieve were considered small. A portion of the seed from each of the four protein-seed size combinations were treated with the GA seed treatment, Release, at 0 and 3 oz/100 lb of seed.

Wild oat was seeded throughout the entire study area at a density of16 plants/ft^2. The spring wheat treatments were then planted to a depth of 2 inches on April 13, 2007 at a seeding rate of16 plants/ft^2, in 6 inch row spacings. The herbicide treatments were applied on May 15, 2007 using a CO_2 backpack sprayer with Teejet XR11002 nozzles and 20 GPA when spring wheat and wild oat were at 4-leaf stage with 1-2 tillers. Harmony Extra (0.6 oz/ac) plus NIS (0.25%) was applied on May 17, 2007 to control broadleaf weeds. Crop injury and wild oat control were visually evaluated at 2 and 4 weeks after application. Spring wheat and wild oat yield components were determined by harvesting two 1.46 ft^2 quadrats near wild oat shattering. Spring wheat yield, test weight, dockage and grain protein were determined at crop maturity.

Treatment effects on spring wheat plant density were generally lacking (Table 1). However, seed size and herbicide rate did affect most other spring wheat variables. As herbicide rates increased, so too did and the number of wheat spikes, biomass, yield, test weight and grain moisture. In contrast, grain protein content decreased as herbicide rate increased. Seed size affected all wheat variables except grain test weight. Compared to plants grown from small seed, those grown from large seeds had more spikes (13%), greater biomass (16%), higher yields (20%), and less dockage (44%). Increasing seed size reduced grain moisture and protein content. Protein and GA seed

treatments did effect wheat spike production, test weight and grain protein. Plants established from the “High” seed treatment combination had more spikes and higher protein content, but lower test weight than those derived from the “low” treatment combination. The lack of a yield difference between the two seed treatment levels may be due to severe heat stress, which shortened the grain filling period.

Herbicide effects were substantial, with all wild oat variables declining as Achieve rate increased from 0 to 0.178 lb ai/ac. The effects of seed size and seed treatments were less apparent. Seed quality (seed size and seed treatments) did affect wild oat control at 4 weeks after application. As either variable increased, wild oat control increased as well. This was especially evident at lower herbicide rates. There was a strong trend in the data which indicated that increased seed quality reduced wild oat panicle, biomass and seed production. However, the effect was not statistically significant.

Summary:

This study demonstrated that improved spring wheat seed quality significantly increased crop competitive ability and weed control under wild oat competition.

Future plan:

Continued to evaluate seed quality for improving wild oat control in spring wheat.

[See tables on following pages.]

Table 1. Effects of seed size (SS), seed treatment (TRT) and herbicide rate (HR) on spring wheat plant variables in 2007at Kalispell, MT.

Seed size (SS)	Seed TRT	Herbicide rate (HR)	Plants	Spikes	Biomass	Yield	Test weight	Grain moisture	Dockage	Protein
			----- No./m^2 -----		g/m^2	bu/ac	lb/bu	---------- % ----------		
Small	Low	0	119.6	288.9	456.1	22.7	55.7	8.7	18.0	14.6
		1/8X	140.1	308.1	474.8	30.0	56.0	8.7	14.0	14.4
		1/4X	145.7	381.5	710.9	46.3	57.8	9.5	7.2	13.6
		1/2X	150.9	372.2	783.8	60.0	58.7	9.6	2.0	13.2
		1X	134.5	400.1	816.7	66.9	58.5	9.1	0.8	13.5
		Mean	**138.2**	**350.1**	**648.4**	**45.2**	**57.3**	**9.1**	**8.4**	**13.9**
Small	High	0	126.8	260.2	329.8	23.7	55.2	8.5	16.8	15.0
		1/8X	112.4	349.2	553.5	31.2	55.2	8.4	11.3	15.0
		1/4X	141.2	417.0	705.4	47.0	57.7	9.4	7.0	13.8
		1/2X	152.4	457.1	889.6	59.5	58.2	9.6	1.9	13.4
		1X	141.3	458.2	920.6	63.5	59.1	9.4	0.9	13.3
		Mean	**134.8**	**388.3**	**679.8**	**44.9**	**57.1**	**9.1**	**7.6**	**14.1**
Large	Low	0	122.7	418.2	559.6	38.2	57.2	8.9	8.9	13.9
		1/8X	147.8	323.0	615.4	41.2	56.2	8.5	8.4	14.2
		1/4X	147.9	406.3	761.7	51.2	57.1	8.3	4.0	13.5
		1/2X	140.1	401.5	825.4	67.1	59.4	9.2	1.4	12.5
		1X	159.0	459.3	992.2	72.8	59.1	9.5	0.7	13.0
		Mean	**143.5**	**401.6**	**750.9**	**54.1**	**57.8**	**8.9**	**4.7**	**13.4**
Large	High	0	147.8	395.7	587.8	34.5	55.0	8.3	12.3	14.4
		1/8X	143.5	360.3	604.0	44.2	56.1	8.6	8.2	14.1
		1/4X	162.4	449.3	852.2	56.2	57.3	8.8	3.9	13.7
		1/2X	143.5	484.9	945.3	63.5	57.6	9.1	1.2	13.5
		1X	140.1	469.3	984.9	69.9	59.4	9.0	0.6	12.9
		Mean	**147.4**	**431.9**	**794.8**	**53.7**	**57.1**	**8.7**	**5.2**	**13.7**
LSD (0.05)		SS	NS	31.8	36.0	3.1	NS	0.2	1.0	0.3
		TRT	NS	31.9	NS	NS	0.5	NS	NS	0.3
		HR	NS	50.4	117.7	5.0	0.8	0.4	1.6	0.4

Seed TRT (T): Low = low protein without gibberellic acid (GA) treatment; High = high protein with GA treatment; 1X: label rate (0.178 lb ai/ac); NS: not significant, P>0.05.

Table 2. Effects of seed size (SS), seed treatment (TRT) and herbicide rate (HR) on wild oat varaibles in 2007 at Kalispell, MT.

Seed size (SS)	Seed TRT	Herbicide rate (HR)	Wild oat control 5/29/07	Wild oat control 6/12/07	Plants	Panicles	Biomass Stems	Biomass Panicles	Biomass Total	Seeds
			--------- % ---------		----- No./m^2 -----		---------- g/m^2 ----------			No./m^2
Small	Low	0	1.0	0.0	65.6	186.3	256.4	167.3	423.8	8659.1
		1/8X	16.3	27.5	100.5	253.5	331.4	204.1	535.5	10749.9
		1/4X	33.8	55.0	57.9	161.3	190.5	109.8	300.3	5485.1
		1/2X	39.8	78.6	41.9	85.8	70.3	41.0	111.3	2181.9
		1X	74.4	91.6	17.7	30.2	26.8	18.0	44.8	895.9
		Mean	**33.0**	**50.5**	**56.7**	**143.4**	**175.1**	**108.0**	**283.2**	**5594.4**
Small	High	0	0.0	0.0	117.1	271.0	372.5	221.0	593.5	11048.2
		1/8X	16.3	30.0	107.9	236.0	287.6	153.3	440.9	8446.5
		1/4X	40.0	58.8	61.8	124.5	149.3	86.1	235.4	4376.9
		1/2X	55.0	82.5	13.8	28.6	37.0	23.3	60.2	1099.2
		1X	73.8	91.3	3.7	10.2	10.4	5.1	15.5	249.8
		Mean	**37.0**	**52.5**	**60.9**	**134.0**	**171.4**	**97.7**	**269.1**	**5044.1**
Large	Low	0	0.0	0.3	158.9	285.1	338.3	229.7	568.0	10905.2
		1/8X	14.4	29.9	123.4	234.2	254.2	172.5	426.8	8134.0
		1/4X	39.8	58.6	46.5	141.1	144.5	85.0	229.5	4298.1
		1/2X	55.0	85.0	30.4	47.9	37.2	23.5	60.7	1331.6
		1X	53.0	93.8	11.1	17.5	12.0	8.4	20.4	499.7
		Mean	**32.4**	**53.5**	**74.1**	**145.2**	**157.3**	**103.8**	**261.1**	**5033.7**
Large	High	0	1.0	0.0	101.3	210.8	296.8	190.1	486.9	10001.7
		1/8X	16.3	48.8	125.4	236.9	285.8	170.0	455.8	8369.6
		1/4X	35.0	63.8	33.3	106.9	102.2	55.9	158.2	2558.7
		1/2X	49.8	87.0	43.2	88.2	83.7	56.9	140.6	2322.2
		1X	72.5	92.5	3.7	4.6	4.3	2.4	6.7	134.6
		Mean	**34.9**	**58.4**	**61.4**	**129.5**	**154.6**	**95.1**	**249.6**	**4677.4**
LSD (0.05)		SS	NS	3.5	NS	NS	NS	NS	NS	NS
		TRT	NS	3.5	NS	NS	NS	NS	NS	NS
		HR	9.4	5.6	18.9	42.1	48.9	30.7	78.6	1528.8

Seed TRT (T): Low = low protein without gibberellic acid (GA) treatment; High = high protein with GA treatment; 1X: label rate (0.178 lb ai/ac); NS: not significant, P>0.05.