HRS Wheat Variety Tolerance to Salt-affected Soil, Carrington

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Trial objective is to determine if differences exist among hard red spring wheat varieties in productivity between low and high levels of soil salinity. Experimental design was a randomized complete block with a split plot arrangement and three replications: soil salt levels as whole plot and varieties as subplot. The trial was seeded with the varieties 'Barlow', 'Linkert', 'Prevail', 'LCS Powerplay', 'SY Soren' and 'WB Mayville' on May 27. Soil analysis from June 2 sampling of the two salt blocks: low = 285 lb/A nitrate N, 8 ppm P, 294 ppm K, 3.4% organic matter, 7.5 pH (0-6" depth), 0.44 (0-6" depth) and 1.35 (6-24" depth) dS/m soluble salts; high = 239 lb/A nitrate N, 24 ppm P, 350 ppm K, 3.9% organic matter, 7.4 pH (0-6" depth), 3.01 (0-6" depth) and 5.36 (6-24" depth) mmhos/cm soluble salts. A hand-held EC meter was used to record soil salt levels on May 28 and July 18. The trial was harvested with a plot combine on September 8.

Soil analysis and EC meter measurements (Table 1) indicate a consistent difference in salt content between soil blocks. Plant emergence generally occurred June 1 in the low-salt soil and June 3 in the high-salt soil. Averaged across varieties, plant density was reduced 25% in high-salt soil compared to low-salt soil (Table 2). The period of planting to maturity was extended 6 days in the low-salt soil. Also, plants were 17 cm (6.7 inches) taller in the low-salt soil. Seed yield was higher by 8.1 bu/A, test weight was higher by 2.2 lb/A, and seed size was 25% larger in the low- vs. high-salt soil. Seed protein was higher in the high-salt soil. Wheat yield generally tends to have an inverse relationship with grain protein, which likely explains the higher protein content on the high-salt soil.

Table 1. Soil EC with HRS Wheat Variety Tolerance to Soil Salt Levels

	Average dS/m (0-6" depth)					
	----May 29[1]----		----May 28[2]----		----July 18[2]----	
	low	high	low	high	low	high
Rep 1	0.79	3.29	0.61	2.59	0.32	1.35
Rep 2	1.02	x	0.84	2.66	0.33	3.22
Rep 3	1.03	6.28	0.94	3.54	0.25	3.71
Block Average	0.95	3.19	0.80	2.93	0.30	2.76

[1] Soil sampled and EC measured as 1:1 soil/water paste.

[2] EC Meter.

Table 2. HRS Wheat Variety Response to Soil Salt Levels

Treatment	Stand Count (June 18) plants/A	Days to Maturity Jday	Plant Height cm	Seed Yield bu/A	Test Weight lb/bu	Seed Count seeds/lb	Seed Protein %
Barlow	1,715,080	223	71	32.4	57.7	17,030	15.1
Linkert	1,806,145	225	65	35.0	57.7	15,845	16.0
Prevail	1,618,955	223	71	27.9	56.3	18,650	14.5
LCS Powerplay	1,682,195	225	69	32.9	57.5	16,410	14.1
SY Soren	1,467,180	224	64	28.6	57.8	15,720	15.5
WB Mayville	1,448,205	225	65	31.9	57.4	15,115	15.7
LSD (0.05)	NS	NS	4.8	NS	NS	1880	1.0
low salt	1,851,260	227	76	35.5	58.5	14,090	14.2
high salt	1,394,660	221	59	27.4	56.3	18,835	16.1
LSD (0.05)	153,665	1	3	4.4	0.9	1085	0.6
Mean	1,622,960	224	67	31.5	57.4	16,460	15.1
C.V. %	14	0.5	5.2	18.0	1.8	10.0	4.8

Soil salt levels were similar among varieties in the low- and high-salt soils (Table 3). Plant stands were generally similar among varieties in the low-salt soil (1.7 to 2.1 million plants/A) and high-salt soil (1.2 to 1.6 million plants/A), as well as days to maturity. 'Linkert' tended to be the highest yielding variety in the low-salt soil. 'Barlow' tended to have the highest yield in the high-salt soil, with a loss of 1.3 bu/A (4%) compared to yield in the low-salt soil. The balance of varieties had yield loss in the high-salt soil ranging from 3.9 to 15.0 bu/A (13 to 35%) compared to the low-salt soil. The relatively low yield losses for Barlow and Sy Soren (13% at 3.9 bu/A) indicates that these two varieties may be more stable than other varieties tested (with >20% loss) within the range of high soil EC for this site. In the high-salt soil, 'Barlow' had the highest test weight loss at 3.3 lb/bu while 'SY Soren' had the least loss at 0.9 lb/bu among varieties, compared to test weight in the low-salt soil.

Table 3. HRS Wheat Variety Response to Soil Salt Levels

Variety	Soil Salt	Stand Count (June 18) plants/A	Soil Salt (July 18) dS/m	Days to Maturity Jday	Plant Height cm	Seed Yield bu/A	Seed Yield bu/A loss high vs. low salt	Seed Yield % loss high vs. low salt	Test Weight lb/bu	Seed Count seeds/lb	Seed Protein %
Barlow	low	2,051,520	0.3	226	82	33.0			59.4	14,925	14.1
	high	1,378,640	2.4	220	61	31.7	1.3	3.9	56.1	19,130	16.0
Linkert	low	2,036,340	0.4	227	74	42.5			59.1	12,855	15.3
	high	1,575,950	3.2	222	56	27.5	15.0	35.3	56.3	18,840	16.8
Prevail	low	1,735,315	0.3	227	80	31.8			57.3	14,595	13.3
	high	1,502,590	3.1	220	61	24.0	7.8	24.5	55.4	22,705	15.6
LCS Powerplay	low	1,935,155	0.4	227	73	39.6			58.7	13,950	13.2
	high	1,429,235	2.4	222	64	26.3	13.3	33.6	56.3	18,875	15.0
SY Soren	low	1,687,255	0.3	228	75	30.5			58.2	15,500	14.5
	high	1,247,100	3.0	221	54	26.6	3.9	12.8	57.3	15,940	16.5
WB Mayville	low	1,661,960	0.5	227	73	35.5			58.6	12,720	14.7
	high	1,234,455	2.5	222	57	28.3	7.2	20.3	56.2	17,515	16.7
LSD (0.05)		NS	NS	NS	NS	NS			NS	2660	NS
Mean		1,622,960	1.6	224	67	31.5			57.4	16,460	15.1
C.V. %		14.2	32.6	0.5	5.2	18.0			1.8	10.0	4.8