

Chloride Fertilization on Winter Wheat

By Ray Lamond, Vic Martin, Tom Maxwell, Robert Bowden, and Stewart Duncan

Research across the Great Plains has shown that wheat often responds to Cl fertilization, particularly when soil Cl levels are less than 20 lb/A (0 to 24 inch depth). Several researchers, however, have reported that wheat cultivars may respond differently. Research in South Dakota showed that the cultivar grown was an important consideration in determining Cl need. In Kansas, certain cultivars have shown leaf spotting, which was eliminated with Cl fertilization.

Studies were conducted at two sites in 1998 (16 cultivars) and 1999 (12 cultivars) to evaluate Cl fertilization/wheat cultivar interactions. Wheat was seeded in early October each year. Chloride as potassi-

um chloride (KCl) was applied as a February topdress. The Cl rate was either 24 or 40 lb/A, depending on location. Treatments were replicated six times. Nitrogen (N) and other needed nutrients were balanced on all treatments.

Plant samples were taken at boot stage and analyzed for Cl. Grain yields as well as grain test weights and thousand kernel weights (TKW) were determined (in 1998 only). Leaf disease pressure was monitored and was rated none to very slight at both sites both years.

Effects of Cl fertilization and cultivar on wheat production are summarized in **Tables 1** to **4**. The 1998 data are reported in **Tables 1** and **2**, 1999 data in **Table 3** and a summary

The objective of the research reported here was to evaluate the effects of chloride (Cl) fertilization on several wheat cultivars commonly grown in the Great Plains.



Cimmaron variety wheat at Sandyland Experiment Field, Kansas, showed deficiency symptoms when no Cl was applied (left). With 24 lb Cl/A, leaf spotting was eliminated (right).

of all sites and years in **Table 4**. Chloride-sensitive cultivars (Cimarron, Triumph 64) showed Cl deficiency symptoms at every site. Symptoms were eliminated when Cl was applied (see photo). Chloride fertilization significantly increased plant Cl concentrations in all cultivars at both sites in 1998. However, significant differences in plant Cl levels were noted among cultivars in the presence or absence of Cl fertilizer, suggesting that cultivars may have different Cl needs. These results suggest that whenever Cl concentrations are less than 0.10 to 0.12 percent, responses to applied Cl are likely.

Chloride fertilization significantly increased yields of most cultivars at each site over the two years, **Table 4**. Soil Cl levels at both sites were less than 20 lb/A (0 to 24 inch depth). The addition of Cl also increased grain test weights and TKWs of most cultivars. Even though most cultivars responded to Cl, Ogallala and Custer have been consistently non-responsive, even with the low soil Cl.

The most yield-responsive cultivars were the same ones that showed leaf spotting or Cl

deficiency symptoms. Many cultivars that failed to exhibit leaf spotting still produced

TABLE 1. Effects of Cl fertilization/wheat cultivars, Sandyland Experiment Field, St. John, KS, 1998.

Cultivar	Grain yield, bu/A		Test weight, lb/bu		TKW, g		Leaf Cl, %	
	+Cl	-Cl	+Cl	-Cl	+Cl	-Cl	+Cl	-Cl
Windstar	70	63	57	54	28	24	.27	.06
Coronado	91	79	60	58	32	29	.30	.06
2180	89	78	58	54	27	25	.32	.06
Tam 107	83	69	56	56	32	26	.32	.05
Tam 200	77	64	61	57	23	19	.36	.05
7853	81	77	61	59	34	32	.29	.05
Custer	78	78	60	59	32	31	.35	.07
Cimarron	84	71	61	58	30	26	.37	.05
2163	77	71	55	55	25	24	.38	.06
Ogallala	70	72	61	58	24	21	.31	.06
Triumph 64	75	63	62	61	34	29	.35	.06
2137	80	73	57	57	31	29	.35	.06
Champ	76	76	59	60	30	27	.31	.05
Mankato	82	78	61	56	32	28	.33	.06
Jagger	89	81	59	58	29	26	.40	.06
Karl 92	83	78	60	58	30	29	.35	.06
Mean	80	73	59	57	30	26	.33	.06
LSD (0.10)								
Between columns	3		1		1		.02	
Soil test Cl: 7 lb/A (0 to 24 in.)								

TABLE 2. Effects of Cl fertilization/wheat cultivars, Saline County, KS, 1998.

Cultivar	Grain yield, bu/A		Test weight, lb/bu		TKW, g		Leaf Cl, %	
	+Cl	-Cl	+Cl	-Cl	+Cl	-Cl	+Cl	-Cl
Windstar	88	83	51	51	30	28	.40	.11
Coronado	90	85	60	60	29	31	.38	.12
2180	88	82	62	60	29	29	.51	.13
Tam 107	98	94	58	55	30	28	.43	.17
Tam 200	69	61	61	61	21	22	.43	.13
7853	96	88	64	63	34	34	.42	.15
Custer	100	103	62	61	31	31	.43	.14
Cimarron	80	63	61	59	29	29	.46	.15
2163	98	95	58	57	26	25	.48	.12
Ogallala	76	75	60	60	22	22	.34	.12
Triumph 64	68	61	65	62	33	30	.48	.17
2137	113	106	61	60	31	31	.43	.15
Champ	88	86	60	60	28	27	.47	.12
Mankato	75	63	60	60	28	27	.50	.14
Jagger	105	87	60	58	27	26	.44	.14
Karl 92	114	95	63	62	31	3	.40	.14
Mean	90	83	61	59	29	28	.44	.14
LSD (0.10)								
Between columns	3		1		NS		.01	
Soil test Cl: 7 lb/A (0 to 24 in.)								

higher yields when Cl was applied.

Summary

Results to date suggest that when Cl soil test levels are low (< 20 lb/A, 0 to 24 inch depth), most wheat cultivars are likely to economically respond to Cl fertilization. Whenever wheat plant tissue Cl concentrations (boot stage samples) are less than 0.10 to 0.12 percent, response to Cl fertilization would be likely.

These results and other wheat nutrient management considerations can be found on our virtual wheat field day site at <http://www.oznet.ksu.edu/wheat>.



The authors are with Kansas State University. Dr. Lamond is Professor/Extension Specialist, Soil Fertility; Dr. Martin is Associate Professor/Research Agronomist, Sandyland Experiment Field; Mr. Maxwell is Saline County Agricultural Extension Agent; Dr. Bowden is Professor/Extension Specialist, Plant Pathology; Dr. Duncan is Associate Professor/Area Extension Specialist, Agronomy.

TABLE 3. Effects of Cl fertilization/wheat cultivars, 1999.

Cultivar	Sandyland Exp. Field				Saline County			
	Grain yield, bu/A		Test weight, lb/bu		Grain yield, bu/A		Test weight, lb/bu	
	+Cl*	-Cl	+Cl	-Cl	+Cl	-Cl	+Cl	-Cl
Custer	71	66	59	56	86	79	57	55
Cimarron	74	57	61	60	65	53	56	57
2163	68	65	59	56	7	55	51	52
Ogallala	72	72	60	60	86	84	57	57
Triumph 64	63	52	59	60	58	52	53	55
2137	76	67	58	58	90	83	57	56
Champ	68	62	57	56	75	70	54	52
Mankato	74	71	57	58	72	63	54	54
Jagger	82	73	58	60	81	77	54	55
Karl 92	64	60	59	58	77	73	55	57
Betty	68	67	60	59	75	71	54	54
Heyne	63	60	59	59	80	77	54	54
Mean	70	64	59	58	75	70	55	55
LSD (0.10)								
Between columns	3		1		4		1	

*Cl applied at 24 lb/A as KCl topdressed in February.
Soil test Cl: 15 lb/A (0 to 24 in.)

TABLE 4. Wheat grain yield response to Cl across sites and years.

Cultivar	1998		1999		Mean
	Sandyland	Saline	Sandyland	Saline	
	Yield response, bu/A				
Windstar	7	5	—	—	6
Coronado	12	5	—	—	9
2180	11	6	—	—	9
Tam 107	14	4	—	—	9
Tam 200	13	8	—	—	11
7853	4	8	—	—	6
Custer	0	-3	5	7	2
Cimarron	13	17	17	12	15
2163	6	3	3	2	4
Ogallala	-2	1	0	2	0
Triumph 64	12	7	11	6	9
2137	7	7	9	7	8
Champ	0	2	6	5	3
Mankato	4	12	3	9	7
Jagger	7	18	9	4	10
Karl 92	5	19	4	4	8
Betty	—	—	1	4	3
Heyne	—	—	3	3	3
Mean	7	7	6	5	7