

CHLORIDE'S ROLE IN MAXIMIZING WHEAT VARIETY PERFORMANCE 1997 Report

C.A. Grant
Brandon Research Centre

Objectives:

- 1) To understand the interactions of major wheat varieties and promising releases with chloride fertilization
- 2) To evaluate effects of chloride fertilization on wheat plant pathology
- 3) To document effects of chloride on plant maturity and thousand kernel weight
- 4) To increase awareness of dealers and growers of the benefits of appropriate chloride fertilization to wheat yield and profitability.

Project Protocol:

A) Variety Study

- 15 varieties of spring wheat, including Hard Red Spring, Amber Durum and Canadian Prairie Spring wheat cultivars
- Cultivars sown with and without Cl applied at 40 lb Cl per acre as KCl, applied as a pre-plant spring banded application

B) Rate study

- Chloride rates of 0, 10, 20, 40 and 80 lb/acre were applied to Biggar wheat, a variety that has been responsive in the past.

Site Selection:

Two sites testing low in Cl were selected in 1996 on two contrasting soil types, a clay loam and a fine sandy loam. In 1997, two similar soil types at different locations were used. The fine sandy loam soil tested low in Cl while the clay loam tested moderate. Samples were to Ag Vise for soil Cl determination.

Experimental Design:

A) Variety Study: Split plot design with 6 replications, for a total of 180 plots per site. Subplots were 2 metres by 5 metres.

B) Rate study: Randomized complete block design with 6 replications for a total of 30 plots per site. Plots were 2 metres by 5 metres.

Sampling:

- 1) Whole plant samples were taken at heading. Analysis for N, K, Cl and micronutrients is in progress.
- 2) Plant pathology evaluation was conducted by barley breeder Dr. Mario Therrien in 1996 and by pathologist Curtis Rempel in 1997. Plots were rated for leaf disease incidence.
- 3) Thousand kernel weight will be measured on all plots, but has not been completed yet. Protein content and cadmium concentration will be assessed on selected plots.
- 4) Information on final grain yield, harvest index and disease incidence is included in this report.

RESULTS

1996 Growing Season

Fine Sandy Loam

A wet spring was followed by severely dry conditions, leading to severe drought stress on the fine sandy loam site. Drought stress superimposed on natural variation in the soil led to high variability in the study. However, significant difference did occur in all variables measured (Tables 1-3).

Grain yield was increased by application of KCl when averaged over all cultivars (Tables 1 and 2). Yield also varied with cultivar. It is interesting to note that the cultivars which normally produce high grain and biomass yield produced the lowest grain yield on this site. This is presumably due to depletion of available water early in the season by the higher biomass production, which led to enhanced drought stress during grain fill. Although there was no significant KCl by cultivar interaction, I chose to break out the results by cultivar because of the large variability on this site. Yield was significantly increased by KCl application for Karma, Majestic and Roblin and tended to increase with Plenty ($p < 0.0639$) and Cora ($p < 0.0787$).

Table 1: Effect of cultivar and KCl treatment on grain yield, leaf diseases and harvest index of wheat grown on a fine sandy loam soil in 1996.

Cultivar	Grain Yield (Bu/acre)			Disease Rating (0-9)			Harvest Index		
	Control	KCl	Mean	Control	KCl	Mean	Control	KCl	Mean
Barrie	27.1	34.6	30.9	6.00	5.67	5.83	0.5	0.51	0.50
CDC Teal	35.0	34.3	34.7	5.50	6.00	5.75	0.55	0.54	0.54
Cora	28.8	33.8	31.3	6.00	6.17	6.08	0.53	0.58	0.56
Domain	28.1	33.1	30.6	6.17	7.00	6.58	0.52	0.57	0.54
Glenlea	29.3	25.4	27.4	5.33	5.33	5.33	0.49	0.45	0.47
Grandin	37.1	31.6	34.4	5.50	6.00	5.75	0.53	0.56	0.55
Guard	28.9	28.9	28.9	7.00	7.17	7.08	0.57	0.58	0.57
Karma	27.4	42.3	34.9	6.83	5.00	5.92	0.53	0.59	0.56
Kyle	25.2	32.6	27.1	6.33	5.83	6.08	0.47	0.48	0.48
Majestic	29.9	40.8	35.3	5.66	5.00	5.58	0.57	0.60	0.59
Marshall	41.8	41.4	41.6	5.66	5.50	5.58	0.61	0.60	0.60
Pioneer 2375	32.7	39.3	36.0	6.50	6.17	6.33	0.59	0.60	0.59
Plenty	22.5	31.5	27.0	6.83	6.33	6.58	0.45	0.49	0.47
Roblin	27.1	32.0	29.6	7.50	7.50	7.50	0.54	0.55	0.54
Taber	35.9	29.9	32.9	5.33	5.67	5.50	0.53	0.51	0.52

Table 2: ANOVA table for effect of cultivar and KCl applications on grain yield, disease incidence and harvest index on a fine sandy loam soil (1996)

Source	DF	Grain Yield	Disease Rating	Harvest Index
Treatment	1	0.0034	ns	0.0661
Cultivar	14	0.0276	0.0001	0.0001
Treat x Cult	14	ns	ns	ns
MSE		721255	0.7697	0.0025

Leaf disease incidence was severe on this location. Leaf disease was not influenced by KCl application when averaged over all cultivars. There was a strong effect of cultivar but no significant cultivar by KCl interaction. When KCl effects on cultivars were considered individually, disease incidence was reduced significantly only in Karma and tended to be slightly higher in Domain with the application of KCl ($p < 0.0925$).

Harvest index tended to increase with application of KCl when averaged over the cultivars ($p < 0.0661$) and differed among cultivars (Tables 1 and 2). There was no cultivar by KCl interaction. When considered separately, there was a significant increase in harvest increase with KCl application in Karma and Domain (Table 3).

Table 3: Probability values associated with treatment effect for individual cultivars for grain yield, disease rating and harvest index on a fine sandy loam soil in 1996.

	Grain Yield	Disease Rating	Harvest Index
Barrie	ns	ns	ns
CDC Teal	ns	ns	ns
Cora	0.0787	ns	ns
Domain	ns	0.0925	0.0353
Glenlea	ns	ns	ns
Grandin	ns	ns	ns
Guard	ns	ns	ns
Karma	0.0024	0.0060	0.0278
Kyle	ns	ns	ns
Majestic	0.0296	ns	ns
Marshall	ns	ns	ns
Pioneer 2375	ns	ns	ns
Plenty	0.0639	ns	ns
Roblin	0.0063	ns	ns
Taber	ns	ns	ns

Clay Loam Soil

Dry conditions after seeding also occurred on the clay loam soil, but the ability of the soil to hold

more available moisture than on the fine sandy loam soil reduced the impact of the drought. Therefore, crop yields were high and variability low on this site.

Grain yield was not increased by KCl application, when averaged over cultivars (Table 4 and 5). However, cultivar significantly affected crop yield and there was a cultivar by KCl interaction. Grain yield was only significantly increased by KCl application in Karma, a high yielding soft white wheat (Tables 4 and 6). Grain yield was reduced by KCl application in Marshall and CDC Teal and tended to be reduced by KCl application in Roblin ($p < 0.0773$). The reason for the reduction in yield with KCl application on this soil escapes me, although in growth chamber studies that I did a number of years ago on this soil type I saw the same tendency.

Table 4: Effect of cultivar and KCl treatment on grain yield, leaf diseases and harvest index of wheat grown on a clay loam soil in 1996.

Cultivar	Grain Yield (Bu/acre)			Disease Rating (0-9)			Harvest Index		
	Control	KCl	Mean	Control	KCl	Mean	Control	KCl	Mean
Barrie	52.5	51.5	52.0	2.83	3.00	2.92	0.37	0.39	0.38
CDC Teal	56.4	51.2	53.8	3.83	4.00	3.92	0.44	0.47	0.46
Cora	56.6	56.5	56.5	3.67	3.50	3.58	0.42	0.46	0.44
Domain	51.6	52.9	52.3	5.50	4.67	5.08	0.41	0.45	0.43
Glenlea	57.6	58.8	58.2	3.83	2.67	3.25	0.35	0.32	0.34
Grandin	52.6	52.1	52.3	4.33	3.67	4.00	0.35	0.36	0.36
Guard	54.4	54.9	54.7	4.83	3.00	3.92	0.40	0.42	0.41
Karma	57.9	66.4	62.1	5.83	3.00	4.42	0.41	0.41	0.41
Kyle	61.2	63.9	62.6	5.00	1.33	3.17	0.34	0.34	0.34
Majestic	56.7	59.5	58.1	3.33	2.67	3.00	0.39	0.42	0.40
Marshall	60.6	56.7	58.6	3.83	4.33	4.08	0.43	0.42	0.42
Pioneer 2375	60.3	57.0	58.7	4.67	5.50	5.08	0.47	0.46	0.46
Plenty	65.2	67.1	66.1	2.83	1.83	2.33	0.35	0.37	0.36
Roblin	47.6	44.0	45.8	4.83	4.83	4.83	0.43	0.44	0.44
Taber	60.7	60.3	60.5	2.17	3.00	2.58	0.41	0.42	0.42

Disease incidence was affected by treatment and cultivar and a treatment by cultivar interaction occurred (Tables 4 and 5). Disease was generally reduced by KCl application, with significant reductions occurring in Domain, Glenlea, Guard, Karma, Kyle and Plenty (Tables 4 and 6). A significant increase in disease with KCl application occurred in Taber. The reason for the increase in this cultivar was unclear. The greater tendency for differences in disease with KCl on this soil as compared to the fine sandy loam soil may be because the disease pressure, while measurable, was lower on the clay loam. The KCl may have been more effective in reducing disease when the pressure was not as severe as on the fine sandy loam soil.

Table 5: ANOVA table for effect of cultivar and KCl applications on grain yield, disease incidence and harvest index on a clay loam soil (1996)

Source	DF	Grain Yield	Disease Rating	Harvest Index
Treatment	1	ns	0.0001	0.0003
Cultivar	14	0.0001	0.0001	0.0001
Treat x Cult	14	0.0015	0.0001	0.0130
MSE		90061	0.7919	0.0004

Harvest index was affected by treatment and cultivar and a treatment by cultivar interaction occurred (Tables 4 and 5). Harvest index increased with KCl application in Cora, Domain, Guard and Majestic, tended to increase in Barrie ($p < 0.0786$) and Plenty ($p < 0.0954$) and tended to decrease with KCl application in Glenlea ($p < 0.0688$). Significant effects on harvest index were not related to changes in grain yield.

Table 6 : Probability values associated with treatment effect for individual cultivars for grain yield, disease rating and harvest index for a clay loam soil (1996)

	Grain Yield	Disease Rating	Harvest Index
Barrie	ns	ns	0.0786
CDC Teal	0.0075	ns	ns
Cora	ns	ns	0.0080
Domain	ns	0.0041	0.0353
Glenlea	ns	0.0335	0.0688
Grandin	ns	ns	ns
Guard	ns	0.0478	0.0100
Karma	0.0164	0.0001	ns
Kyle	ns	0.0027	ns
Majestic	ns	ns	0.0276
Marshall	0.0433	ns	ns
Pioneer 2375	ns	ns	ns
Plenty	ns	0.0409	0.0954
Roblin	0.0773	ns	ns
Taber	ns	0.0422	ns

Effect of Rate of Chloride Fertilizer on Biggar Wheat 1996

Biggar wheat was selected to use as an indicator cultivar in rate studies as it had been reported to be responsive to Cl application in other trials (Flaten - personal communication). However, application of KCl did not influence growth of Biggar on either soil, although there was a tendency towards lower yield with application of KCl on the clay loam site ($p < 0.0705$) (Tables 7 and 8). Disease and harvest index showed no response or tendency to response to KCl application.

Table 7: Effect of rate of KCl fertilizer (kg Cl ha⁻¹) on grain yield (kg ha⁻¹), leaf disease (0 to 9 scale) and harvest index on two soil types (1996)

Cl Rate	Fine Sandy Loam			Clay Loam		
	Grain Yield	Disease	Harvest Index	Grain Yield	Disease	Harvest Index
0	2004	6.17	0.58	4608	3.17	0.44
20	2228	6.00	0.57	4625	2.50	0.45
40	2228	6.00	0.58	4457	3.33	0.45
60	2157	5.83	0.58	4598	2.83	0.46
80	2230	5.83	0.58	4402	2.83	0.44

Table 8: ANOVA for effects of rate of KCl on grain yield, disease incidence and harvest index of Biggar wheat on two soil types (1996)

Source	DF	Fine Sandy Loam			Clay Loam		
		Grain Yield	Disease	Harvest Index	Grain Yield	Disease	Harvest Index
Rate	1	ns	ns	ns	0.0705	ns	ns
Rep	5	0.0001	0.0007	0.0008	0.0001	ns	ns
CV		10.66	8.60	5.30	4.14	32.0	4.44

1996 Summary

Grain yield was increased by KCl application in Karma wheat on both a fine sandy loam and a clay loam soil. Responses were more frequent on the fine sandy loam soil, with increases in yield with KCl occurring in 1/3 of the cultivars evaluated. On the clay loam soil, a yield increase occurred only in Karma, while decreases occurred on two cultivars with a tendency to a decrease in a third. The beneficial effect of KCl on disease was greater on the clay loam than the fine sandy loam soil, possibly due to the lower variability or the lower disease incidence on the clay loam soil. Harvest index tended to increase with KCl application on both sites although this did not relate closely to changes in grain yield.

1997 Growing Season

Clay Loam Soil

As in 1996, a wet spring was followed by dry conditions, leading to severe drought stress on both soils during the grain filling period. A hail storm just prior to heading damaged wheat at the clay loam site, but the crop recovered well. The clay loam soil contained greater than 30 kg Cl ha⁻¹, yet wheat grown on this site showed a significant increase in grain yield with KCl application.

Table 9: P-values from ANOVA for effect of cultivar and KCl applications on grain yield, straw yield, harvest index and disease incidence on a clay loam soil (1997)

<u>Source</u>	<u>Grain Yield</u>	<u>Straw Yield</u>	<u>Harvest Index</u>	<u>Disease 1</u>	<u>Disease 2</u>
Treatment	0.0001	ns	0.0022	ns	ns
Cultivar	0.0001	0.0001	0.0001	ns	0.0001
Treat*Cultivar	0.0006	ns	0.0448	ns	0.0207
MSE	77535	1554689	0.0010	0.1574	0.2617
CV	7.1	17.3	6.7	43.0	19.9

Grain yield and harvest index on the clay loam soil were increased by application of KCl when averaged over all cultivars, while straw yield was not affected (Tables 9 and 11). All three yield parameters varied with cultivar. Disease incidence was relatively low at the first assessment and there was no effect of treatment or cultivar. At the second assessment, disease incidence varied with cultivar but not with treatment. A treatment by cultivar interaction occurred for grain yield, harvest index and disease incidence at the second sampling, indicating that response to KCl application differed among cultivars. Therefore, analysis was conducted for each cultivar separately (Table 10).

Table 10: P-values for analysis of variance for effect of KCl treatment on grain yield, leaf diseases and harvest index of wheat grown on a clay loam soil in 1997.

<u>Cultivar</u>	<u>Grain Yield</u>	<u>Straw Yield</u>	<u>Harvest Index</u>	<u>Disease 1</u>	<u>Disease 2</u>
Barrie	ns	ns	ns	ns	ns
CDC Teal	ns	ns	ns	ns	ns
Cora	ns	0.0306	0.0576	ns	ns
Domain	ns	ns	ns	ns	ns
Glenlea	ns	ns	ns	ns	ns
Grandin	ns	ns	ns	ns	0.0004
Guard	0.0738	ns	ns	ns	ns
Karma	0.0065	ns	0.0128	ns	ns
Kyle	0.0150	0.0978	0.0053	ns	ns
Majestic	ns	0.0769	ns	ns	ns
Marshall	0.0008	ns	ns	ns	0.0798
Pioneer 2375	0.0420	ns	0.0017	ns	ns
Plenty	ns	ns	ns	ns	ns
Roblin	ns	ns	ns	ns	ns
Taber	0.0562	ns	ns	ns	0.0001

Table 11: Effect of cultivar and KCl treatment on grain yield, straw yield and harvest index of wheat grown on a clay loam soil in 1997.

Cultivar	Grain Yield (Bu/acre)			Straw Yield (Kg/ha)			Harvest Index		
	Control	KCl	Mean	Control	KCl	Mean	Control	KCl	Mean
Barrie	54.7	54.5	54.6	4092	4233	4163	0.47	0.46	0.47
CDC Teal	57.3	56.1	56.7	4029	3988	4009	0.49	0.49	0.49
Cora	52.6	53.0	52.8	5325	4417	4871	0.40	0.45	0.42
Domain	50.8	53.2	52.0	3554	3958	3756	0.49	0.47	0.48
Glenlea	54.6	59.6	57.1	4080	4871	4476	0.47	0.45	0.46
Grandin	60.1	60.5	60.3	4517	4738	4628	0.47	0.46	0.47
Guard	57.0	62.8	59.9	4154	4538	4346	0.48	0.48	0.48
Karma	53.8	64.0	58.9	3533	3517	3525	0.51	0.55	0.53
Kyle	61.9	69.2	65.6	6186	5870	6028	0.40	0.44	0.42
Majestic	50.2	48.4	49.3	4204	3467	3836	0.45	0.48	0.46
Marshall	61.9	67.8	64.9	4471	4254	4363	0.48	0.52	0.50
Pioneer 2375	59.6	66.4	63.0	3546	3367	3457	0.53	0.57	0.55
Plenty	68.6	72.5	70.6	5467	5325	5396	0.46	0.48	0.47
Roblin	51.4	48.1	49.8	3867	3679	3773	0.47	0.47	0.47
Taber	58.6	55.0	56.8	3708	3767	3738	0.52	0.50	0.51

Grain yield of Guard, Karma, Kyle, Marshall and Pioneer 2357 were all increased by the application of KCl (Tables 10 and 11). In contrast, Taber showed a decrease in grain yield with KCl application. In 1996, the only cultivar showing an increase in grain yield with KCl application on the clay loam soil was Karma, while three other cultivars showed decreases in grain yield with KCl. Kyle and Majestic both showed decreases in straw yield with KCl application, while Kyle, Karma and Pioneer 2375 all showed increases in harvest index with application of KCl. The effect of KCl on responsive cultivars appears to be primarily through improvements in grain filling.

Disease incidence at the first sampling in early July was very light and there was no effect of KCl addition in any cultivar (Tables 10 and 12). However, at the second sampling, later in July, disease incidence was somewhat higher and KCl suppressed leaf diseases in Grandin, Marshall and Taber. It is interesting that Taber showed a decrease in leaf disease combined with a decrease in grain yield. It also should be noted that the cultivars showing a decrease in leaf disease were not the cultivars that showed an increase in grain yield. Therefore, leaf disease suppression did not appear to be the major mechanism of yield increase from KCl application at this site. In 1996, on the clay loam site, reduction in disease incidence occurred more frequently with KCl application than did increases in grain yield, however disease incidence was substantially higher in 1996 as compared to 1997.

Table 12: Effect of cultivar and KCl treatment on leaf diseases at two dates on 15 cultivars of wheat grown on a clay loam soil in 1997.

Cultivar	Disease 1			Disease 2		
	Control	KCl	Mean	Control	KCl	Mean
Barrie	0.88	0.82	0.85	2.43	2.40	2.42
CDC Teal	0.87	1.07	0.97	2.37	2.38	2.38
Cora	0.97	0.95	0.96	2.37	2.07	2.22
Domain	1.23	1.02	1.13	2.38	2.78	2.58
Glenlea	0.92	1.04	0.98	2.44	2.06	2.25
Grandin	1.03	1.02	1.03	3.82	2.50	3.16
Guard	0.98	1.05	1.02	2.97	3.15	3.06
Karma	0.73	0.93	0.83	2.87	2.53	2.70
Kyle	0.76	0.80	0.78	2.83	2.78	2.80
Majestic	1.13	1.02	1.08	2.57	2.63	2.60
Marshall	0.65	0.88	0.77	2.55	2.38	2.47
Pioneer 2375	0.98	0.88	0.93	2.65	3.05	2.85
Plenty	0.70	0.72	0.71	2.25	2.52	2.38
Roblin	1.10	0.98	1.04	2.60	2.47	2.53
Taber	0.78	0.78	0.78	2.30	2.05	2.18

Fine Sandy Loam

The fine sandy loam soil contained less than 15 kg Cl per hectare to 60 cm, yet wheat showed less response to KCl application on the fine sandy loam than on the higher-Cl clay loam soil (Tables 13 and 15). When all cultivars were combined, there was an increase in grain yield and harvest index with application of KCl. There was no influence of KCl on disease incidence at either date. Cultivar affected grain yield, straw yield and harvest index, but the only treatment by cultivar interaction occurred with straw yield.

Table 13: P-values from ANOVA table for effect of cultivar and KCl applications on grain yield, disease incidence and harvest index on a fine sandy loam soil (1997)

Source	Grain Yield	Straw Yield	Harvest Index	Disease 1	Disease 2
Treatment	0.0406	ns	0.0328	ns	ns
Cultivar	0.0001	0.0001	0.0127	ns	0.0015
Treat*Cultivar	ns	0.0959	ns	ns	ns
MSE	115981	172083	0.0019	0.7187	0.3575
CV	17.1	14.2	10.7	39.5	28.4

When cultivars were examined individually, the only significant increase in grain yield occurred with Plenty (Tables 14 and 15). Two cultivars, Pioneer 2375 and Plenty, showed an increase in straw yield with KCl application, while three cultivars, Cora, Guard and Majestic, showed decreases in straw yield. Harvest index was only affected in CDC Teal, increasing with KCl application. Disease incidence was only affected in Kyle, where the early disease was decreased with KCl application (Tables 14 and 16).

Table 14: P-values from analysis of variance for effect of KCl treatment on grain yield, leaf diseases and harvest index of wheat grown on a fine sandy loam soil in 1997.

<u>Cultivar</u>	<u>Grain Yield</u>	<u>Straw Yield</u>	<u>Harvest Index</u>	<u>Disease 1</u>	<u>Disease 2</u>
Barrie	ns	ns	ns	ns	ns
CDC Teal	ns	ns	0.0616	ns	ns
Cora	ns	0.0736	ns	ns	ns
Domain	ns	ns	ns	ns	ns
Glenlea	ns	ns	ns	ns	ns
Grandin	ns	ns	ns	ns	ns
Guard	ns	0.0038	ns	ns	ns
Karma	ns	ns	ns	ns	ns
Kyle	ns	ns	ns	0.0158	ns
Majestic	ns	0.0748	ns	ns	ns
Marshall	ns	ns	ns	ns	ns
Pioneer 2375	ns	0.0135	ns	ns	ns
Plenty	0.0072	0.0772	ns	ns	ns
Roblin	ns	ns	ns	ns	ns
Taber	ns	ns	ns	ns	ns

Table 15: Effect of cultivar and KCl treatment on grain yield, leaf diseases and harvest index of wheat grown on a fine sandy loam soil in 1997.

<u>Cultivar</u>	<u>Grain Yield</u> (Bu/acre)			<u>Straw Yield</u> (Kg/ha)			<u>Harvest Index</u>		
	<u>Control</u>	<u>KCl</u>	<u>Mean</u>	<u>Control</u>	<u>KCl</u>	<u>Mean</u>	<u>Control</u>	<u>KCl</u>	<u>Mean</u>
Barrie	37.5	44.5	41.0	3679	3896	3788	0.41	0.43	0.42
CDC Teal	32.4	37.3	34.9	3463	3550	3506	0.39	0.41	0.40
Cora	38.8	37.7	38.3	4063	3359	3711	0.39	0.43	0.41
Domain	38.8	37.8	38.3	3425	3213	3319	0.43	0.44	0.44
Glenlea	33.2	38.0	35.6	3755	4086	3921	0.37	0.38	0.38
Grandin	38.2	37.8	38.0	3829	3409	3619	0.40	0.43	0.41
Guard	32.2	29.2	30.7	3279	2963	3121	0.40	0.40	0.40
Karma	42.5	37.7	40.1	3538	3609	3573	0.45	0.41	0.43
Kyle	39.0	35.6	37.3	4250	3745	3998	0.38	0.39	0.39
Majestic	38.1	41.6	39.9	3525	3954	3739	0.42	0.41	0.42
Marshall	37.0	40.0	38.5	3975	3850	3913	0.39	0.41	0.40
Pioneer 2375	36.8	39.0	37.9	3171	3788	3479	0.44	0.41	0.42
Plenty	30.1	37.6	33.8	3146	3663	3404	0.39	0.41	0.40
Roblin	27.3	30.2	28.8	3291	3300	3296	0.36	0.38	0.37
Taber	40.1	46.2	43.1	4196	4163	4179	0.39	0.43	0.41

Table 16: Effect of cultivar and KCl treatment on leaf diseases at two dates on 15 cultivars of wheat grown on a fine sandy loam soil in 1997.

<u>Cultivar</u>	<u>Disease1</u>			<u>Disease 2</u>		
	<u>Control</u>	<u>KCl</u>	<u>Mean</u>	<u>Control</u>	<u>KCl</u>	<u>Mean</u>
Barrie	2.16	1.83	2.00	2.13	1.87	2.00
CDC Teal	2.50	2.67	2.59	2.10	2.50	2.30
Cora	1.17	2.00	1.59	2.03	1.87	1.95
Domain	2.33	2.33	2.33	2.60	2.73	2.67
Glenlea	2.20	1.71	1.96	1.76	1.69	1.73
Grandin	1.83	2.83	2.33	2.37	2.00	2.19
Guard	2.67	2.17	2.42	2.60	2.33	2.47
Karma	2.67	2.33	2.50	2.47	2.00	2.24
Kyle	2.86	1.60	2.23	2.51	1.96	2.24
Majestic	1.83	2.17	2.00	2.10	2.30	2.20
Marshall	1.83	2.00	1.92	1.63	1.70	1.67
Pioneer 2375	2.17	1.67	1.92	1.93	1.97	1.95
Plenty	2.33	2.17	2.25	2.57	1.80	2.19
Roblin	1.67	1.83	1.75	2.10	2.10	2.10
Taber	2.50	2.17	2.34	1.53	1.80	1.67

Effect of Rate of Chloride Fertilizer on Biggar Wheat

Rate of KCl fertilizer did not influence any parameter measure when sites were combined (Tables 17 and 19). However there were significant site effects on all parameters except straw yield and a rate by site interaction occurred with grain yield and harvest index, so the two sites were examined separately (Tables 18 and 19).

Table 17: P-values from ANOVA for effect of KCl rate and soil type on grain yield, straw yield, harvest index and disease incidence (1997)

<u>Source</u>	<u>DF</u>	<u>Heading</u>	<u>Straw Yield</u>	<u>Grain Yield</u>	<u>Harvest Index</u>	<u>Disease 1</u>	<u>Disease 2</u>
Rate	1	ns	ns	ns	ns	ns	ns
Site	1	0.0001	ns	0.0001	0.0001	0.0001	0.0397
Rate*Site	1	ns	ns	0.0365	0.0791	ns	ns
Rep	5	0.0179	ns	0.0810	ns	ns	ns
MSE		344.3	161557	42131	0.000946	0.302	0.2929
CV		11.3	11.72	7.34	6.88	35.33	20.87

Clay Loam soil

On the clay loam soil, grain yield decreased slightly with KCl applications. The highest grain yield was with no applied KCl and the lowest was with the highest level of fertilization (Tables 18 and 19). Dry matter yield at heading, straw yield, harvest index and early disease incidence were not influenced by KCl rate. However, disease late in July was reduced by increasing KCl application.

Table 18: P-values from ANOVA for effect of KCl rate on grain yield, straw yield, harvest index and disease incidence on two soils (1997)

<u>Clay Loam</u>							
<u>Source</u>	<u>D</u>	<u>Heading</u>	<u>Straw Yield</u>	<u>Grain Yield</u>	<u>Harvest Index</u>	<u>Disease 1</u>	<u>Disease 2</u>
	<u>F</u>						
Rate	1	ns	ns	0.0594	ns	ns	0.0528
Rep	5	ns	ns	0.0037	ns	ns	0.0001
MSE		446.3	77858	24085	0.000679	0.0607	0.0409
CV		10.93	8.1	4.76	5.34	28	7.24
<u>Fine Sandy Loam</u>							
Rate	1	ns	ns	ns	ns	ns	ns
Rep	5	0.0004	ns	ns	ns	ns	0.0423
MSE		204	185199	45556	0.0011	0.44696	0.3922
CV		10.6	12.6	9.17	8.08	30.68	26.17

Fine Sandy Loam

None of the parameters measured were influenced by KCl application on the fine sandy loam soil. Grain yield was substantially lower on the fine sandy loam soil than on the clay loam soil and the low yield potential due to drought may have restricted response to fertilizer additions, in spite of the low soil Cl concentration.

Table 19: Effect of cultivar and KCl treatment on dry matter yield at heading, grain yield, straw yield, harvest index and leaf diseases of wheat grown on a clay loam and fine sandy loam soil in 1997.

<u>Clay Loam</u>							
<u>Rate</u>	<u>Heading</u>	<u>Straw Yield</u>	<u>Grain Yield</u>	<u>Harvest Index</u>	<u>Disease1</u>	<u>Disease2</u>	
	<u>(g m⁻¹)</u>	<u>(kg ha⁻¹)</u>	<u>(bu acre⁻¹)</u>				
0	191	3242	50.7	0.51	0.77	2.92	
10	205	3379	48.5	0.49	0.92	2.87	
20	188	3654	47.6	0.47	0.93	2.75	
40	191	3442	48.4	0.49	1.00	2.75	
80	191	3488	47.3	0.48	0.78	2.68	
<u>Fine Sandy Loam</u>							
0	134	3330	34.7	0.41	1.83	2.20	
10	132	3480	34.5	0.40	2.50	2.17	
20	136	3217	31.9	0.40	2.50	2.93	
40	142	3757	35.6	0.39	2.17	2.53	
80	131	3300	36.3	0.43	2.17	2.13	

1997 Summary

When all cultivars were combined, grain yield and harvest index were increased by KCl application on both soils, with the greatest effect occurring on the clay loam soil, which contained higher levels of Cl. When cultivars were examined individually, Guard, Karma, Kyle,

Marshall and Pioneer 2375 showed an increase in grain yield on the clay loam soil and only Plenty showed an increase on the fine sand loam soil. The grain yield was not associated with increased straw yield or consistently with reduced disease incidence.

The KCl response patterns for cultivars were not consistent from year to year or location to location, although the cultivar Karma showed increased grain yield with KCl addition in three of the four site-years. Due to the inconsistency, prediction of KCl response appears to be a challenge.

Submitted December 15, 1997