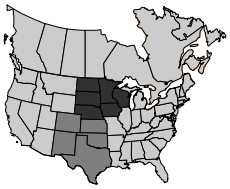
NEWS & VIEWS

A regional newsletter published by the Potash & Phosphate Institute (PPI) and the Potash & Phosphate Institute of Canada (PPIC)



Dr. W.M. Stewart, Great Plains Director and Dr. T.S. Murrell Northcentral Director

January 1999

Is Your Winter Wheat Lacking Chloride?

Responsiveness of wheat to chloride (Cl) fertilization has been well established in the past few years through research across the U.S. Great Plains and the Canadian prairies. Over 200 research trials from western Canada to Texas have demonstrated that the average wheat response to Cl fertilization is just over 5 bu/A. To answer the question posed by our title, we must review some Cl basics.

- Chloride is an anion in soils. It moves freely with soil water and is most likely deficient in sandy, well-drained soils, although deficiencies are common in clay soils in high rainfall production regions.
- It may be deficient in soils with little or no history of application of Cl-containing fertilizer like muriate of potash.
- Atmospheric deposition of Cl tends to be rather high along the coasts and decreases inland. Wheat producing regions 200 miles or so from the coast may be deficient and should be soil tested to evaluate the likelihood of a response to Cl fertilizer.
- Wheat response to Cl is likely when soil Cl levels are less than 30 lb/A as determined from 2-ft. soil samples. The optimum level of soil Cl is at least 60 lb/A-2 ft. Yield response is also likely when whole plant Cl is less than 0.1 percent.
- Fall soil tests for Cl in higher rainfall areas may not reflect available Cl at jointing and after.
- Irrigation water can supply large amounts of Cl.

Wheat yield increase from Cl fertilization is usually associated with classical nutrient response and/or suppression of fungal diseases. Some varieties will exhibit Cl deficiency symptoms, also referred to as physiological leaf spot syndrome, under low soil Cl conditions. The symptoms are similar in appearance to tanspot or septoria with no associated pathogen. Chloride has been shown to suppress septoria, leaf rust, stripe rust, tanspot, and common and take-all root rots in wheat.

Texas research has demonstrated the importance of Cl fertilization in reducing leaf rust infection during years of heavy infestation. Table 1 shows the effect of topdressing winter wheat with Cl in the Texas Blacklands in a year of heavy leaf rust infestation. At the time of the topdress application, 30 to 40 percent of the lower canopy of the wheat plants had been destroyed by leaf rust. Chloride fertilization resulted in an average 40 percent less damage from leaf rust and a 6.1 bu/A yield increase. No significant difference was observed in the effectiveness of Cl sources.

Table 1. Effect of Cl fertilization on winter wheat yield and rust infection (Texas).

Source	Rate lb Cl/A	Leaf rust rating*, % April 13	Leaf rust rating*, % May 1	Yield, bu/A
Check	0	70	67.5	35.4
Ammonium chloride	40	30	26.3	41.7
Muriate of potash	40	60	27.5	42.0
Magnesium chloride	40	65	28.8	40.9

*F-2 leaf on April 13, flag leaf on May 1
Variety- 2163, Topdressed on 2/23/95, Feeke's 4
Soil Cl level- 14 lb/A 6 inches

In addition to soil and plant Cl levels and disease pressure, variety is an important component determining wheat responsiveness to Cl. A multi-regional study investigating the varietal component of Cl fertility management is currently underway. Results from 3 years of investigation in Kansas from sites testing less than 20 lb Cl/A-2 ft are listed in **Table 2**. Average response to 40 lb Cl/A topdress application across these sites over 3 years was 5.3 bu/A. Some varieties have proven to be consistently responsive, some consistently non-responsive, and some inconsistent in responsiveness to Cl fertilization. For example, Karl 92, Jagger, and 2163 were consistently responsive to Cl topdressing while Ogallala was consistently non-responsive. The greatest yield increase was 23

Co-authors:

Dr. W. Mike Stewart
Great Plains Director
Potash & Phosphate Institute (PPI)
P.O. Box 6827
Lubbock, TX 79493
Phone: (806) 795-3252
Email: mstewart@ppi-far.org

Dr. T. Scott Murrell
Northcentral Director
Potash & Phosphate Institute (PPI)
14030 Norway St. N.W.
Andover, MN 55304
Phone: (612) 755-3444
E-mail: smurrell@ppi-far.org

Dr. Travis D. Miller
Professor and Extension Agronomist
Small Grains and Soybeans
Texas A&M University System
350 Soil & Crop Sciences
College Station, TX 377843-2874
Phone: (409) 845-0884

Dr. Ray E. Lamond
Department of Agronomy
Kansas State University
2014 Throckmorton Hall
Manhattan, KS 66506-5504
Phone: (785) 532-5776
E-mail: rlamond@bear.agron.ksu.edu

bu/A and was observed with Cimarron, a variety that readily exhibits leaf spotting under low soil Cl conditions. None of the varieties showed a significant response to Cl fertilization at a 1997 Saline County site (not listed in **Table 2**) where soil Cl level was 22 lb Cl/A-2 ft. When data from this site are included, the overall average response to Cl fertilization is reduced from 5.3 to 4.1 bu/A.

Winter wheat variety Cl research in South Dakota has shown more modest responses than those observed in Kansas. Two of the three years of South Dakota research are reported in **Table 3**. Chloride response in 1996 may have been affected by an unusually severe winter and a windstorm with 60 to 80 mph winds. This resulted in winter kill and removal of an estimated 1 to 2 inches of topsoil from wind erosion. Only one cultivar, Vista, showed a significant 2.3 bu/A yield increase from Cl fertilization. The 1997 season again had a harsh winter that resulted in nearly complete winter kill of the wheat crop, so no results for that year are reported. The most recent data from 1998 are more positive, resulting in part from a favorable growing season. Five cultivars… Crimson, KS2163, Rose, Siouxland, and Windstar… responded with an average increase of 2.6 bu/A.

Results of the wheat variety Cl research in Texas were compromised by extremely dry conditions and freeze injury in 1996 and freeze injury in 1997. Response to Cl among varieties in 1998 ranged from about 6 bu/A to minus 5 bu/A with an average yield increase of zero. A possible explanation for the lack of response is that dry 1998 spring conditions may have resulted in upward migration of Cl into the crop root zone.

Table 3. Yield difference of various wheat cultivars due to Cl fertilization (Wall, South Dakota).

Cultivar	1996	1998	Average
	Yield difference due to Cl fertilization, bu/A		
Abilene	0.1	—	0.1
Alliance	0.2	1.2	0.7
Arapahoe	-1.1	1.3	0.1
CDC Kestrel	—	0.1	0.1
Crimson	—	3.1*	3.1
Dawn	1.5	0.8	1.2
Elkhorn	-1.7	0.0	-0.8
Jagger	-1.5	1.0	-0.3
Kestrel	-0.8	—	-0.8
KS2163	-1.0	2.4*	0.7
Nekota	-0.3	0.7	0.2
Rose	1.4	2.7*	2.1
Sage	-0.1	1.9	0.9
SD89119	0.6	0.7	0.7
Siouxland	-0.4	2.7*	1.2
TAM107	-2.1	-1.2	-1.7
Vista	2.3*	—	2.3
Windstar	—	2.2*	2.2
Average across:			
all cultivars	**-0.2**	**1.3**	**0.7**
responsive cultivars	**2.3**	**2.6**	**2.6**

*Indicates significant positive grain yield response. Chloride applied at 40 lb/A as spring topdress. All sites tested less than 20 lb Cl/A-2 ft.

Is your winter wheat lacking Cl? Several factors are important in making this determination. Soil Cl level, disease pressure, and variety are key components to consider. If a responsive situation is suspected or has been identified, there are several sources of fertilizer Cl available for use. The most common source is muriate of potash (0-0-60, 47 percent Cl). Other sources such as magnesium chloride ($MgCl_2$) may also be commercially available. Research has shown that there is no difference in the efficacy of different Cl fertilizers. Fall preplant application is effective if excessive leaching does not occur during the fall and winter months. Spring topdress application is more likely to give a good response in high rainfall environments. In trials in the Texas Blacklands, topdress applications have consistently given better responses than preplant applications. Application rates should be determined by soil tests. Recommendations commonly call for Cl fertilization to bring the total soil plus fertilizer Cl to 60 lb/A-2 ft. ■

Table 2. Yield difference of various wheat cultivars due to Cl fertilization (Kansas).

Cultivar	1996 Saline Co.	1997 Marion Co.	1998 Saline Co.	1998 Sandyland	Average
	- - - - - Yield difference due to Cl fertilization, bu/A - - - - -				
AP 7510	2.6*	4.0*	-	-	3.3
Coronado	-2.4	4.0*	5.0*	12*	4.7
Custer	0.3	5.0*	-3.0	0	0.6
Cimarron	0.3	23.0*	17.0*	13*	13.3
2163	3.3*	10.0*	3.0*	6*	5.6
2180	7.6*	-1.0	6.0*	11*	5.9
Ogallala	-1.5	-1.0	1.0	-2	-0.9
Rowdy	3.2*	3.0*	-	-	3.1
TAM 107	0.6	4.0*	4.0*	14*	5.7
TAM 200	1.4	8.0*	8.0*	13*	7.6
2137	2.0*	2.0*	7.0*	7*	4.5
7853	4.4*	2.0*	8.0*	4*	4.6
Pecos	-2.2	6.0*	-	-	1.9
Tomahawk	4.0*	-1.0	-	-	1.5
Jagger	3.6*	2.0*	18.0*	8*	7.9
Karl 92	2.0*	10.0*	19.0*	5*	9.0
Champ	-	-	2.0	0	1.0
Mankato	-	-	12.0*	4*	8.0
Triumph	-	-	7.0*	12*	9.5
Windstar	-	-	5.0*	7*	6.0
Average	**1.8**	**5.0**	**7.4**	**7.1**	**5.3**

*Indicates significant positive grain yield response. Chloride applied at 40 lb/A as spring topdress. All sites tested less than 20 lb Cl/A-2 ft.

Note: *News & Views* are available online through the "What's New" section at the PPI web site: www.ppi-far.org.