Chloride Fertilization of Wheat: Profit Waiting to Happen

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CHLORIDE (Cl) is one of several micronutrients essential for plant growth and development. Research conducted across the U.S. Great Plains and Canadian Prairies has demonstrated that wheat is sensitive to Cl deficiencies (**Figure 1**) and that Cl plays an important role in suppressing wheat fungal disease infection and hastening maturity. Lack of sufficient Cl in wheat production can result in substantial yield and economic losses. Observed response to Cl in winter wheat research has been as high as 23 bu/A (KS), but averages about 5 bu/A in responsive conditions. Despite years of evidence showing the profitability of Cl use on wheat, it remains an underutilized crop production input.

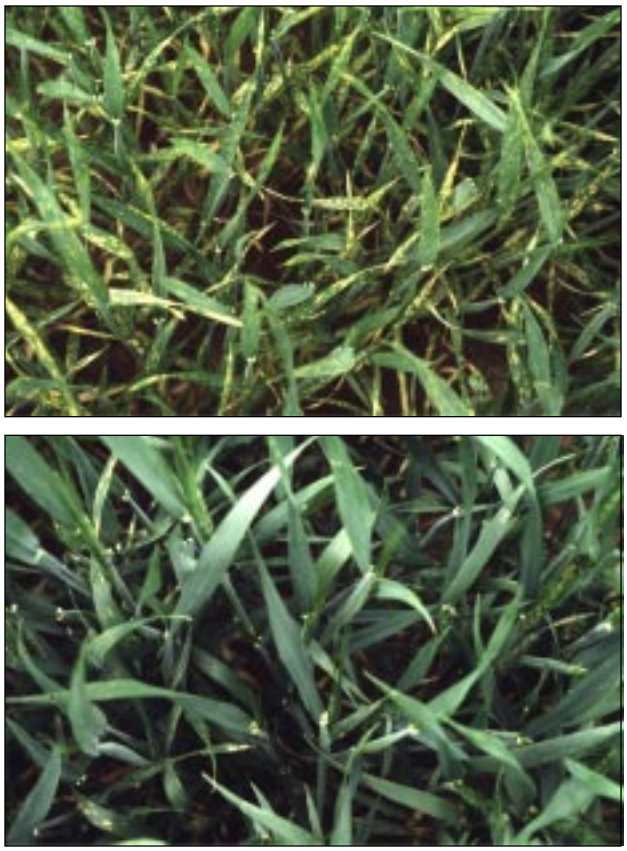

Figure 1. Wheat deficient in Cl (top) compared to wheat topdressed with 24 lb Cl/A (Kansas, Cimarron winter wheat). Some cultivars exhibit leaf spot deficiency symptoms more readily than others.

Several factors should be considered when evaluating the likelihood of winter wheat response to Cl, including:

- **Soil test level**– Soil testing is a useful tool in predicting whether a wheat crop will respond to Cl. Chloride is a highly mobile nutrient in most soils, similar to nitrate in this regard. Therefore, soil samples for Cl determination should be taken to a depth of 2 feet. Research has shown that when soil test level is below 30 lb Cl/A (2 ft. depth) there is a high probability of yield response to Cl fertilization. Chloride application rate should target a soil test level of 60 lb/A (2 ft. depth). For example, if the soil test level is 15 lb/A, then the application rate should be 45 lb Cl/A.
- **Fungal disease pressure**– Chloride fertilizer can dramatically suppress wheat fungal disease infection and consequently increase yield. Research has demonstrated this effect time and again. For example, in a year of heavy leaf rust pressure, Texas trials showed a marked decline in leaf rust infection and a corresponding 6 bu/A yield response due to Cl topdressing (**Table 1**).

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

Source	Rate, lb Cl/A	Leaf rust rating*, %		Yield, bu/A
		April 13	May 1	
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 Feb. 23; Feeke's 4
Soil Cl level- 14 lb/A (6-in. depth)

- **Wheat cultivar**– Cultivar is an important component determining wheat responsiveness to Cl. Some cultivars are more responsive than others. Evaluations of cultivar responsiveness to Cl have been conducted in several wheat producing states. Since a detailed accounting of this effect is beyond the scope of this article, it's best to contact the appropriate university extension or PPI representative for more detail.

- **Application timing**- Fall preplant application is effective if excessive leaching is not a problem during the fall and winter months. Spring topdress application will more likely be effective in high rainfall environments or where leaching potential is high.
- **Chloride source**- Research has shown that there is no difference in the performance of various Cl fertilizers. The most common source is muriate of potash (KCl, 0-0-60, 47 percent Cl). Other sources such as magnesium chloride ($MgCl_2$) or calcium chloride ($CaCl_2$) may also be commercially available.
- **Other factors to consider**- Atmospheric deposition of Cl tends to be rather high along coastal areas and decreases inland. Wheat producing regions more than about 200 miles from the coast may be deficient and should be evaluated by soil testing to determine the likelihood of response to Cl fertilizer. Chloride may be low in soils with little or no history of Cl fertilization. Under irrigated conditions, Cl is not likely to be deficient since irrigation water often supplies large amounts of Cl.

Substantial profit can be generated from Cl fertilization. For example, consider recent research conducted in Kansas from 1994 to 2000. Over this seven-season period, 22 site years of research evaluating Cl rate (10, 20, and 30 lb Cl/A) and source (KCl, $MgCl_2$, and $CaCl_2$) were accumulated. The average yield response across rates and sources was 5 bu/A. **Table 2** shows the economic breakdown at the 20 lb Cl/A rate using KCl. This analysis includes results from soils testing both above and below the critical level for Cl. The average response to 20 lb Cl/A was 5 bu/A, generating a profit of almost $10/A (excluding application costs). The nutrient value of potassium (K) is completely ignored in this evaluation.

Table 2. Average winter wheat yield response and economic return to 20 lb Cl/A from KCl (Kansas, 20 site years).

Rates, lb/A	
Cl	20
KCl	43
Cost of Cl, $/A	3.44
Yield, bu/A	
Control	45
With Cl	50
Yield response, bu/A	5
Value of response, $	13
Net profit from Cl, $	9.56

Assumes KCl cost of $160/ton and wheat price of $2.60/bu.

Growers should consider the profit opportunity that Cl nutrition can offer. There are clear guidelines to aid in deciding whether Cl fertilizer application is likely to pay. Chloride use on winter wheat may be profit waiting to happen…don't hesitate to take advantage of it. ■

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