Chloride Fertilizer Effects in Winter Wheat and Interactions with Foliar Fungicides under Severe Leaf Rust Pressure

By Travis D. Miller

Responses to Cl fertilizers in winter wheat have been widely documented in the Great Plains and the Pacific Northwest. Increased yields have been attributed to micronutrient response as well as reduced incidence of fungal disease associated with enhanced Cl nutrition. In Texas trials, topdress applications of Cl have significantly reduced leaf rust and septoria ratings at bloom and increased wheat yields.

In the trial reported in this paper, chloride (Cl) had positive and significant interactions with systemic foliar fungicides which are commonly used in wheat production. Use of Cl resulted in lower leaf rust ratings and significant yield increases when used either in combination with or in sequence with wheat fungicides. Previously reported data do not document such interactions.

Materials and Methods

A test plot was established in a winter wheat (var. 2163) field heavily infested with leaf rust near Hillsboro, Texas. Plot size was 15 x 40 feet. Plots were replicated 3 times in a randomized block design. Alleys were cut 5 feet wide, with a resulting plot harvest of 35 feet by 4.5 feet. Plots were direct harvested with a research plot combine.

The soil at this site is a Houston Black Clay with a pH of approximately 8.0. It is poorly drained, and the wet winter had caused frequent standing water and conditions which favored the proliferation of wheat leaf rust.

Chloride was applied as a foliar solution of magnesium chloride ($MgCl_2$) at the rate of 40 lb Cl/A at Feekes stage 6 on March 5. Wheat fungicides, Bayleton and Tilt, were applied with a CO_2 backpack sprayer at 35 psi in a water volume of 19 gpa. Both fungicides received a non-ionic surfactant at 0.25 percent volume to volume (v/v). Initial treatments were applied on March 6. Sequential fungicide applications were made on April 7 at Feekes growth stage 9, or flag leaf fully emerged.

Thirteen treatments involving rate, time of application and sequential treatments were applied (**Table 1**). Bayleton 50 percent DF was applied at the 2.0 oz/A rate topdress either alone or in combination with $MgCl_2$. The 2 oz/A with $MgCl_2$ was also evaluated with a sequential 2 oz/A application at stage 9. A treatment evaluating a 2 oz/A topdress application of Bayleton followed by a 4 oz/A sequential application of Tilt at stage 9 was included. Tilt was applied at the 2 oz/A rate, either alone or in combination with $MgCl_2$ at topdress. Tilt at the 4 oz/A rate was also applied as a single treatment either at topdress or at Feekes 9. Magnesium chloride was applied at the 40 lb Cl/A rate at topdress either alone or in sequence with the Bayleton or Tilt 2 or 4 oz/A rate at Feekes 9.

Leaf rust ratings were taken visually once per week, beginning about 1 week after initial treatments were made. The first three ratings reflect whole plant values, or estimates of the percentage of the entire leaf mass damaged by overwintering leaf rust. After March 29, the uppermost leaf with a significant infection of leaf rust was selected and rated.

Results and Discussion

Conclusions from this trial should be tempered by the fact that leaf rust was severe to the extent that more than half of the plant canopy was destroyed prior to initial treatments. Plots treated topdress with Bayleton had significantly lower leaf rust ratings than the untreated check for 6 weeks following treatment, whereas plots treated with the 2 oz rate of Tilt were significantly less injured than the untreated check for only 2 weeks. Neither of these treatments yielded more than the check.

Wheat treated with the combination of either Bayleton or Tilt at 2 oz/A plus Cl at 40 lb/A was significantly less affected by leaf rust than the untreated check for 7 weeks, with the Cl treatment resulting in 1 and 5 weeks of added protection, respectively. The Cl plus fungicide combination provided more protection from leaf rust than either the 2 or 4 oz fungicide rates. Both 2 oz/A topdress treatments yielded significantly more than plots treated with fungicide only. The Cl topdress treatment alone resulted in 5 weeks of leaf rust suppression. This treatment did not yield significantly lower than the fungicide-Cl treatments, but leaf rust suppression was not as persistent.

Treatments with 2 oz/A of either Bayleton or Tilt in combination with Cl followed by a second 2 oz/A rate at flag leaf exsertion gave essentially season long protection from damaging levels of leaf rust, with a slight advantage observed in the Tilt plus Cl treatments. Topdress Cl followed by a full 4 oz/A rate of Bayleton or Tilt also gave good season-long protection against rust and yielded comparably with the sequential fungicide plus Cl fungicide treatments. The Cl topdress treatment followed by 4 oz/A Bayleton at flag leaf gave the best grain yield and overall leaf rust protection across the season with the exception of the last rating date of May 10. This corresponded with 10 days post bloom.

From this trial, it is obvious that the effect of Cl and foliar fungicides are complementary and additive. Light or full rates of fungicides applied early season (Feekes 6) in a heavy leaf rust infestation reduced damage from the disease

TABLE 1. Leaf injury by rust and yield of winter wheat treated with Cl fertilizer and fungicides (Hill County, Texas 1996-97).

	Fungicide Rate, oz/A		Leaf injury by rust, %					
			F-1 on April 19		Flag leaf on May 10		Grain yield, bu/A	
Treatment	Mar 5/6	Apr 7	0	40 lb Cl/A	0	40 lb Cl/A	0	40 lb Cl/A
Check	0	0	44	30	92	74	25.8	26.6
Bayleton	2	0	58	17	79	72	20.8	30.1
Bayleton	2	2	–	19	–	67	–	30.0
Bayleton	0	4	43	14	79	72	21.4	31.3
Tilt	2	0	44	14	94	85	22.8	29.6
Tilt	2	2	–	16	–	60	–	29.4
Tilt	4	0	46	–	85	–	24.1	–
Tilt	0	4	20	13	58	32	24.1	30.5
(B) + (T)	2(B)	4(T)	15	–	34	–	27.7	–
LSD.05				18		19		5.2

temporarily, but were inadequate to relieve pressure from the disease through grain fill. Chloride alone reduced crop injury from the disease for about 5 weeks, but was not different from the check at season's end. Chloride and fungicides applied as a combination at topdress, or sequentially at topdress, gave significant relief from crop injury due to leaf rust for most of the growing season and improved yields over treatments not using both products. Sequential fungicide applications (Bayleton 2 oz/A followed by Tilt 4 oz/A) did not give leaf protection equal to combination or sequential treatments with Cl and fungicide.

Leaf rust infestations of the magnitude observed in this study are the exception rather than the rule, occurring only every 4 or 5 years. The topdress Cl and fungicide strategy which was employed in this study has the potential to allow farmers to scout fields and make applications of Cl fertilizer and/or fungicide as needed to deal with a major disease problem in wheat. BC

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Alfalfa Response to Boron... *(continued from page 23)*

production. Liming these soils to raise pH to 6.5 or higher is often recommended. Based on results from this research, pH 6.5 is not sufficiently high for maximum alfalfa yield on a Coastal Plain Darco soil. The additional cost of limestone needed to raise soil pH to 7.0 is rapidly offset by the estimated additional 0.78 tons of dry matter (0.87 tons of 12 percent moisture hay) produced. When low organic matter, acid soils are limed, residual, plant-available B is adsorbed by hydroxy aluminum compounds in the pH range of 6 to 9. Adsorption decreases the availability of B to plants, creating the need to apply B to B-deficient soils for crops such as alfalfa that have an elevated need for this nutrient.

Alfalfa response to increased levels of hot-water-soluble soil B appears to be greater than its response to rates of applied B over a varying soil pH range. This indicates the importance of maintaining adequate levels of hot-water-soluble soil B to optimize yield as long as pH is in a favorable range. The higher the pH, the greater is the adsorption and retention of plant-available soil B against leaching with water. In this study, the critical level of hot-water-soluble soil B for alfalfa approximated 0.4 ppm. Alfalfa yield increased only 0.2 tons/A between 0.3 and 0.4 ppm B, but the estimated yield increase was 0.73 tons/A as soil B increased from 0.4 to 0.5 ppm. The hot-water-soluble soil B level considered adequate for alfalfa production on limed acid soils could not be determined in this research because estimated yield was still increasing at the highest level of soil B attained. Additional research is needed at even higher variable levels of soil B and pH to determine the maximum yield response on Coastal Plain soils. BC

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