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DISEASE AND YIELD RESPONSE OF WINTER WHEAT TO CHLORIDE FERTILIZER AND FOLIAR FUNGICIDE IN THE TEXAS BLACKLAND PRAIRIE

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Introduction:

Chloride fertilizer response has been widely documented in wheat in many production regions of the U.S. (Woodard, et.al., 1994; Miller, 1994 and 1998; Lamond 1994; Goos, 1986; Engle, et.al. 1997; Bonczkowski, 1989; Christensen, et.al., 1981, Miller, 1998, Lamond et.al., 1998). This body of wheat research indicates that wheat planted in chloride deficient soils can have higher test weight, higher yields and a decreased incidence and severity of some foliar fungal diseases when chloride fertilizer is applied. It further suggests that response is not similar between varieties; some clearly respond better to applied Cl than other wheat varieties in the same trial. This variable response in some cases is attributed to variable resistance to prevalent fungal diseases; in other cases to greater or lesser physiological leaf spot associated with chloride deficiency. About 1 million acres of wheat are planted annually on the Blackland Prairie of Texas. This region is known for mild and frequently wet winter weather which results in the loss of soluble anions such as Cl to leaching, while promoting foliar fungal diseases, which thrive due to prolonged periods of leaf wetness and warm weather. Numerous trials have documented wheat response to Cl, but little research has been directed at differentiating the response of wheat to Cl as a fertilizer element and that due to reduced incidence of prevalent fungal diseases.

Materials and Methods

These paper reports on the effect of chloride fertilization and foliar fungicides, either applied singly or sequentially on wheat heavily infected by wheat leaf rust (*Puccinia recondita* f. sp. *tritici*) in the field. In this study, wheat planted in soil with very high levels of native potassium was topdressed with potassium chloride and compared to untreated wheat not fertilized with KCl. Tilt, a systemic foliar fungicide, was used on fertilized and unfertilized plots in an attempt to partition the effect of relative differences in genetic resistance to wheat leaf rust by 11 wheat varieties at McGregor. Plots were a randomized block design with 4 replications. Plot size was 13 feet by 25 feet. KCl was applied as a topdress application in late winter at Feekes 4 on February 2. Fungicide was applied with a CO_2 backpack sprayer at Feekes stage 8 on March 24. Leaf rust ratings were made on April 13. They were visual ratings of the percentage of the area of the uppermost leaf damaged or destroyed by leaf rust at bloom. Yields were harvested from a 4.5 foot swath the length of the plot with a Hege plot combine.

Results and Discussion

The application of Cl fertilizers and foliar fungicides both had a profound impact on wheat yield and the progress and extent of damage from wheat leaf rust to the leaves of wheat (Table 1). In this study, it was clear that there was wide range of genetic susceptibility to leaf rust between wheat varieties, with the untreated check ranging from 10-

to 75% injury at bloom, with a test average of 44%, while the range for the same varieties treated with Cl and Tilt ranged from 7 to 40% and 8 to 68%, respectively, with treatment averages of 14 and 31%. The sequential application of Cl fertilizer followed by Tilt improved this range to a low of 5 and a maximum damage rating of 26%. The wheat varieties HR 217, TAM 302 and 2174 displayed an excellent yield response to applied Cl although they had negligible injury from the leaf rust fungus at bloom. These varieties did not have a significant yield response to Tilt fungicide, and the sequential Cl followed by Tilt was not different than the Cl only treatment.

Overall, despite the high and sustained level of injury in the study from leaf rust, particularly on the more susceptible cultivars such as 814, Jagger, Hickok and Custer, yield response to Tilt applied at Feekes 8 did not exceed more than 4.2 bu/ac, or between 4 and 12% increase. In varieties with good genetic resistance to leaf rust, yield response to applied fungicide was less than 2 bu/ac, with a treatment mean of 1.5 bu/ac increase with the early Tilt application across all varieties. The relatively low response to fungicide was most likely due to lack of persistence, as leaf rust ratings taken 35 days after treatment, while most literature suggests that propiconazol efficacy is about 21 days at the rate applied in this study. As leaf rust injury ratings were taken at or near bloom, and ratings on the flag leaf of Tilt treatments were not significantly different than the untreated check, it was expected that this treatment would have little effect on wheat yield. It is evident in reviewing the data that the early topdress application of Cl profoundly reduced leaf rust infection in susceptible varieties as all except TAM 302, HR 217 and 814 had significantly lower leaf rust ratings than the untreated check. It is clear in reviewing the yield data that 814 did not respond to Cl, while the non-significant leaf rust reaction, but significant yield response in TAM 302 and HR 217 could be attributed to their genetic leaf rust resistance.

In plots treated sequentially with Cl and Tilt, leaf rust ratings were slightly better numerically than the Cl only treatment, but not significantly so. Yields were not different between the Cl and the sequentially treated plots, but there was a slight numerical advantage to the Cl only treatment.

In this study we find that in a comparison of nine commercial wheat varieties, there were several with significant, season long suppression of leaf rust following Cl topdress application and there were several that had significantly increased grain yield with the Cl topdress application. An early application of Tilt at Feekes 8 in a severe leaf rust epidemic was not useful in either grain or rust ratings 35 days after treatment. A sequential application of Cl followed by Tilt improve leaf rust ratings a bit over Cl topdress only, but did not improve grain yield significantly. Certain varieties such as 814 did not respond to Cl application and the Feekes 8 Tilt application did not improve yield or flag leaf rust ratings. As has been documented in many studies, adequate Cl nutrition appears to play a significant role in the resistance to leaf rust in many wheat varieties.

Table 1. Wheat Response to Foliar Fungicide and Chloride Fertilizer. McGregor, Texas. 1998-99.

Variety	Leaf Rust Injury, Percent [1/]				Grain Yield Response, Bushels/Ac			
	KCl-40	KCl+Tilt	Tilt, 4oz	Untreated	Untreated	KCl-40	KCl+Tilt	Tilt, 4 oz
TAM 302	7.0 AB	5.8 A	10.0 BC	10.8 BC	33.0 A	38.8 B	40.4 B	34.0 A
2174	5.8 A	7.0 AB	11.3 BC	13.8 BC	26.4 A	35.4 BC	33.3 BC	28.2 AB
Tomahawk	16.3 A	23.8 AB	36.3 BC	52.5 BC	34.1 A	37.9 A	34.1 A	32.9 A
Custer	12.5 A	15.0 AB	67.5 B	72.5 B	30.8 A	40.6 B	35.9 AB	32.9 AB
2180	12.5 A	15.0 AB	33.8 AB	56.3 B	29.9 A	37.1 B	32.3 AB	32.7 AB
Coronado	5.8 A	7.5 AB	21.3 BC	37.5 BC	35.4 AB	42.6 B	36.8 AB	33.6 A
814	40.0 B	26.3 A	41.3 B	62.5 B	34.1 A	37.9 A	38.8 A	38.3 A
Hickok	25.0 AB	16.3 A	52.5 BC	75.0 BC	28.6 A	35.8 A	33.6 A	32.1 A
Terra HR 217	4.8 A	4.5 A	7.5 A	9.5 A	35.7 A	44.3 B	45.4 B	37.9 AB
Ogallala	7.5 A	6.3 AB	13.8 AB	29.5 B	28.6 A	40.2 B	37.6 B	31.5 AB
Jagger	13.8 AB	10.0 A	45.0 BC	65.0 BC	31.7 AB	35.8 BC	33.6 BC	33.1 A
Treatment Mean	13.7	12.6	30.9	44.1	31.5	38.8	36.1	33.3

[1/]Means in the same row followed by the same letters are not significantly different at the 95% confidence level according to LSD separation.

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