

Correcting Physiologic Leaf Spot Damage in 'Redwin' and Other Winter Wheat Cultivars

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A winter wheat leaf spot complex of unknown origin that results in tissue necrosis is often observed in the region. Historically, this phenomenon has been referred to as a "physiological leaf spot" by plant pathologists and breeders, meaning it could not be attributed to an infectious pathogen. It has been presumed to result from an unknown metabolic process, or reflect a plant genetic weakness. In Montana, physiological leaf spot has been frequently observed in Redwin hard red winter wheat. Typically, symptoms initially appeared at flag leaf emergence to boot stage. Lesion symptoms are first apparent on the lower or older leaves, and advance to younger leaves after full-emergence. In early stages, lesions are chlorotic (yellow), circular to oblong in shape (1 to 10 mm), with distinct margins. Later, lesions become necrotic (bleached white or gray), their size increases (>10 mm), and they become more numerous. In severely affected plants, spots coalesce and result in premature leaf senescence.

Visual symptoms of physiological leaf spot in Redwin and other winter wheat cultivars are sometimes confused with tanspot and Septoria leaf blotch diseases. However, plant pathogens responsible for these diseases, i.e., *Septoria nodorum* and *Pyrenophora tritici* f. sp. *repentis*, can not be isolated from affected tissue. Also, field studies have revealed foliar fungicides, e.g., propiconazole (Tilt), have no effect on leaf spot severity (lesion size or numbers) (Table 1). Winter wheat cultivars differ greatly in their susceptibility to physiologic leaf spot. In side-by-side comparisons, specific winter wheat varieties will exhibit leaf spot symptoms while other varieties, grown at the same location, do not. 'CDC Kestrel' is the most leaf spot susceptible winter wheat cultivar, followed by 'Promontory', Redwin, and 'Sierra'. 'Stephens' and 'Manning' are also affected, but their susceptibility is not as great as Redwin.

Table 1. Application of propiconazole (Tilt) on physiologic leaf spot severity in Redwin and CDC Kestrel winter wheat at three locations south of Lodgegrass.

<u>Year</u>	<u>Site</u>	<u>Cultivar</u>	<u>Flag leaf spot severity</u>	
			<u>Control</u>	<u>+ Tilt</u>
			----- % -----	
1993	1	Kestrel	23.7	§ 26.5
		Redwin	7.0	5.2
1993	2	Redwin	26.2	21.6
1994	1	Kestrel	13.0	14.4
		Redwin	3.5	3.2

§ Portion of flag leaf affected by lesions.

Field research has revealed that control of physiologic leaf spot in Redwin and other susceptible cultivars is consistently achieved through application of chloride (Cl) containing fertilizers. Visual responses to Cl are

particularly impressive in cultivars with considerable susceptibility (e.g., CDC Kestrel), or at sites where there has been considerable leaf spot damage. A summation of results, from ten locations where Redwin winter wheat was grown, illustrates the relationship between soil Cl and leaf spot damage (Figure 1). At sites with soil Cl levels >10 lbs/a (0-24 in. depth), damage from physiologic leaf spot is minor. As soil Cl drops below a 10 lbs/a threshold level, leaf spot

severity increases exponentially. Similar relationships are observed in other leaf spot susceptible cultivars, except the threshold levels for leaf spot damage differ slightly. For the most susceptible cultivar, CDC Kestrel, the threshold soil Cl level (0-24 in. depth) is approximately 20 lbs/a.

Chloride fertilization has consistently increased winter wheat grain yield and mature kernel weights at sites with physiological leaf spot (Table 2). Yield responses to applied Cl averaged 6.9 bu/a or 10%, but can vary considerably with location. Thousand kernel weight increases from applied Cl averaged 7.2%, hence kernel size is the most important yield component affected by Cl. Leaf spot suppression by Cl may explain a portion of the yield responses. A reduction in photosynthetic area due to lesion formation, especially in the flag leaf, could affect yield by reducing kernel size at harvest.

Physiologic leaf spot is a problem of low Cl soils. To prevent potential damage in susceptible varieties, fertilize to increase soil analysis (not all soil labs perform soil Cl tests) it is recommended that growers

apply 20-25 lbs/a Cl (40-50 lbs/a 0-0-60 material) to fields where physiologic leaf spot has been a problem. Granular 0-0-60 is the most economic source of Cl to apply (\$0.17/lb Cl), and the material application cost of this recommendation is about \$4/a. This material can be blended with nitrogen, and broadcast applied in the fall or early spring to produce satisfactory results. While yield responses to Cl fertilizer at sites with physiologic leaf spot are variable, the cost of correcting physiologic leaf spot through 0-0-60 fertilization is small when contrasted with the potential for improved yields and economic return.

Fertilizer facts

- Applying chloride containing fertilizers (e.g., 0-0-60) prevents leaf spotting in Redwin and other winter wheat varieties.
- Application rates of 20-25 lbs/a Cl, or 40-50 lbs/a of 0-0-60 material, are recommended.
- Yield and economic return is improved by correcting potential leaf spot problems with chloride fertilization.

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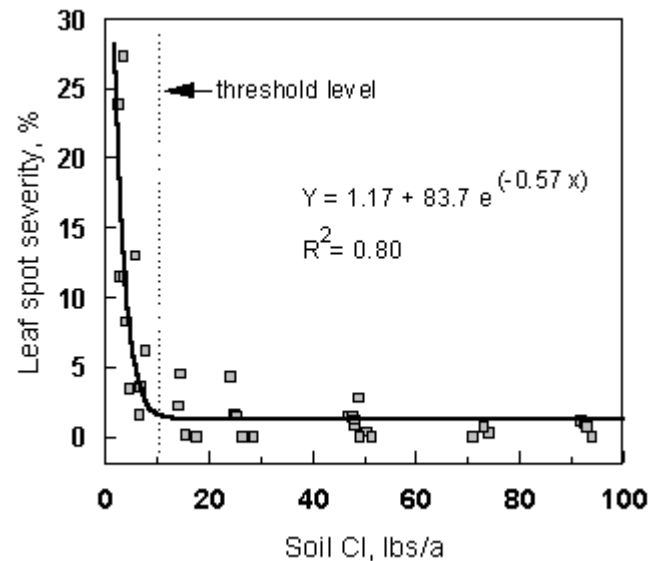


Figure 1. The relationship between leaf spot severity and soil Cl levels.

Table 2. Chloride fertilizer effect on grain yield and mature kernel weight in leaf spot susceptible winter wheat varieties.

Site†	Cultivar	Yield		Mature kernel weight	
		Control	+Cl‡	Control	+Cl
		----- bu/a -----		---- g/1000 kernels ----	
1	Redwin	47.0	49.5	28.6	31.7
	Manning	49.5	51.6	31.5	34.0
2	Redwin	56.9	62.8	33.5	36.6
	Manning	69.8	76.4	35.7	38.8
3	Redwin	82.0	94.2	33.7	36.7
	Manning	77.9	83.8	31.7	34.1
4	Redwin	71.1	78.8	32.4	33.8
	Manning	53.7	60.3	28.6	30.3
	CDC Kestrel	64.5	70.5	30.5	31.3
5	Redwin	50.9	55.3	30.9	33.4
	Manning	64.3	70.6	32.9	33.7
	CDC Kestrel	58.1	61.5	29.7	31.2
6	Redwin	71.2	80.1	31.9	34.7
	Sierra	87.9	94.5	33.5	36.7
	Manning	87.9	98.2	31.0	33.9
	CDC Kestrel	76.9	90.7	28.4	32.0
7	Redwin	77.1	86.2	33.7	35.6
	Sierra	86.1	89.7	34.8	36.9
	Manning	90.2	95.5	32.4	34.4
	CDC Kestrel	76.3	88.4	29.5	31.8
	Average	70.0	76.9	31.8	34.1

†Site 1 = Garryowen, 1991; 2= Lodgegrass, 1991; 3-6 = South of Lodgegrass, 1992-1995, respectively; 7=Fort Smith, 1995.
‡40 lbs Cl/a at Sites 1-3; 60 lbs Cl/a at Sites 4-7.