

Evaluation of Fungicides for the Control of Leaf Diseases in Alfalfa Seed

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Abstract

A replicated field study was established to evaluate the efficacy of fungicides to control common leaf spot in alfalfa seed production fields. Plots were established in a second-year field with a history of common leaf spot. Treatments included 7 fungicides and a water-treated control applied once in early June. Although common leaf spot was not detected in any plots, mild symptoms caused by downy mildew were observed. Significant differences in downy mildew severity, plant height, leaf retention, or seed yield were not observed ($P > 0.05$) among treatments in this trial. The identification of downy mildew in central Oregon alfalfa seed crops is novel information that can be used by the industry to proactively detect, prevent, and manage the disease in the future.

Introduction

Leaf diseases of alfalfa are often more prevalent once flowering is initiated, making them of particular concern for alfalfa seed producers. Several leaf diseases have previously been reported in Oregon, including common leaf spot, spring black stem and leaf spot, yellow leaf blotch, *Stemphylium* leaf spot, and downy mildew. These diseases can result in reduced photosynthesis, premature defoliation, and reduced growth and yield. Growers routinely apply pyraclostrobin (Headline[®]) to control common spot in alfalfa seed production fields in the Treasure Valley of Idaho but not necessarily in central Oregon. The objective of this study was to evaluate the efficacy of pyraclostrobin and other fungicides to control common leaf spot in alfalfa seed production under central Oregon growing conditions.

Materials and Methods

Field plots were established in a grower-cooperator's 2-year old field located in Jefferson County, Oregon. Each plot was 33 ft long and 12 ft wide and consisted of 5 rows of alfalfa plants. Each plot was separated by a 2 ft buffer at each end. Plots were managed by the grower according to practices standard for alfalfa seed production in the area with the exception of fungicide applications. Fungicide treatments included pyraclostrobin+fluxapyroxad (Priaxor[®]) at 4.0 and 5.5 oz/acre, pyraclostrobin (Headline SC[®]) at 6.0 oz/acre, boscalid (Endura[®]) at 6.5 oz./acre, azoxystrobin (Quadris[®]) at 6.0 oz/acre, and copper hydroxide (Kocide 2000[®]) at 1.5 lb/acre. A tank mix of Headline SC and Endura, equivalent to Pristine[®] at 18.0 oz/acre, and a water treated control were also included. All treatments included a non-ionic surfactant (Induce[®] at 16 oz/100 gal) and were applied in a total volume of 20 gal/acre. Treatments were applied on June 5, 2014 to coincide with regular grower practices. Treatments were replicated four times.

Plots were evaluated every 4 to 7 days from June 11 to July 31 for leaf disease symptoms. Disease symptoms were measured as the % of total diseased area. Weekly ratings were converted to area under disease progress curve (AUDPC) values. Plant height was measured on July 31 and was determined based on the height of five plants arbitrarily selected in the middle

rows. Leaf retention, also determined on July 31, was evaluated in the middle three rows and rated as follows: 0 = 0% leaf retention; 1 = 1 to 25% of leaves retained; 2 = 26 to 50% of leaves retained; 3 = 51 to 75% of leaves retained; 4 = 76 to 90% of leaves retained; and 5 = 91 to 100% of leaves retained. All variables were measured from the middle 3 rows of plants to avoid edge effects.

Plots were mechanically harvested on September 11. Five foot wide headers were cut from the end of each plot. The harvested area in each plot was approximately 5 ft wide by 21 ft long and consisted of the middle 3 rows of plants. The seed was cleaned and extraneous matter was removed using hand sieves and a seed blower. Cleaned seed was weighed and yields were converted to lbs/acre.

Results and Discussion

Common spot symptoms were not observed in the trial and disease issues were negligible. However, downy mildew, caused by the fungus-like oomycete *Peronospora trifoliorum*, was first observed on July 7 in all plots. Symptoms of downy mildew were mild and limited to irregular, chlorotic spots on the leaflets that were generally less than ½ inch in diameter. Grayish to violet-gray growth was observed on the underside of chlorotic spots and were confirmed to be downy mildew sporangia (spores) and sporangiophores (spore-producing structures) using microscopic examination. The severity of downy mildew was low in all plots (5 to 10%) and symptoms declined after July. Significant differences in downy mildew AUDPC values were not observed among fungicide treatments ($P = 0.52$). Phytotoxicity was not observed in any of the treatments and significant differences in plant height ($P = 0.72$), leaf retention ($P = 0.08$) or yield ($P = 0.88$) were not observed among fungicide treatments in this trial (Table 1).

Alfalfa seed production is relatively new to central Oregon, making the identification of new or emerging pathogens important for the effective, long-term management of diseases in this crop. Downy mildew is promoted by cool temperatures (optimum = 65°C) and moist conditions (high relative humidity and free moisture), so symptoms generally subside during periods of hot, dry weather. The pathogen can survive systemically in infected crown buds and shoots, as spores in plant debris, and can be seedborne. Although downy mildew is not a disease that is new to alfalfa seed crops, the confirmation of its presence in central Oregon provides growers and stakeholders with information that can be used to detect, diagnose, and, if necessary, manage the disease.

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Tables

Table 1. Downy mildew area under disease progress curve (AUDPC) values, plant height, leaf retention, and seed yield in alfalfa seed plots treated with various fungicides to control leaf diseases

Treatment (product @ rate/acre)	Downy mildew AUDPC	Plant height (in)	Leaf retention ¹	Seed yield (lb/acre)
Control	126	36	3.5	376
Pyraclostrobin+fluxapyroxad (Priaxor @ 4.0 oz)	111	37	4.3	368
Pyraclostrobin+fluxapyroxad (Priaxor @ 5.5 oz)	106	37	4.5	367
Pyraclostrobin (Headline SC @ 6.0 oz)	90	36	4	412
Boscalid (Endura @ 6.5 oz)	113	36	3.3	392
Azoxystrobin (Quadris @ 6.0 oz)	96	36	3.5	413
Pyraclostrobin+boscalid (Pristine @ 18.0 oz) ²	120	38	3.5	372
Copper hydroxide (Kocide 2000 @ 1.5 lb)	94	37	3.5	399
<i>P</i> -value	0.52	0.72	0.08	0.88

¹ Leaf retention was rated as follows: 0 = 0% leaf retention; 1 = 1 to 25% of leaves retained; 2 = 26 to 50% of leaves retained; 3 = 51 to 75% of leaves retained; 4 = 76 to 90% of leaves retained; and 5 = 91 to 100% of leaves retained.

² The Pristine treatment consisted of a tank mix of Headline SC and Endura with active ingredients equivalent to Pristine at a rate of 18 oz/acre.