Impact of Foliar Fungicide to control Crown Rust in Oats in 2009

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Oat is considered a multiple use crop, with primary uses being companion crop, livestock feed, grain and seed. There are approximately 300,000 acres of oat in Minnesota. Crown rust is the most widespread and damaging disease of oat. Moderate to severe epidemics can reduce yield by 10 to 40%, decrease test weight and cause severe lodging problems. Damage to leaves, particularly the flag leaf, reduces photosynthesis and interferes with grain development at fill, resulting in shriveled kernels and reduced feed value. Loss due to the disease can reach 100% if infection is early, if a susceptible cultivar is grown, and if weather conditions are favorable for disease development and spread.

Crown rust of oats, also know as leaf rust, is caused by the fungus *Puccinia coronata var. avenae*. Crown rust fungus is specific to cultivated oat, wild oat, and a few other grasses, but will not infect wheat, barley or rye. Symptoms include small oval-to-oblong, bright orange-yellow pustules developing on leaves. Pustules may also occur on leaf sheaths, stems and panicles. Each pustule contains thousands of spores that can spread to neighboring plants, producing new pustules in 7-10 days under ideal conditions. In Minnesota, oat crown rust overwinters on buckthorn. Crown rust usually appears on buckthorn about 3-4 weeks ahead of oats. The inoculum moves from the buckthorn to infect oats.

Most of the effort to manage the disease has been through the development of resistant cultivars. Developing crown rust resistant varieties is an ongoing job for cereal breeders, because new races of the disease continue to develop and overcome the resistant genes.

Fungicides could be a management tool when economics are favorable for application. Approved foliar fungicides are largely protective. The ideal time to apply a fungicide is at flag leaf emergence to protect the flag leaf. Rust can develop quickly, so one must be vigilant on proper timing of application to protect the leaves. Once spots develop on the flag leaf, it is too late to apply a fungicide.

In summary, to manage and control of crown rust on oat 1) Grow crown rust resistant varieties, 2) Plant oats as early as possible to reduce the risk of infection, 3) Eradicate buckthorn where feasible, and 4) Use a foliar fungicide when the risk of disease is present and economics are favorable.

2009 Field Trial

In 2009, we conducted a field trial to evaluate foliar fungicides to control crown rust on oat. Research plots were planted at Rochester on April 15, 2009. Kame oat was seeded at 3 bushels/acre and fertilized according to University of Minnesota guidelines. Kame oats was released in 2004. It's characteristics are: early maturity, below average yield, short, good lodging resistance, poor test weight and yellow seed. In 2005, Kame was rated as moderately tolerant to moderately susceptible to crown rust. In 2008, this rating changed to moderately susceptible to susceptible to crown rust. (University of Minnesota Varietal Trials, 2009)

The experimental design was a randomized complete block with four replications. Plot size was 10' X 30'. Foliar fungicides were applied on June 5, 2009, just after flag leaf emergence. Application date, environmental conditions, and crop stage at application are listed in Table 1. Crop injury and disease severity were visually rated on June 9 and July 1, respectively. Plots were machine harvested on July 28, 2009, and grain yields, test weight and moisture are reported in Table 2. Data was analyzed with an ANOVA at a p value of 0.10.

Summary

The use of foliar fungicides significantly reduced crown rust severity compared to the untreated check, Table 2. All fungicides used in this trial performed similarly, significantly increasing test weight (1.4 - 2.3 lbs/bu) and significantly increasing yield (13.7 - 17.1 bu/ac) compared to the untreated check, Table 2. (University of Minnesota Extension - Regional Office, Rochester, MN)

Table 1. Application date, environmental conditions, and crop stage at application.

Date	June 5, 2009
Treatment	POST I
Temperature (F)	
Air	71.0
Soil	64.4
Relative Humidity (%)	42
Wind (mph)	14
Soil Moisture	Dry
Oat Stage	Flag leaf emerged
Rainfall after application	
Week 1	1.97
Week 2	1.03
Week 3	0.31

Table 2. Oat injury, crown rust disease severity, harvest moisture, test weight and grain yield of oats at Rochester, MN in 2009.

Treatment [1]	Rate	Injury	Disease Severity		Moisture		Test Weight		Yield	
		6/9	7/1		7/28		7/28		7/28	
	(rate/A)	1 =none[2]	1 = none[3]		(%)		(lbs/bu)		(bu/A)	
Untreated Check		1.8	3.4	a	14.5	c	28.3	b	63.5	b
POST I										
Headline + NIS	6 fl oz/a + 0.25% v/v	2.5	1.8	b	17.3	a	29.8	a	77.2	a
Twinline	7 fl oz/a	3.5	1.9	b	16.7	ab	30.6	a	77.4	a
Caramba	12 fl oz/a	3.0	2.0	b	16.8	ab	29.7	a	80.6	a
Stratego	7 fl oz/a	2.0	2.0	b	16.2	b	30.6	a	79.3	a
	LSD (P=0.10)	NS	0.5		1.0		1.3		8.0	

Means followed by the same letter do not significantly differ (P=0.10, LSD)

1. Treatments – all fungicides used in this trial are labeled for use on oat.
2. Rating scale, 1 – 5, with 1 = no visible injury, 5 = complete necrosis. Injury caused by fungicide was leaf speckling and necrotic spots.
3. Rating scale, 1 – 5, with 1 = no visible disease symptoms, 5 = flag leaf covered with rust lesions

Sources: *Oat Crown Rust, USDA-ARS, Minnesota, 2008; RPD No. 109 - Crown Rust of Oats, University of Illinois Extension, Integrated Pest Management, University of Illinois at Urbana – Champaign, 1989; Crown Rust of Oats – FAQs, Government of Saskatchewan, Agriculture, 2009; Oat Cultivar Selection and Fungicide Application for Control of Rust, Langdon, ND 2002, North Dakota State University.*