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Foliar Fungicide in Oat Production

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Introduction

Oats are a major spring-sown, small grain crop in Iowa. Oats can be used for grain and straw production, as a companion crop to establish hay and pastures, or for early-season forage such as hay or haylage. Because oats mature in late July to early August, it allows for cropping options for the remainder of the season including establishment of a perennial forage or cover crop and a timely window for a mid-season animal manure application.

Careful management and proper choice of variety can make oats a profitable crop, due to their low input requirements and favorable effects on succeeding crops in a rotation. Planting oats before April 15 is recommended for optimal yields in Iowa. This helps avoid exposure to warmer weather during grain fill.

Test weight is the most commonly used indicator of grain quality. High test-weight varieties should be chosen by growers who intend to market oat grain. Grain quality components such as beta glucans and fat also are gaining importance by food processors. Beta glucans are noteworthy for positive effects on human health. Lower fat concentration in grain tends to store better, reducing the potential for grain rancidity.

Oat growth is regularly affected by rust and barley yellow dwarf virus. Variety resistance to these diseases should be considered. Another option is the use of a foliar fungicide applied at Feekes 9 growth stage, defined as flag leaf emerged with ligule visible. This research evaluates the effects of foliar fungicide application on oat production.

Materials and Methods

Four oat varieties were planted in 2015. The soils at the site consist of 83B Kenyon loam and 198B Floyd loam. The site was in soybeans the previous year and has been in a corn-soybean crop rotation for over 20 years. The site was fertilized with 18 lb N/acre and 35 lb K_2O/acre to meet optimal soil test levels based on ISU soil fertility recommendations.

The site was field cultivated once before planting on April 1. The planter was a John Deere BD1108 drill with 7.5-in. row spacing planted at a rate of four bushels/acre, followed by one pass with a cultipacker. Each plot of a variety by fungicide treatment combination occupied 553 sq ft and there were three replications. The trial was sufficiently weed-free to not require the use of herbicides or hand weeding. Priaxor fungicide was applied at 4 oz/ac on all varieties when Badger oats reached Feekes 9 growth stage.

The trial was harvested July 23 with a JD4420 combine with Weigh-Tronix load cells on weigh bin. Subsamples of grain were analyzed by General Mills for percent groats, plump groats, beta glucans, and fat. Straw yields were determined from 8.125-ft wide by 20-ft long windrows from the center of each plot. Subsamples were collected and dried for percent dry matter determination.

The 2015 season provided normal growing degree days and precipitation (Table 1).

Results and Discussion

Variety trial results for 2015 are presented in Table 2. Yields reported are on a 32 lb/bushel basis. Test weight is the most important indicator of grain milling quality. Minimum test weights are 36 lb/bushel for U.S. No. 1 oats, and 33 lb/bushel for U.S. No. 2 oats.

Some of the grain quality components are included in Table 3. Higher concentrations of groats, plump groats, and beta glucans, and lower concentrations of fat are more favorable to the oat food processing companies.

Yield results from a single year are not reliable predictors of next year's yield. Environment and disease conditions can fluctuate greatly from year to year, so it is important to consider yields averaged over multiple years. Table 4 provides results of a similar trial conducted on this farm in 2014.

Foliar fungicide did not significantly affect yield or grain moisture of varieties in 2015, but improved yield and increased grain moisture in one of three varieties in 2014. Fungicide treatments improved test weight in two varieties in 2015, but none in 2014. These treatments also reduced lodging in two of three varieties in 2014, but none in 2015. Fungicide treatments improved two of the grain quality components measured in 2015, plump groats in three varieties, and beta glucans in one variety.

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Table 1. Rainfall and oat growing degree days (GDD) for 2015 and the long-term normal.

	Rainfall, in.		GDD, base 32°F	
Month	2015	Normal	2015	Normal
April	4.3	3.8	519	498
May	3.5	4.4	867	823
June	5.8	5.3	1,099	1,098
July	4.0	4.7	1,185	1,250
Total	17.6	18.2	3,670	3,669

Table 2. State of origin, PVP[a] and disease ratings[b] for oat varieties included in the 2014 and 2015 foliar fungicide trials at the ISU Northeast Research and Demonstration Farm, Nashua, Iowa.

				Disease name and disease ratings[c] by variety			
Variety	State of origin[a]	PVP[b]	Maturity	Crown rust	Stem rust	BYDV[d]	Smut
Badger	WI	PVP	Early	MR	MS	MR	R
GM423	GM	PVP	Late	MS	MS	MR	- -
Goliath	SD	PVP	Late	MS	R	MR	MR
Jerry	ND	PVP	Medium	MS	MS	MS	MS
Rockford	ND	PVP	Late	MS	MS	MR	MR
Shelby 427	SD	PVP	Medium	MS	MS	MR	MR

[a]Origin: GM = General Mills; ND = North Dakota State University; SD = South Dakota State University; WI = University of Wisconsin.

[b]PVP = Plant Variety Protection. The PVP Act provides a certificate to the developer of a variety granting exclusive rights for reproducing and marketing the seed.

[c]Disease ratings: S = susceptible; MS = moderately susceptible; MR = moderately resistant; R = resistant.

[d]Disease: BYDV = Barley Yellow Dwarf Virus.

Table 3. Performance of foliar fungicide on four oat varieties tested in 2015 at the ISU Northeast Research and Demonstration Farm, Nashua, Iowa.

Variety	Grain yield[a] July 23	Grain moisture	Test weight	% Heading June 12	% Mature July 2	Plant height July 23	% Lodging July 23	Straw yield July 25	Groats	Plump groats	Beta glucans	Fat
	bu/ac	%	lb/bu	%	%	in.	%	tons/ac	%	%	%	%
No fungicide:												
Badger	121	13.9	33	100	5	31	33	0.9	68	51	4.9	7.2
GM423	117	14.9	31	1	1	38	0	1.4	67	42	6.2	8.2
Goliath	111	18.4	34	1	1	41	0	1.4	70	34	4.9	9.4
Rockford	101	15.4	34	1	1	34	0	1.4	70	50	4.5	7.5
Average without	113	15.7	33	- -	- -	36	- -	1.3	69	44	5.1	8.1
Fungicide:												
Badger	119	13.6	34	100	5	32	30	0.9	69	57	4.9	7.2
GM423	128	16.6	31	1	1	34	0	1.7	67	48	6.7	8.2
Goliath	121	19.5	34	1	1	43	0	1.8	70	45	4.7	9.3
Rockford	108	17.1	35	1	1	36	0	1.6	70	52	4.8	7.4
Average with	119	16.7	34	- -	- -	36	- -	1.5	69	51	5.3	8.0
Overall average	116	16.2	34	- -	- -	36	- -	1.4	69	48	5.2	8.1
LSD[b] 0.05	14	1.8	1	- -	- -	6	- -	0.7	5	6	0.5	0.4

[a]Grain yields are based on 32 lb/bushel test weight.
[b]LSD = least significant difference. Entries that differ by one LSD or more are considered to be in different classes with 95 percent certainty.

Table 4. Performance of foliar fungicide on three oat varieties tested in 2014 at the ISU Northeast Research and Demonstration Farm, Nashua, Iowa.

Variety	Grain yield[a] Aug. 4	Grain moisture	Test weight	% Heading June 20	% Mature July 14	Plant height Aug. 3	% Lodging Aug. 3	Straw yield Aug. 8
	bu/ac	%	lb/bu	%	%	in.	%	tons/ac
No fungicide:								
Badger	93.6	14.2	27.3	90	6	29.6	18.6	1.42
Jerry	79.7	14.0	29.3	50	5	36.5	11.6	1.70
Shelby 427	82.7	14.7	30.3	50	4	34.3	0	1.34
Average without	85.3	14.3	29.0			33.5	10.1	1.49
Fungicide:								
Badger	102.9	17.1	28.4	90	6	30.8	6.5	1.70
Jerry	85.7	15.4	30.1	50	5	36.9	3.3	1.91
Shelby 427	84.3	16.1	30.4	50	4	34.1	2.0	1.60
Average with	91.0	16.2	29.6	- -	- -	33.9	3.9	1.74
Overall average	88.2	15.3	29.3	- -	- -	33.7	7.0	1.62
LSD[b] 0.05	9.1	2.2	1.2	- -	- -	2.4	7.8	0.30

[a]Grain yields are based on 32 lb/bushel test weight.
[b]LSD = least significant difference. Entries that differ by one LSD or more are considered to be in different classes with 95 percent certainty.