Fungicide timing and rate to control blackleg disease in winter canola.

Final Project Report to the Washington Oil Seed Commission

SUBMITTED BY:

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FUNDS REQUESTED: 2017 $4000, 2018 $5000, 2019 $9,500 2020 $9,500, Total $28,000

PROJECT PERIOD: February 2017 to March, 2021

INVESTIGATOR:

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DESCRIPTION: The goal of this project is to understand the effect of timing and frequency of application of azoxystrobin on blackleg disease in winter canola in the PNW. The outcome of this project will be recommendations for use of azoxystrobin and related fungicides on winter canola and an understanding of the relationship between level of infection and expected yield reduction.

JUSTIFICATION AND BACKGROUND:

Blackleg, (BL) caused by the fungus *Leptosphaeria maculans*, is the most serious disease of canola and oilseed rape worldwide. BL was identified and confirmed in Umatilla county Oregon in March of 2015. It was observed in four fields of winter canola and was observed on canola crop residues in at eight field from the previous year. Since first confirmation of the disease, it has been observed in several fields in 2015, 2016 and 2017. It is likely that BL was present in the area several years before confirmation. BL has also been observed in Idaho. BL poses in severe threat to the regional canola and the Brassica seed industries. It is very likely that BL will become a greater risk as acreage of winter canola increase in the region. Because BL incidence is newly identified to the region, there is not available information management of this disease. One component of management is the use fungicides. Currently there are not local recommendations for rate and timing of fungicides to control this disease. Information from Canada, while excellent is for spring canola and is not easily extrapolated to winter canola grown here. In addition, no information exists on the degree to which BL is lowering yields. It is critical that information on yield loss and recommendations for fungicide application be developed. Since BL is a serious disease and every effort should be made to contain its spread, research can only be conducted where the problem already exists.

More than 250,000 acres of canola could be grown in the region and not adversely affect the market. Development of better agronomic practices will assist in increasing the acreage of winter canola. Proper and feasible management of BL will help in the effort to increase winter canola acreage in PNW. Recently acreage of canola has been expanding due to the existence of a regional crushing facility at Warden, Washington is driving the need for a rotation crop with winter wheat, and low wheat prices. As acreage expands, the risk of disease and other pests will increase.

OBJECTIVES:

1. Apply azoxystrobin in autumn, late winter and early spring in 1, 2, or 3 applications to determine the level of BL control and measure the benefit of control on yield.
2. Develop recommendations for fungicide applications to winter canola for treatment of BL disease

RESEARCH PROCEDURES:

The effect of timing and frequency of application of Azoxystrobin (Quadris) (Group 11) fungicide to control BL was studied over four seasons from 2017 to 2020. Each year a randomized complete block experiment with 5 to 8 treatments and 4 replications was planted at the OSU Columbia Basin Agricultural Research Center at Pendleton, Oregon. Treatments consisted of date and frequency of 7oz ai/acre Azoxystrobin applications (Table 1). Year references the year harvested, with planting occurring the previous autumn. Application dates for each season are listed in Table Dates were selected to match equivalent crop stages shown.

Table1. Blackleg fungicide treatments on winter canola for each season at CBARC, 2017-2020.

Year	Azoxystrobin Treatments applied each seaon on winter canola, CBARC 2017-2020							
	Control (No Fungicide)	Autumn	Autumn, Spring 1	Autumn, Spring 2	Spring 1	Spring 1 Spring 2	Spring 1, Spring 3	Spring 1, Spring 2, Spring 3
2017	X				X	X	X	X
2018	X	X	X	X	X	X		X
2019	X	X	X	X	X	X	X	X
2020	X	X	X	X	X	X	X	X

Table 2. Crop Stage and Fungicide application dates by year, CBARC 2017-2020

Fungicide timing	Crop Stage	Fungicide application dates			
		2016-2017	2017-2018	2018-2019	2019-2020
Autumn	6 leaf		30-Oct	30-Oct	6-Nov
Spring 1	Rosette	7-Apr	15-Mar	30-Mar	27-Feb
Spring 2	Elongation	15-Apr	4-Apr	15-Apr	26-Mar
Spring 3	flower initiation	25-Apr	26-Apr	29-Apr	13-Apr

The experiments were sown on tilled summer fallow at the Columbia Basin Agricultural Research Center, Pendleton, Oregon on a Walla Walla silt loam, coarse loamy, mixed, mesic, hyperactive Typic Haploxeroll. Date of sowing, herbicide application (11 oz/acre Assure II), swathing and combining and nutrient application rate are show for each year (Table 3).

Table 3 Dates of sowing, herbicide application, swathing and combining and nutrients applied to winter canola for each year, CBARC 2017-2020

Year	Date				Nutrients applied lb/acre		
	Sowing	Assure II	Swath	Combine	nitrogen	P2O5	sulfur
2016-2017	15-Sep	3-Nov	29-Jun	5-Jul	80	20	10
2017-2018	14-Sep	20-Mar	22-Jun	27-Jun	80	20	15
2018-2019	17-Sep	1-Nov	28-Jun	8-Jul	78	5	5
2019-2020	11-Sep	4-Nov	1-Jul	8-Jul	90	20	10

Plots of Amanda winter canola were sown each season at 6 lb seed/acre with a 5-foot wide Hege plot, using 6-inch row spacing, JD double disk openers and press type packer wheels. Individual plots had a dimension of 10 X 20 feet. In each experiment, subplots of 5 X 20 foot plot were used for combine harvest and for destructive plant sampling for assessment of BL and SC. Harvested plots were swathed with a 5-foot wide Swift Current plot swather and combined with a Hege 140 plot combine with draper pick-up and auger feed into the feeder housing. Harvested seed was collected in cloth bags and later cleaned with a M2B clipper cleaner with appropriately sized sieves. Seed was weighed and yield determined using harvested plot area. Oil content, percent protein, test weight and percent moisture were determined on subsamples using a Perten 9200 NIR grain analyzer that has a canola algorithm. The remaining subplot in each plot were sampled for incidence of BL or Sclerotinia (SC). All plants in an individual 20-foot of row in each subplot were cut through at the base with hand shears to expose the basal stem area for presence of BL and SC. In addition stems were inspected to 60 cm height for Sclerotina stem rot. This is typical procedure for identifying BL and SC respectively. Observation of each plant was recorded as healthy, BL infected or sclerotina infected. In addition each BL infected plant was given a severity rating using a scale of 1 to 4 (Figure 1). The scale was the percent of basal area blackened with disease with 1 = < 25 %, 2 =

25-50 %, 3 = 50-75 %, and 4 = >75 %. Percent BL or SC was determined by comparing those infected to the total number of plants sampled.

Figure 1. Examples of the Blackleg severity rating

RESULTS AND DISSCUSSION:

The weather and environmental conditions varied widely for each of the four seasons of this this trial. Reporting annual weather data is beyond the scope of this report. Achieved weather data is available upon request https://www.ars.usda.gov/pacific-west-area/pendleton/columbia-plateau-conservation-research-center/docs/weather-data/ .

Results of the each season's trial are presented in Table 4 and a summary of years in Table 5. The 2016-2017 season showed response to in both yield and suppression of BL. During the 2017-2018 crop year, sclerotina had a devastating impact on the trial and none to the treatments produced significant statistical results. For crop seasons 2018-2019 and 2019-2020 a side experiment was conducted to control SL. In both seasons no treated and untreated SL was shown not to be a problem. In both the 2018-2019 and 2019-2020, statistically, yield was found to be non-significant for the fungicide treatments. However BL infection and Severity was highly significant got fungicide treatments. BL severity rating was used to estimate the severity of basal stem rot using the scale explained in the procedures. As percent infection increases there is fairly good correlation that severity does as well. At lower levels of infection the disease severity was less and as percent BL infection increases so generally does the severity rating. In general this means disease severity increases with the level of infection.

CONCLUSIONS AND RECOMMENDATIONS

In summary of four years of this study, several basic conclusions and recommendations for Blackleg control and treatment on winter canola can be made.

1. Autumn application of 7 oz ai/acre Azoxystrobin provide no control of BL

2. A single early spring application of 7 oz ai/acre Azoxystrobin at the rosette stage provided the great single control of BL (Table 5.)
3. single applications of 7 oz ai/acre Azoxystrobin made later than early spring provided less control that an early spring
4. Repeated spring applications of 7 oz ai/acre Azoxystrobin continued to decrease blackleg infection, however at only small percentage. Most benefit was provided by the early spring application.
5. Only in the 2016-2017 crop was a yield increase observed from an early spring application. This yield increase was 550 lb/acre

Based on the performance of the various fungicide treatments of this study the basic recommendation for BL treatment is to apply a single 7 oz ai/acre Azoxystrobin in early spring, when BL lesions are observed on the older leaves of 5 percent of rosette plants. Although we did not use other fungicides, it is expected that other fungicides labeled for BL control on winter canola would provide similar control. It is also recommended that growers rotate fungicide groups to avoid development of resistance.

Although here was only significant yield response in the first year of this study, that single yield response more that covered the cost of applications in all subsequent years
A quick economic assessment using these prices:
Azoxystrobin $1.85 oz = $13.12/acre;
Costume application $6.70/acre;
Total application cost $19.82/acre;
Cost of 4 applications (4 years) = $79.28/acre;
550 lb canola yield increase in 2017; 2017 July bid $19.28/cwt
Increased return $106.04 by once in 4 year response.

Table 4. Effect of azoxystrobin application on percent Blackleg infection, yield and oil content of winter canola at CBARC, Oregon, by year

2016-2017

Azoxystrobin Application	Blackleg infection %		Yield lb/acre		Oil Content %	p 0.05
Control	41.7	A	3516	A	45.3	A
S1	16.1	BC	4069	B	45.2	A
S1, S2	20.2	B	4075	B	45.7	A
S1, S2, S 3	6.6	C	4083	B	45.2	A
LSD 0.05	18		446		2	

2017-2018

Treatment	Blackleg infection %	BL Severity rating	Sclerotina infection %	yield lb/acre	oil content %
control	16.5	1.90	36.0	1374	43.5
A	4.9	1.13	66.0	1159	43.2
A, S1	10.5	1.50	49.1	1408	43.6
S1	14.6	2.03	44.0	1484	44.5
S1, S2	5.4	1.25	61.6	1110	42.4
S1, S2, S3	13.0	1.16	36.4	1652	45.5
	NS	NS	NS	NS	NS

2018-2019

Effect of azoxystrobin application on yield, Blackleg infection, Sclerotina infection, and Blackleg

Treatment	Yield lb/acre	Blackleg %		sclerotina %		severity rating	
Control	2707	20.4	A	3.4	A	2.09	A
A	2990	23.1	AB	3.4	A	1.62	AB
A S1	2935	11.9	C	4.1	A	1.86	AB
A S2	2632	11.2	C	6.9	A	1.67	AB
S1	2172	12.6	BC	5.4	A	1.85	AB
S1 S2	2672	6.6	C	5.7	A	1.96	AB
S1 S3	2423	9.9	C	3.5	A	1.54	AB
S1 S2 S3	2382	4.2	C	5.5	A	1.12	B
LSD 0.05	NS	8.5		14		0.86	

2019-2020

Treatment	Yield lb/acre	Blackleg %		sclerotina %		severity rating	
Control	2569	14.9	AB	0.5	C	2.0	AB
A	2798	15.8	A	3.0	ABC	2.2	AB
A S1	3057	2.8	D	1.3	BC	2.4	A
A S2	3129	7.4	BCD	0.8	BC	1.4	B
S1	2862	12.2	ABC	5.8	A	2.0	AB
S1 S2	2964	8.0	ABCD	0.5	C	1.7	AB
S1 S3	2827	7.6	BCD	3.8	AB	1.8	AB
S1 S2 S3	2584	5.5	CD	2.5	BC	2.0	AB
LSD 0.05	NS	3.9		1.5		0.8	

Table 5. Yearly response from one early spring 7 oz application of Azoxystrobin to winter canola over 4 consecutive years, CBARC, Pendleton 2016-2020

Year	Yield lb/acre		% Blackleg infection		BL Severity rating	
	Control	Azoxy App	Control	Azoxy App	Control	Azoxy App
2017	3516*	4069*	41.7*	16.1*		
2018	1374	1484	16.6	14.4	1.9	1.13
2019	2707	2935	23.1*	9.9*	2.09*	1.85*
2020	2569	2862	16.3*	2.8*	2.20*	1.40*

*Significant at P=0.05