Evaluation of Canola Cultivars for Resistance to Sclerotinia

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Abstract

The objective of this project is to identify canola (*Brassica* napus L.) cultivars which are less susceptible to Sclerotinia. In 2005, field trials were conducted at the North Dakota State University Carrington Research Extension Center and an on-farm site near Red Lake Falls, Minnesota. Twenty-six canola cultivars, representing current production varieties and private breeding lines, were evaluated in a randomized complete block design with four replicates. Plot size was approximately seven 7-inch rows x 25 feet. At flowering, plots were inoculated with ascospores (foliar spray) and misted until physiological maturity to provide a favorable environment for disease development. Disease incidence and severity were evaluated, as well as plant height and lodging at maturity and grain yield, test weight, and oil concentration at harvest. Data were analyzed by standard statistical procedures and means were compared by F-protected LSD. Weather during flowering was exceptionally hot and dry and the inoculations with ascospores were probably ineffective. Minimal disease pressure was achieved at Red Lake Falls (only two plots had disease incidence greater than 6%). At Carrington, heavy misting late in the season stimulated germination of residual sclerotia from the 2004 sunflower head rot trial, which resulted in significant disease pressure (incidences ranging from 4.5 to 68.5%). However, the disease attacked relatively late, favoring the entries which were close to physiological maturity (a 14-day range was recorded in the date of physiological maturity). Highly significant negative correlations were observed between disease incidence and days to flowering and physiological maturity, plant height, yield, and seed size. Disease was highly and positively correlated with lodging. One application of Endura fungicide reduced Sclerotinia incidence in both varieties which were treated, but yield was not increased due to the lateness of disease pressure.

Introduction

Sclerotinia sclerotiorum (Lib.) de Bary (white mold) is a fungal disease which frequently results in a significant reduction in the yield and quality of canola (*Brassica napus* L.). Sclerotinia was the most common and most serious disease of canola in North Dakota and Minnesota each year from 1993 to 2001 (Lamey 1998; Lamey et al. 2001), but resistant cultivars are not yet available.

Objectives

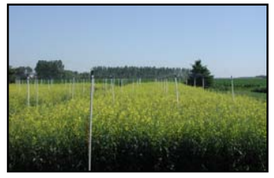
- Identify canola cultivars with lower susceptibility to Sclerotinia for use in current production and plant breeding programs,
- Develop field methodology for screening cultivars for resistance to Sclerotinia,
- Disseminate results to the scientific and agricultural communities.

Canola misting system .

Severely-infected and less-susceptible plots .

Apothecia .

Sclerotinia stem rot in canola.



Flowering canola .

Materials and Methods

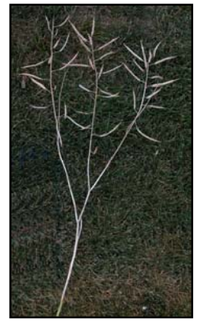
Planting Date:	23 May 2005
Plot Size:	Seven (7") rows x 25', 4 replicates
Borders:	Apetalous and fungicide plots were surrounded by borders to avoid contamination of adjacent plots
Fungicide:	Endura (0.49 g product / plot) applied 8 July
Inoculation:	5.5 million ascospores / plot on 11 July
Misting:	2 – 4 minutes every half hour from 11 July to 13 August
Evaluation:	18 August (50 plants / plot, divided into 4 distinct areas)
Evaluation Scale: (see photos)	1 = small branch infected 2 = large branch infected 3 = stem at least 50% girdled 4 = plant dead, good yield 5 = plant dead, poor yield.
Incidence:	% of plants showing symptoms
Severity:	Mean severity score of plants showing symptoms

Heavily-misted canola .

Disease rating 1.

Disease rating 2.

Disease rating 3.



Disease rating 4.

Disease rating 5.

Results and Discussion

Red Lake Falls, Minnesota. Disease pressure at Red Lake Falls was very low (data not shown). This problem has been observed in previous canola Sclerotinia trials and has been attributed to very hot weather conditions (> 85° F.) after inoculation (Lamey et al. 2002).

Carrington. Good disease pressure was observed at Carrington, ranging from 4.5 to 68.5% incidence (Table 1). In general, lower incidences were recorded for the breeding lines than for the commercial cultivars tested, which shows promise for more resistant varieties in the future. Severity ratings of infected plants did not differ significantly among entries.

Yield was highly negatively correlated with Sclerotinia incidence and lodging (Table 2). Incidence and lodging were positively correlated. Although confounded with genetic resistance, these results suggest that reducing lodging will also reduce Sclerotinia infection. Plant height at maturity was inversely correlated to lodging, indicating that selecting for shorter plants will not automatically increase standability. Grain oil concentration decreased with lodging and increased with yield.

However, Sclerotinia symptoms appeared relatively late in the season. The delay in reaching physiological maturity in some entries (Table 1) may have resulted in more lodging, more senesced plant tissue, and more disease in the earlier-maturing entries. This was probably the case with Hylite 201 (the apetalous cultivar), in which heavy infection is normally avoided by the lack of flower petals. This situation can be circumvented in the future by including larger alleys between replicates to allow a timely harvest of all entries.

Table 1. Canola germplasm performance in the evaluation for Sclerotinia susceptibility, NDSU Carrington, 2005.

Entry	10% Bloom (DAP)[1]	90% Bloom (DAP)	Physiological Maturity (DAP)	Disease Incidence (%)	Disease Severity (0-5)	Height (cm)	Lodging (1-9)[2]	Yield (lbs/acre)	Test Weight (lbs/bushel)	Seed Weight (g/200)	Oil (%)
44A89	39.0	61.0	79.8	49.5	4.3	108.0	6.0	1288	49.9	0.65	43.0
46A65	38.0	61.8	83.3	48.0	4.2	114.0	5.8	1999	50.5	0.67	43.9
46A65+Fungicide	38.3	63.3	83.8	25.0	4.2	107.3	6.3	1817	50.7	0.68	43.9
46A76	40.8	72.0	88.5	16.0	3.7	116.5	3.5	2162	50.2	0.69	44.5
46A76+Fungicide	40.3	72.8	88.0	12.5	3.3	118.8	3.5	1882	50.3	0.73	44.1
BN1	37.5	63.5	82.3	28.0	4.1	96.0	7.8	1246	51.4	0.72	39.3
BN1-1	37.8	75.0	83.5	23.5	4.4	100.3	7.8	946	51.4	0.73	41.2
BN3	40.0	72.5	89.8	13.5	4.0	123.3	5.3	2212	51.1	0.76	43.3
DKL3455	39.5	67.0	86.3	30.0	4.0	117.8	3.8	2077	50.5	0.70	45.0
EXP1	37.8	73.0	87.0	19.5	3.7	116.0	6.3	1907	50.9	0.77	42.4
EXP1-1	38.8	67.5	82.0	35.5	4.0	108.3	7.0	1742	51.2	0.77	41.4
EXP2	37.5	69.0	86.3	20.0	4.2	126.3	4.0	2207	51.4	0.75	41.7
EXP2-1	39.5	63.5	86.8	11.5	3.4	117.3	3.3	2259	50.6	0.69	44.0
EXP3	38.3	64.0	83.3	20.5	4.0	116.5	6.3	2074	50.7	0.77	41.4
EXP4	37.3	61.0	80.5	11.5	2.9	117.5	5.0	1845	51.4	0.74	41.7
EXP5	39.0	69.8	87.3	8.0	2.9	125.8	2.8	2625	51.8	0.70	41.9
HyCLASS 905	40.3	66.0	83.3	35.0	4.2	126.5	3.3	2168	50.1	0.74	45.6
HyLite 201	38.5	63.3	79.8	41.0	3.9	90.3	7.0	1284	48.3	0.67	42.0
Hyola 357 Magnum	36.3	60.8	83.0	55.5	3.9	104.0	6.5	1724	50.5	0.69	41.6
Hyola 401	37.3	63.3	87.0	54.5	3.7	102.8	6.3	1896	50.6	0.78	41.9
InVigor 4870	39.8	65.5	85.5	20.0	4.0	130.0	2.0	2892	51.2	0.71	45.9
InVigor 5630	38.8	62.5	83.8	44.5	4.2	109.0	3.8	2334	48.5	0.71	44.2
MON01	41.0	63.5	88.5	11.0	4.0	117.8	3.8	2183	50.2	0.64	43.4
MON02	41.8	72.5	93.3	4.5	3.2	122.8	3.0	1364	50.5	0.73	43.5
MON03	41.3	72.3	91.3	9.5	4.2	121.0	3.8	1461	50.4	0.74	44.6
MON04	41.3	66.0	90.0	14.5	4.0	117.5	3.8	1858	50.2	0.67	45.8
PR9040	37.8	68.0	87.0	25.0	4.2	124.5	3.5	1743	47.9	0.77	43.5
Z2409	38.5	58.0	81.3	68.5	4.8	106.8	7.8	1194	51.0	0.60	44.5
Mean	39.0	66.2	85.4	27.0	3.9	114.4	4.9	1872	50.5	0.71	43.2
C.V. (%)	1.4	3.7	2.5	35.3	20.5	6.8	16.6	17.0	1.6	4.5	2.7
P-value	<0.0001	<0.0001	<0.0001	<0.0001	0.2823	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (0.05)	0.8	3.5	3.1	13.5	NS	11.0	1.2	448	1.2	0.05	1.7
LSD (0.01)	1.1	4.6	4.1	17.8	NS	14.6	1.6	595	1.5	0.06	2.2

[1]Days after planting

[2]1 = erect, 9 = prostrate

Table 2. Correlation coefficients in the canola germplasm evaluation for Sclerotinia susceptibility, NDSU Carrington, 2005.

	Beginning Bloom	End Bloom	Physiological Maturity	Incidence	Severity	Height	Lodging	Yield	Test Weight	Seed Weight	Oil
Beginning Bloom	1	0.3659	0.5886	-0.4266	-0.0591	0.3867	-0.5412	0.1357	-0.0760	-0.1357	0.5250
P-value		<0.0001	<0.0001	<0.0001	0.5362	<0.0001	<0.0001	0.1556	0.4277	0.1557	<0.0001
End Bloom	0.3659	1	0.5847	-0.4975	-0.0546	0.3253	-0.2591	-0.0349	0.0888	0.3546	0.0576
P-value	<0.0001		<0.0001	<0.0001	0.5729	0.0006	0.0065	0.7200	0.3608	0.0002	0.5539
Physiological Maturity	0.5886	0.5847	1	-0.4987	-0.1313	0.4510	-0.5402	0.2026	-0.0218	0.2423	0.3317
P-value	<0.0001	<0.0001		<0.0001	0.1677	<0.0001	<0.0001	0.0330	0.8206	0.0104	0.0004
Incidence	-0.4266	-0.4975	-0.4987	1	0.3507	-0.3440	0.5080	-0.2946	-0.1764	-0.2526	-0.0609
P-value	<0.0001	<0.0001	<0.0001		0.0001	0.0002	<0.0001	0.0017	0.0641	0.0075	0.5256
Severity	-0.0591	-0.0546	-0.1313	0.3507	1	-0.0765	0.2988	-0.1635	-0.0804	-0.1701	-0.0221
P-value	0.5362	0.5729	0.1677	0.0001		0.4225	0.0014	0.0864	0.4017	0.0743	0.8179
Height	0.3867	0.3253	0.4510	-0.3440	-0.0765	1	-0.5869	0.4186	0.0807	0.2142	0.3880
P-value	<0.0001	0.0006	<0.0001	0.0002	0.4225		<0.0001	<0.0001	0.3996	0.0240	<0.0001
Lodging	-0.5412	-0.2591	-0.5402	0.5080	0.2988	-0.5869	1	-0.5831	0.1104	-0.0989	-0.5627
P-value	<0.0001	0.0065	<0.0001	<0.0001	0.0014	<0.0001		<0.0001	0.2487	0.3017	<0.0001
Yield	0.1357	-0.0349	0.2026	-0.2946	-0.1635	0.4186	-0.5831	1	0.0307	0.1629	0.3319
P-value	0.1556	0.7200	0.0330	0.0017	0.0864	<0.0001	<0.0001		0.7495	0.0876	0.0004
Test Weight	-0.0760	0.0888	-0.0218	0.1764	-0.0804	0.0807	0.1104	0.0307	1	-0.0311	-0.1716
P-value	0.4277	0.3608	0.8206	0.0641	0.4017	0.3996	0.2487	0.7495		0.7457	0.0717
Seed Weight	-0.1357	0.3546	0.2423	-0.2526	-0.1701	0.2142	0.0989	0.1629	-0.0311	1	-0.1773
P-value	0.1557	0.0002	0.0104	0.0075	0.0743	0.0240	0.3017	0.0876	0.7457		0.0627
Oil	0.5250	0.0576	0.3317	-0.0609	-0.0221	0.3880	-0.5627	0.3319	-0.1716	-0.1773	1
P-value	<0.0001	0.5539	0.0004	0.5256	0.8179	<0.0001	<0.0001	0.0004	0.0717	0.0627	

Acknowledgements

This research was made possible by a grant from the U.S. Department of Agriculture under Agreement No. 58-5442-2-263, a cooperative project with the USDA-ARS Sclerotinia Initiative. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

The authors wish to thank E. Aberle, J. Forde, L. Scheen, and C. Wolf for capable technical assistance, B. Montgomery for data entry, and M. Friedt for poster preparation.

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