

Evaluation of Canola Cultivars for Resistance to Sclerotinia

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Abstract

The objective of this project is to identify canola cultivars which are less susceptible to Sclerotinia. In 2003, 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 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 near 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. Excellent disease pressure was attained at both sites, with incidence ranging from 90 to less than 51% at Carrington and 76 to 4% at Red Lake Falls. Significant differences among entries were observed for all parameters measured at both locations. Highly significant correlations existed among disease incidence, severity, and relative ranking of the entries within and across sites. In Carrington, disease incidence, but not severity, was negatively correlated with plant height. In Red Lake Falls, lodging was more pronounced than in Carrington and was positively correlated with disease incidence and severity. Although lower than normal for small-plot research, yields of some cultivars were quite good considering the level of disease pressure.

Introduction

Sclerotinia is a fungal disease which attacks a wide range of broadleaf crops in the Northern Plains and other regions. The disease has caused severe economic losses in canola and other crops in recent years. Genetic resistance to Sclerotinia has not yet been found in canola germplasm. The objective of this project is to identify canola cultivars which are less susceptible to Sclerotinia.



Healthy canola, left, and Sclerotinia-infected canola, center and right.

Materials and Methods

In 2003, 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 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, each plot was inoculated (foliar spray) with a minimum of 19,500 (Carrington) or 2,300 (Red Lake Falls) ascospores/ft² and misted until physiological maturity to provide a favorable environment for disease development. Disease incidence and severity (Table 1) were evaluated on 50 plants per plot. At maturity, plant height, lodging, grain yield, test weight, and oil concentration were recorded. Data were analyzed by standard statistical procedures and means were compared by F-protected LSD.

Table 1. Canola Sclerotinia incidence rating scale.

1 = superficial lesions or small branch infected; 2 = large branch dead; 3 = main stem at least 50% girdled
4 = main stem girdled but plant produced good seed; 5 = main stem girdled, much reduced yield

Table 2. Canola cultivar performance in the Sclerotinia screening trial, NDSU Carrington R / E Center, 2003.

Cultivar	Disease Incidence (%)	Disease Severity (0-5)	Field Severity ¹	Height (cm)	Lodging (1-9) ²	Yield (lb/acre)	Test Weight (lb/bushel)	Seed Weight (g/200)	Oil (%)
44A89	90.0	3.6	64.8	99	3.0	812	51.9	0.59	41.2
46A76	51.0	2.4	25.6	117	2.5	1370	51.6	0.61	41.8
DKL3455	52.5	2.9	30.3	108	2.5	1401	51.2	0.60	43.4
HyClass601	47.5	2.8	26.5	126	2.8	1428	51.2	0.58	42.1
HyLite201	65.0	2.4	32.1	88	6.0	524	50.7	0.62	37.2
Hyola357	60.5	2.6	30.9	100	3.3	1695	51.1	0.65	40.6
Hyola401	55.0	2.5	28.2	103	2.5	1926	51.7	0.76	41.9
InVigor2663	61.5	2.8	34.4	118	2.3	1553	52.2	0.75	42.4
X395	52.0	3.0	31.5	102	3.5	1192	52.2	0.62	42.6
X401	73.5	2.7	40.1	99	4.5	883	51.3	0.57	41.1
X403	59.0	2.6	31.9	112	4.8	1377	51.0	0.68	41.8
X435	59.5	2.8	33.0	105	2.8	1312	51.7	0.65	42.2
X497	71.0	2.6	37.8	101	2.3	1321	52.6	0.69	41.6
X498	60.0	3.0	36.1	127	2.3	1771	51.7	0.72	42.3
X499	76.0	3.2	49.3	118	2.8	1231	51.6	0.67	42.3
X500	80.0	3.0	49.4	106	5.3	1254	51.7	0.64	39.8
Mean	56.7	2.7	31.8	110	3.3	1310	51.7	0.65	41.7
C.V. (%)	23.2	11.7	27.6	6.6	20.8	21.0	0.7	5.2	2.9
LSD (0.05)	18.7	0.5	12.4	11	1.0	390	0.5	0.05	1.7
LSD (0.01)	24.9	0.6	16.6	14	1.3	520	0.7	0.07	2.3

¹Incidence x Severity / 5; ²1 = erect, 9 = prostrate

Results and Discussion

- Excellent disease pressure was attained at both sites, with incidence ranging from 90 to less than 51% at Carrington (Table 2) and 76 to 4% at Red Lake Falls (Table 3).
- Significant differences among entries were observed for all parameters measured at both locations.
- Highly significant correlations existed among disease incidence, severity, and relative ranking of the entries within and across sites (Table 4).
- In Carrington, disease incidence, but not severity, was negatively correlated with plant height (Table 2). In Red Lake Falls, lodging was more pronounced than in Carrington and was positively correlated with disease incidence and severity (Table 3).
- Although lower than normal for small-plot research, yields of some cultivars were quite good considering the level of disease pressure.

Table 3. Performance of canola cultivars in the Sclerotinia evaluation, Red Lake Falls, Minnesota, 2003.

Entry	Disease Incidence (%)	Disease Severity (0-5)	10% Bloom (DAP) ¹	Physic. Maturity (DAP)	Height (inches)	Lodging (1-9) ²	Yield (lb/acre)	Test weight (lb/bushel)
44A89	76	5.0	42	80	32	7.3	1198	52.1
46A76	21	4.3	47	87	38	4.5	1499	51.7
DKL34-55	29	4.5	43	85	33	5.5	1341	51.5
HyClass 601	25	3.8	45	86	42	4.8	1522	51.2
HyLite 201	4	2.5	43	81	24	4.8	1067	51.3
Hyola 357 Mdg	18	4.8	40	85	30	6.5	1719	51.5
Hyola 401	11	3.8	40	85	31	4.5	1745	52.2
InVigor 2663	30	4.5	45	85	39	5.8	1628	52.5
X395	5	2.8	48	85	26	3.8	999	51.3
X401	34	3.5	42	82	29	5.8	1262	52.0
X403	21	4.0	45	86	34	6.3	1365	51.6
X435	41	4.0	45	85	32	6.5	1163	51.8
X497	45	4.0	43	80	34	5.0	1227	53.1
X498	32	4.8	44	84	34	4.0	1548	51.9
X499	47	4.0	43	84	34	5.8	1421	52.0
X500	24	4.5	41	81	30	6.0	1156	52.5
Mean	24	3.5	44	84	33	5.3	1366	52
C.V.	55.8	25.6	2.4	1.1	11.8	22.6	10.8	0.6
LSD 0.05	19.0	1.28	1.5	1.3	5.5	1.76	208.3	0.43

¹Days after planting; ²1 = erect, 9 = prostrate

Table 4. Correlations among disease readings at Carrington (Cgtn) and Red Lake Falls (RLF), 2003.

	Cgtn Rank	RLF Rank	Cgtn Incidence	RLF Incidence	Cgtn Severity	RLF Severity
Cgtn Rank	1	0.8016	0.9502	0.7883	0.6493	0.7005
P-value		<0.0001	<0.0001	<0.0001	0.0026	0.0008
RLF Rank	0.80155	1	0.8210	0.9428	0.6462	0.7371
P-value	<0.0001		<0.0001	<0.0001	0.0028	0.0002
Cgtn Inc	0.95019	0.8210	1	0.8114	0.7083	0.8132
P-value	<0.0001	<0.0001		<0.0001	0.0007	<0.0001
RLF Inc	0.78831	0.9428	0.8114	1	0.7201	0.6715
P-value	<0.0001	<0.0001	<0.0001		0.0005	0.0012
Cgtn Sev	0.64932	0.6462	0.7083	0.7201	1	0.5416
P-value	0.0026	0.0028	0.0007	0.0005		0.0166
RLF Sev	0.70051	0.7371	0.8132	0.6715	0.5416	1
P-value	0.0008	0.0002	<0.0001	0.0012	0.0166	

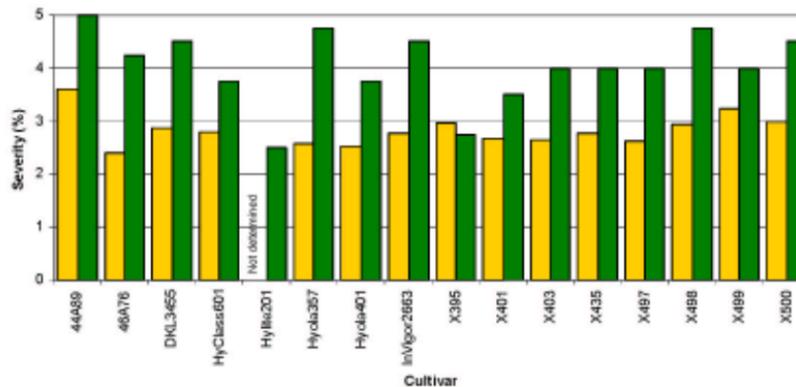


Inoculating canola at Red Lake Falls.

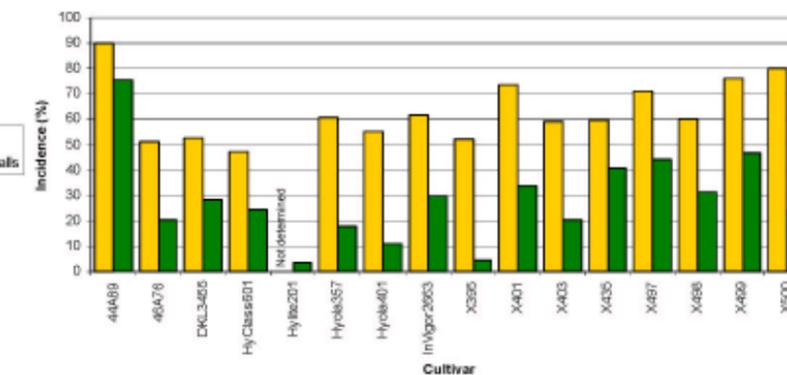


Misting the canola sclerotinia trial at Red Lake Falls.

Canola disease severity in Carrington and Red Lake Falls, 2003.



Canola disease incidence in Carrington and Red Lake Falls, 2003.



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Disease rating 1.



Disease rating 2.



Disease rating 3.



Disease rating 4.



Disease rating 5.