Progress Report for "Research to minimize the impact of blackleg in the U.S." funded by the National Canola Research Program – 2005

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Background

Blackleg, caused by *Leptosphaeria maculans*, is a reemerging disease in North Dakota. Short crop rotations and the development of more aggressive *L. maculans* strains may be partially responsible for the reemergence of the disease, as highly aggressive pathogenicity groups (PG) 3 and 4 of *L. maculans* were identified in North Dakota in 2003 (Bradley et al., 2005). Because of the growing threat of blackleg to canola in the major production region in the U.S., research was conducted to: i) establish a blackleg nursery in North Dakota for screening cultivars and experimental lines for resistance; and ii) evaluate northern canola cultivars and experimental lines for blackleg resistance against highly aggressive and variable *L. maculans* populations in University of Georgia blackleg nurseries.

Materials and Methods

North Dakota blackleg nursery. A blackleg nursery was established near Langdon, ND. The blackleg nursery site was located on a grower's farm with a history of blackleg. In the trial, 27 commerical cultivars, 39 lines from University of Georgia, and 4 check cultivars were evaluated for blackleg resistance. The majority of the lines entered from the University of Georgia were selections of early maturity from material that were segregating for maturity at Langdon in 2004. The experimental design was a randomized complete block (RCB) with 4 replications. Plots were evaluated for blackleg severity on 22 August 2005 by cutting stems of 25 plants per plot and rating using a 0 to 5 severity scale where:
0= No penetration or noticeable infection of the stem
1= 25% of the stem circumference infected; lesion superficial
2= 50% of the stem circumference infected; some penetration
3= 75% of the stem circumference infected; significant penetration
4= stem completely girdled, but intact at the base; significant penetration
5= stem girdled at the base, constricted, dry and brittle, may be completely severed; plant dead

University of Georgia blackleg nursery. Blackleg nurseries in Griffin and Plains, GA were used to evaluate 11 northern commercial cultivars, 5 University of Georgia breeding lines, and 8 check cultivars for their resistance to the diverse and highly aggressive strains of *L. maculans* present in those nurseries. The rating scale used to evaluate blackleg severity was based on external symptoms of blackleg as follows:
0 = no externally visible symptoms
1 = 1 plant to 8% of the plants lodged, dead or with obvious basal canker
2 = 8 to 20% of the plants lodged, dead or with obvious basal canker
3 = 20 to 35% of the plants lodged, dead or with obvious basal canker
4 = 35 to 50% of the plants lodged, dead or with obvious basal canker

5 = 50 to 65% of the plants lodged, dead or with obvious basal canker
6 = 65 to 80% of the plants lodged, dead or with obvious basal canker
7 = 80 to 95% of the plants lodged, dead or with obvious basal canker
8 = over 95% of the plants lodged, dead or with obvious basal canker
9 = all plants dead without viable seed

Results

North Dakota blackleg nursery. Disease pressure was high, with blackleg severity ranging from 1.3 to 4.8 (on a 0 to 5 scale) (Table 1). Many of the lines tested had good blackleg resistance, with 37 of the 70 tested having less than a 2.0 severity rating. Twenty-two of the entries with <2.0 rating were selections for early-maturity from University of Georgia breeding lines, indicating that the recurrent selection for blackleg resistance by the University of Georgia has resulted in excellent blackleg resistance. Ten of the entries with <2.0 rating were from commercial seed companies, and one entry was the check cultivar Q2.

In 2004, selections from University of Georgia lines that were segregating for maturity and flowering were made. These selections were tested in the blackleg nursery at Langdon, and will be tested for resistance at the University of Georgia blackleg nurseries as well. More selections from these material will provide excellent germplasm for breeders in the northern U.S. to use to improve blackleg resistance over current cultivars.

University of Georgia blackleg nursery. Disease pressure was high at the Griffin, GA nursery, with blackleg severity ranging from 0.7 to 9.0 (on a 0 to 9 scale) (Table 2). Only lines from the University of Georgia and the check cultivars Oscar and Flint showed adequate levels of resistance in this trial. The northern cultivars tested did not perform well, indicating that blackleg resistance in northern cultivars are vulnerable to highly aggressive strains of *L. maculans* as seen in Georgia.

Reference

Bradley, C. A., Parks, P. S., Chen, Y., and Fernando, W. G. D. 2005. First Report of Pathogenicity Groups 3 and 4 of *Leptosphaeria maculans* on Canola in North Dakota. Plant Dis. 89:776.

Table 1. Reaction of canola entries to blackleg at Langdon, ND in 2005.

Entry	Blackleg severity (0-5)[a]
1867 (sel from G04029)	1.3
1872 (sel from G04029)	1.3
1994 (sel from G04023)	1.3
1818 (sel from G02088)	1.4
1837 (sel from G03036)	1.4
1864 (sel from S4029)	1.4
1906 (sel from S4083)	1.4
CG17	1.4
Q2	1.4
SW PG 02-1008	1.4
1821 (sel from G02088)	1.5
1845 (sel from G03036)	1.5
1858 (sel from G03047)	1.5
G04083	1.5
1990 (sel from G04023)	1.5
2051 (sel from G04052)	1.5
MON11	1.5
MON12	1.5
1992 (sel from G04023)	1.6
MON13	1.6
SW H5289	1.6
1820 (sel from G02088)	1.7
1836 (sel from G03036)	1.7
1993 (sel from G04023)	1.7
G04026	1.7
MON14	1.7
MON18	1.7
1831 (sel from G03002)	1.8
1863 (sel from G04029)	1.8
1871 (sel from G04029)	1.8
1902 (sel from G04083)	1.8
G04086	1.8
2019 (sel from G04026)	1.8
MON4	1.8
G04068	1.9
1950 (sel from G02551)	1.9
CG14	1.9
1852 (sel from G03047)	2.0
1870 (sel from G04029)	2.0
2025 (sel from G04026)	2.0
2029 (sel from G04027)	2.0
CG19	2.0
Defender	2.0
MON15	2.0
1991 (sel from G04023)	2.1
MON10	2.1
MON9	2.1
1941 (sel from G01114)	2.2

2032 (sel from G04027)	2.2
MON1	2.2
MON7	2.2
1940 (sel from G01114)	2.3
CG2	2.3
MON3	2.4
MON6	2.4
1865 (sel from G04029)	2.5
MON17	2.5
2024 (sel from G04026)	2.6
AC Excel	2.7
2021 (sel from G04026)	2.8
2050 (sel from G04052)	2.8
CG1	2.8
2023 (sel from G04026)	2.9
CG20	2.9
CG9	3.0
MON8	3.0
MON16	3.5
MON2	3.5
MON5	4.2
Westar	4.8
P > F	**0.0001**
LSD 0.05	**0.9**
C. V. (%)	**30**

[a]Blackleg Disease Severity was rated by cutting 25 stems per plot and rating on a 0 to 5 scale, where:
0= No penetration or noticeable infection of the stem
1= 1/4 of the stem circumference infected; lesion superficial
2= 1/2 of the stem circumference infected; some penetration
3= 3/4 of the stem circumference infected; significant penetration
4= stem completely girdled, but intact at the base; significant penetration
5= stem girdled at the base, constricted, dry and brittle, may be completely severed; plant dead

Table 2. Reaction of canola cultivars to blackleg at Griffin and Plains, GA in 2005.

Entry	Plains Nursery Blackleg severity (0-9)[a]	Griffin Nursery Blackleg severity (0-9)[a]
45H21	6.3	8.3
CH586	8.3	9.0
Crosby	9.0	9.0
CYCLONE	6.7	7.3
Defender	5.3	8.0
Excel	7.0	8.0
EXP 2050602	2.7	7.7
FALCON	1.0	1.0
FLINT	1.0	1.0
G04023	2.0	1.3
G04026	3.3	2.3
G04027	3.0	2.3
G04068	1.7	0.7
G04083	3.7	1.7
HyClass 905	6.7	8.0
HyClass 910	5.0	8.7
Hyola 357 Magnum	8.7	9.0
Hyola 440	7.0	7.7
Nex830CL	3.7	8.3
OSCAR	2.3	2.3
Q2	6.7	8.0
SW5207	8.0	9.0
WESTAR	6.7	9.0
X445	5.3	8.7
P > F		**0.0001**
LSD 0.05		**1.3**
C.V. (%)		**13**

[a] Blackleg severity rated using the following scale:
0 = no externally visible symptoms
1 = 1 plant to 8% of the plants lodged, dead or with obvious basal canker
2 = 8 to 20% of the plants lodged, dead or with obvious basal canker
3 = 20 to 35% of the plants lodged, dead or with obvious basal canker
4 = 35 to 50% of the plants lodged, dead or with obvious basal canker
5 = 50 to 65% of the plants lodged, dead or with obvious basal canker
6 = 65 to 80% of the plants lodged, dead or with obvious basal canker
7 = 80 to 95% of the plants lodged, dead or with obvious basal canker
8 = over 95% of the plants lodged, dead or with obvious basal canker
9 = all plants dead without viable seed