

Report to Oklahoma Oilseed Commission

Biology and Management of Blackleg of Canola – 2010/2011 Crop Year

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Field trials on canola during the 2010/2011 cropping season focused on management of black leg. Trials evaluated genetic resistance, fungicide effectiveness and timing, and yield loss assessment. Rainfall during the cropping season was half of the 30-year average. The dry conditions made stand establishment in the fall a challenge. The drought conditions reduced black leg pressure and produced yield variability that made treatment comparisons difficult. In addition, below zero freezing conditions in February induced winter decline syndrome. Winter decline syndrome resulted in varying degrees of browning (necrosis) in internal areas of the plant crown near the soil line. Severely affected plants lodged while partially affected plants survived to harvest. Despite the adverse conditions, black leg developed and disease ratings were collected. However it was difficult at times to distinguish between black leg and winter decline syndrome.

Results from the field trials are summarized in this report. In interpreting the results, small differences in treatment values should not be overemphasized. Least significant differences (LSD) values are shown at the bottom of most tables. Unless two values differ by at least the LSD value shown, little confidence can be placed in the superiority of one treatment or variety over another.

Yield Response of Canola Varieties to Black Leg

Commercial canola varieties representing a range of reactions to black leg were selected based on results from screening trials in Georgia. The varieties HyClass 107W (susceptible), DKW 46-15 (moderately susceptible), and HyClass 154W (moderately resistant) were planted on 28 Sep. The varieties were inoculated with the black leg fungus growing on oat kernels, and with stubble from an infested canola field at seedling (2-3 leaves), early rosette (6-8 leaves), and late rosette (12-15 leaves) growth stages in the fall; and at bolting (first flower bud) in the spring. Non-inoculated plots served as the untreated check. Disease incidence, the percentage of plants with black leg, and disease severity, the degree of stem girdling by black leg were determined on stubble immediately after harvest on 4 Jun. Yields were adjusted to 10% moisture.

Table 1. Response of canola varieties to black leg at the Agronomy Research Station, Lake Carl Blackwell, 2010/2011.

Inoculation timing ¹	HC 107W (S)	DKW46-15 (MS)	HC 154W (MR)	Average
	Black leg incidence (%) ²			
Check	74.1	59.8	76.8	70.2 ab ³
Seedling	91.6	85.1	89.9	88.8 a
Early rosette	70.2	76.8	80.3	75.7 ab
Late rosette	78.3	59.8	73.9	70.7 ab
Bolting	58.9	58.9	72.4	63.4 b
Average	74.6 ab	68.1 b	78.7 a	
LSD _{0.05} ⁴				20.8
	Black leg severity (0-5) ⁵			
Check	1.3	1.0	1.7	1.3 b
Seedling	2.1	2.2	2.2	2.2 a
Early rosette	1.6	2.0	1.8	1.8 ab
Late rosette	1.7	1.2	1.3	1.4 b
Bolting	1.3	0.9	1.7	1.3 b
Average	1.6 a	1.5 a	1.7 a	
LSD _{0.05}				0.7
	Yield (lb/A) ⁶			
Check	1245	1783	1161	1396 a
Seedling	894	1192	1239	1108 a
Early rosette	1078	1619	1302	1333 a
Late rosette	1096	1705	1197	1332 a
Bolting	1221	1729	1344	1431 a
Average	1107 b	1605 a	1248 b	
LSD _{0.05}				NS

¹ Inoculation dates were seedling=18 Oct, early rosette=5 Nov, late rosette=7 Dec, and bolting=6 Mar.

² Percentage of plants with black leg

³ Values in a column or row followed by the same letter are not statistically different according to Fishers Least Significant Difference Test.

⁴ Least significant difference, NS=treatment effect not significant at P=0.05.

⁵ Stem girdling where 0 = no disease, 5 = stem completely girdled by black leg.

Black leg developed in the trial, but the severity was low (Table 1). Varieties responded in a similar pattern to black leg inoculation timing. Most plants developed disease, even in the non-inoculated check. However, both disease incidence and severity were greatest at the early (seedling) inoculation timing compared to the other inoculation times. Drought stress reduced yield in one of the replications, which contributed to yield variability. There was a trend for reduced yield at the seedling

inoculation stage but the effect of inoculation timing on yield was not statistically significant. Varieties responded similarly to black leg inoculation indicating they had similar levels of disease resistance. HC 154W was previously classified as the most resistant of the three varieties, but had the highest disease incidence. DKW46-15 was previously classified as intermediate, but had the lowest disease incidence in this trial. Varieties did not differ for disease severity. Yields of DKW-46-15 were higher than the other entries. In assessing the relationship between plot yields and plot disease ratings for the 60 plots, yields were negatively correlated with black leg incidence and severity. There was an 11 lb/acre reduction in yield for every increase in percent infection and a 313 lb/A reduction in yield for every increase in disease severity from 0 to 5.

Screening Canola Varieties and Breeding Lines for Resistance to Black Leg

Canola varieties and breeding lines were obtained from commercial seed companies and the breeding program at Kansas State University and planted in replicated plots. Plots were inoculated with the black leg fungus by broadcasting oat kernels colonized by the black leg fungus and canola stubble from an infested field at the seedling stage on 18 Oct 2011. Plots were evaluated for lodging caused by winter decline syndrome in April, and for black leg and internal symptoms of winter decline syndrome on stubble after harvest on 10 Jun. Yields were adjusted to 10% moisture.

Plots in parts of one of the three replications were drought stressed which caused variability in plant growth, disease development, and yield. Both black leg and winter decline syndrome developed in the trial and were evaluated, although it was difficult to distinguish the two diseases on the canola stubble after harvest. A total of 173 entries were screened in this trial. Data from released varieties are shown in Table 2. The varieties Dimension, Hornet, Hybristar, MH06E10, HyClass 110W, TCI 805, AAMU 607, and AAMU 6407 were most susceptible to black leg. The varieties Baldur, Kadore, HyClass 115W, DKW 41-10, and HPX 7341 had the lowest black leg ratings. The entries HyClass 115W, DKW 41-10, and HPX 7341 had low black leg and winter decline syndrome ratings. When plot yields and disease ratings were directly compared, yields were better correlated with winter decline syndrome than with black leg.

Fungicide Screening

Plots of DKW 46-15, a popular canola variety, were planted on 21 Sep and inoculated with the black leg fungus by broadcasting oat kernels colonized by the black leg fungus and canola stubble from an infested field at the seedling stage on 18 Oct. Fungicides representing the major mode of action groups were broadcast at the early rosette stage and again 2 weeks later. All fungicides were experimental except for Quadris, a strobilurin fungicide registered for use on canola. Disease incidence, the percentage of plants with black leg, and disease severity, the degree of stem girdling by black leg were determined on stubble immediately after harvest on 8 Jun. Yields were adjusted to 10% moisture.

Table 2. Reaction of selected canola varieties to black leg and winter decline syndrome, Agronomy Research Station, Lake Carl Blackwell, 2010/2011.

Entry	Black leg		Winter Decline Syndrome (%)		Yield (lb/A)
	Incidence (%) ¹	Severity (0-5) ²	28 Apr ³	10 Jun ⁴	
Baldur	73	1.9	8	15	879
Dimension	91	3.0	12	27	1308
Dynastie	75	2.1	16	41	797
Flash	83	2.6	18	24	838
Hornet	94	3.0	14	50	981
Safran	73	2.1	12	47	981
Sitro	88	2.9	43	20	511
Visby	85	2.1	20	30	1287
Hybristar	91	2.7	57	54	429
Hybrisurf	76	2.2	33	39	306
Hybrilux	81	2.7	43	23	429
Kadore	45	1.1	37	17	1287
Chrome	92	2.7	3	38	1328
MH06E10	100	3.7	28	50	572
MH06E11	93	2.9	35	32	940
MH06E4	91	2.8	35	51	817
HyClass 110W	92	2.9	17	39	1042
HyClass 115W	59	1.6	2	7	1001
HyClass 125W	82	2.5	3	33	1042
HyClass 154W	80	2.6	8	23	1124
DKW 41-10	61	1.5	0	10	797
DKW 44-10	82	2.5	12	22	1042
DKW 46-15	76	2.5	2	20	1185
DKW 47-15	82	2.5	8	20	899
Virginia	90	2.9	1	61	552
VSX-3	77	2.5	1	45	981
Athena	96	3.0	13	57	450
Amanda	85	2.7	13	36	797
Durola	75	2.3	20	37	470
HPX 501	81	2.3	20	19	981
HPX 7228	98	3.1	27	17	858
HPX 7341	64	1.8	2	15	1328
Kiowa	71	2.1	7	31	1001
Riley	78	2.0	4	15	1369
Sumner	84	2.1	26	29	858
Wichita	89	2.8	11	35	1308
Rossini	76	2.3	3	50	1124
TCI 805	97	3.5	32	27	838
TCI 806	90	2.9	32	42	593
AAMU 607	95	3.3	40	61	531
AAMU 3307	90	3.0	35	24	1165
AAMU 6207	85	2.9	47	27	266
AAMU 6407	95	3.2	49	41	266
LSD _{0.05} ⁵	23	1.0	28	44	658

- ¹ Percentage of plants with black leg after harvest.
² Stem girdling after harvest: 0 = no disease, 5 = stem completely girdled by black leg.
³ Percentage of plot lodged from winter decline syndrome.
⁴ Plants with internal crown discoloration from winter decline syndrome after harvest.
⁵ Least Significant Difference.

Black leg pressure was low in this trial and drought stress in areas of the trial adjacent to wooded borders increased yield variability. Quadris, the registered standard, and Proline, an experimental fungicide reduced disease incidence and severity compared to the untreated check (Table 3). None of the other fungicides reduced disease levels compared to the check. Yield was variable and did not differ among treatments.

Table 3. Evaluation of fungicides for control of black leg on the canola variety DKW 46-15 at the Entomology and Plant Pathology Research Farm, Stillwater, 2010/2011.

Treatment and rate/A (Timing) ¹	Black leg		Yield (lb/A)
	Incidence (%) ²	Severity (0-5) ³	
check	61 abc ⁴	1.2 ab	1893 a
Quadris 2.08F 6.2 fl oz (1,2)	31 de	0.4 cd	1749 a
Endura 70WG 5 oz (1,2)	63 ab	1.1 ab	2030 a
Caramba 50WG 4 oz (1,2)	57 abc	1.1 abc	1756 a
Proline 4F 5.7 fl oz (1,2)	21 e	0.3 d	1700 a
Folicur 3.6F 7.2 fl oz (1,2)	41 cde	0.7 bcd	1130 a
Topsin 70W 1.0 lb (1,2)	71 a	1.4 a	1991 a
Bravo 6F 1.5 pt (1,2)	54 abc	1.1 abc	1458 a
ProPhyt 4.2L 2 pt (1,2)	58 abc	1.2 ab	1795 a
Quilt 1.66F 14 fl oz (1,2)	43 bcd	0.8 abcd	2095 a
LSD _{0.05} ⁵	21	0.7	NS

- ¹ Application dates of 1=21 Oct and 2= 5 Nov.
² Percentage of plants with black leg after harvest.
³ Stem girdling after harvest: 0 = no disease, 5 = stem completely girdled by black leg.
⁴ Values in a column followed by the same letter are not statistically different at P=0.05 according to the Least Significant Difference Test.
⁵ Least Significant Difference, NS=treatment effect not significant at P=0.05.

Fungicide Application Timing

The effectiveness of the registered fungicide Quadris was evaluated at various application timings and number of applications. Quadris was applied once, twice, and three times at all possible combinations of application timings at the seedling, early rosette, and late rosette stages of crop development. Treated plots were compared to non-treated check plots. Disease incidence, the percentage of plants with black leg, and disease severity, the degree of stem girdling by black leg were determined on stubble immediately after harvest on 8 Jun. Yields were adjusted to 10% moisture.

Disease pressure was low in this trial and there were no differences in black leg levels or yield among treatments (Table 4).

Table 4. Evaluation of fungicide timing for control of black leg on the canola variety DKW 46-15 at the Entomology and Plant Pathology Research Farm, Stillwater, 2010/2011.

Treatment and rate/A (Timing) ¹	Black leg		Yield (lb/A)
	Incidence (%) ²	Severity (0-5) ³	
check	53 a ⁴	0.9 a	1564 a
Quadris 2.08F 6.2 fl oz (S)	42 a	0.7 a	2441 a
Quadris 2.08F 6.2 fl oz (S,ER)	39 a	0.7 a	2231 a
Quadris 2.08F 6.2 fl oz (S,ER,LR)	61 a	1.2 a	2343 a
Quadris 2.08F 6.2 fl oz (ER)	56 a	1.1 a	2144 a
Quadris 2.08F 6.2 fl oz (S, LR)	58 a	0.9 a	1785 a
Quadris 2.08F 6.2 fl oz (ER, LR)	52 a	1.0 a	2031 a
Quadris 2.08F 6.2 fl oz (LR)	44 a	0.8 a	1933 a
LSD _{0.05} ⁵	26	0.6	NS

¹ Application timings were S=seedling on 14 Oct, ER=early rosette on 5 Nov, and LR=late rosette on 19 Nov.

² Percentage of plants with black leg after harvest.

³ Stem girdling after harvest: 0 = no disease, 5 = stem completely girdled by black leg.

⁴ Values in a column followed by the same letter are not statistically different at P=0.05 according to the Least Significant Difference Test.

⁵ Least Significant Difference, NS=treatment effect not significant at P=0.05.