Chapter One

DISEASES OF CEREALS

BARLEY (*Hordeum vulgare*)

BACTERIAL BLIGHT

Xanthomonas translucens

Cultural: The disease is seed-borne and can also overwinter on crop debris. Sowing seed from uninfected fields and rotation with non-cereal crops should reduce disease incidence.

Resistant Cultivars: None.

Chemical: None.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

BARLEY STRIPE MOSAIC

Barley stripe mosaic virus

Cultural: Use pedigreed seed. Control wild oats (see Notes).

Resistant Cultivars: None.

Chemical: None.

Notes:

1. The virus is rare or absent in the various classes of pedigreed seed, i.e. select, foundation, registered, and certified seed.

2. Wild oats are a repository for BSMV which can be transmitted to barley via leaf contact (2).

3. Barley from Canada intended for seed use in Montana must be certified free of seed-borne barley stripe mosaic virus.

References:

1. Chiko, A.W. 1973. Barley stripe mosaic in the Canadian Prairies in 1972. Can. Plant Dis. Surv. 53: 107-111.

2. Chiko, A.W. 1983. Reciprocal contact transmission of barley stripe mosaic virus between wild oats and barley. Plant Dis. 67: 207-208.

BARLEY YELLOW DWARF

Barley yellow dwarf virus

Cultural: Seed early to avoid aphid infestation and damage.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
none	none	CDC Sisler	CDC Copeland, AC Metcalfe	all others

Chemical: None.

References:

1. Gill, C.C. 1970. Epidemiology of barley yellow dwarf in Manitoba and effect of the virus on yield of cereals. Phytopathology 60: 1826-1830.

2. Haber, S. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre. Winnipeg, MB.

COMMON ROOT ROT

Cochliobolus sativus, Fusarium spp.

Cultural: Rotations that include several years of non-host crops (rapeseed, flax, legumes) or growing bromegrass will reduce inoculum in the soil and may reduce levels of disease. Deep seeding increases disease severity and should be avoided if possible. Use adequate levels of fertilizer (N + P) on stubble-planted barley to reduce disease severity. Under reduced tillage, especially direct seeding, disease severity may decrease in comparison to conventional tillage.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
None	CDC Alamo, CDC Battleford, Bedford, CDC Bold, B1602, CDC Clyde, Desperado, Excel, CDC Gainer, CDC Kendall, Lacey, Legacy, CDC McGwire, Manley, Newdale, Peregrine, AC Ranger, Rivers, AC Rosser, CDC Silky, Stockford, Tradition, CDC Trey, Trochu, CDC Unity, Virden, Vivar, Xena, CDC Yorkton	Alston, AC Bacon, Bentley, Binscarth, AC Bountiful, Bronco, Calder, CDC Candle, CDC Coalition, Conrad, CDC Cowboy, Condor, Conlon, CDC Copeland, CDC Dawn, CDC Dolly, CDC Earl, Enduro, Falcon, CDC Freedom, AC Harper, Harrington, HB 805, CDC Helgason, Kasota, McLeod, CDC Meredith, Merit, Merlin, AC Metcalfe, Millhouse, AC Oxbow, Phoenix, Ponoka, CDC Reserve, Robust, Seebe, Selkirk, CDC Sisler, CDC Springside, Stander, CDC Stratus, CDC Thompson, Tyto	CDC Aurora Nijo, Jaeger, CDC Kamsack, AC Lacombe, CDC Landis, CDC Laurence, Mahigan, Manny, CDC Mayfair, Niobe, Niska, CDC Rattan, CDC Select, Stein, Sundre, Tercel, CDC Tisdale	Chigwell, CDC Fibar (see Note 1)

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; maneb (COM) LI; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triadimenol (COM) SU; triticonazole (COM) SU; triticonazole + thiram SU (see Note 2).

Limitations: As per label.

Notes:

1. The resistance status of the cultivars Champion, Dillon, Formosa, CDC Mindon and Westford is undetermined due to insufficient data.

2. Seed treatment reduces seedling blight caused by these fungi but does not control root rot in post-seedling plants.

References:

1. Bailey, K.L. and L.J. Duczek. 1996. Managing cereal diseases under reduced tillage. Can. J. Plant Pathol. 18: 159-167.

2. Conner, R.L. et al. 1996. Influence of crop rotation on common root rot of wheat and barley. Can. J. Plant Pathol. 18: 247-254.

3. Duczek, L.J. and Piening, L.J. 1982. Effect of seeding depth, seeding date, and seed size on common root rot of spring barley. Can. J. Plant Sci. 62: 885-891.

4. Piening, L.J. *et al.* 1976. Barley losses due to common root rot in the Prairie Provinces of Canada. Can. Plant Dis Surv. 56: 41-45.

5. Piening, L.J. *et al.* 1983. Effect of fertilizer on root rot of barley on stubble and fallow land. Can. J. Plant Pathol. 5: 136-139.

6. Piening, L.J. and Orr, D. 1988. Effects of crop rotation on common root rot of barley. Can. J. Plant Pathol. 10: 61-65.

7. Turkington, T.K. 2008. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lacombe, AB.

8. Turkington, T.K. 1998. The influence of tillage and rate of nitrogen fertilizer on common root rot of barley. Can. J. Plant Pathol. 20: 130-131.

COVERED SMUT and FALSE LOOSE SMUT

Ustilago hordei and *U. nigra*

Cultural: None (see Note 1).

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
Alston, CDC Aurora Nijo, Binscarth, Calder, Champion, Chigwell, CDC Clyde, Desperado, CDC Kamsack, Kasota, McLeod, Mahigan, Manny, CDC Mayfair, CDC Mindon, Ponoka, CDC Rattan, Seebe, Selkirk, Stockford, Sundre, Rivers, CDC Trey, Tyto, Vivar	CDC Alamo, CDC Battleford, Bentley, CDC Bold, AC Bountiful, Bronco, CDC Coalition, Conrad, CDC Cowboy, CDC Earl, Enduro, Falcon, CDC Freedom, HB 805, CDC Helgason, Lacey, AC Lacombe, CDC Landis, CDC Laurence, Legacy, CDC McGwire, Manley, CDC Meredith, Merit, Merlin, Millhouse, Newdale, Niobe, Niska, AC Rosser, CDC Select, Stein, CDC Thompson, Tradition, Trochu, CDC Yorkton	B1602, AC Bacon, Bedford, Conlon, CDC Copeland, CDC Dolly, Excel, AC Harper, AC Metcalfe, AC Oxbow, Phoenix, AC Ranger, Robust, CDC Silky, CDC Springside, CDC Stratus, Tercel, Virden	Condor, CDC Dawn, CDC Gainer, Jaeger, Harrington, CDC Kendall, CDC Reserve, CDC Sisler, Stander, Xena	CDC Candle (see Note 2)

Chemical: Treat seed with - carbathiin + thiram SU; difenoconazole + metalaxyl-M (COM) SU; maneb (COM) LI; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triadimenol SU (COM); triticonazole (COM) SU; triticonazole + thiram (COM) SU (see Notes 3, 4, 5).

Limitations: Treated grain must not be mixed with untreated grain for feed or sale. If treated seed has been stored longer than the time specified on the label, it should be buried at a depth and location where it will not be accessible to animals or birds, and will not contaminate water supplies.

Notes:

1. There are presently no standards in the Seeds Act for covered and false loose smuts in pedigreed barley seed.

2. No ratings given for Dillon, CDC Fibar, Formosa, and Westford because of insufficient data.

3. Seed of resistant and moderately resistant cvs. and seed of any cultivar observed to be free of smut should not require chemical treatment. If smut was observed in a crop which is being used for seed, or is detected by a laboratory seed test, it should be treated. When using seed of a cv. that is susceptible or moderately susceptible to smut and the presence of smut is uncertain, it would be wise to treat the seed.

4. Triadimenol is available only for custom-treated seed lots.

5. Registered seed treatments may have minimal effects with hulless barley (2).

References:

1. Menzies, J.G. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

2. Evans, I.R. 1999. Personal communication. Alberta Agr., Food & Rural Development, Edmonton AB.

ERGOT

Claviceps purpurea

Cultural: Avoid sowing barley, wheat, rye or triticale on land where an ergoty crop was harvested the preceding year or near headlands and roadsides unless they were mowed at anthesis (flowering) the previous year to prevent sclerotia formation.

Resistant Cultivars: None.

Chemical: None.

Notes: Resistance to ergot in barley is by exclusion of inoculum from the floret until it is fertilized. Factors such as low soil-available copper, occasionally low boron, or late application of herbicides, all of which reduce pollen fertility will greatly increase susceptibility to ergot of any cultivar. Sandy, high organic and black loamy soils are most often copper deficient and subject to ergot infestation.

References:

1. Seaman, W.L. 1980. Ergot of grains and grasses. Can. Dep. Agric. Publ. 1438 (rev.) 16 pp.

2. Evans, I.R. 1998. Personal communication. Alberta Agric., Food and Rural Development, Edmonton, AB.

3. Evans, I.R. *et al.* 1990. Ergot control in wheat and barley with soil applied copper sulphate. Can. J. Plant Pathol. 12: 333.

4. Evans, I.R., *et al.* 1995. Copper, a key element for disease control in wheat and barley crops in Alberta. (Abstract) Phytopathology 85: 1125.

5. Agri-fax. 1995. Copper deficiency: diagnosis and correction. Agdex 532-2, 8 pp. Alberta Agr., Food and Rural Development, Edmonton AB.

EYESPOT

Pseudocercosporella herpotrichoides

Cultural: Rotation to crops other than cereals and turning under barley straw and stubble is an effective means of keeping the disease under control.

Resistant Cultivars: None.

Chemical: None.

References:

1. Slopek, S.W. 1989. First report of eyespot (*Pseudocercosporella herpotrichoides*) in spring barley in Alberta. Can. Plant Dis. Surv. 69: 125-127.

FLAME CHLOROSIS

Soil transmitted virus-like agent

Cultural: If flame chlorosis is identified infecting more than 5% of plants in the field, rotate that field out of cereals for one or more years (1, 2). Flame chlorosis reaches most damaging levels in fields with many years of continuous cultivation in barley (or barley and wheat), and where seed type, seeding practices and seeding conditions result in slow germination and emergence. To reduce risk of flame chlorosis, use vigorous seed and avoid deep seeding.

Resistant Cultivars: None.

Chemical: None.

Notes:

1. Flame chlorosis is a newly recognized disease which affects primarily barley and wheat, occasionally oat and some graminaceous weeds. The disease is most prevalent in western Manitoba and the eastern Red River Valley south of Winnipeg (4).

2. The disease has not been confirmed in barley or other cereal crops in western Canada since 2003 (5).

References:

1. Haber, S. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

2. Haber, S., Barr, D.J.S., and Platford, R.G. 1991. Observations on the distribution of flame chlorosis in Manitoba and its association with certain zoosporic fungi and the intense cultivation of cereals. Can. J. Plant Pathol. 13: 241-246.

3. Haber, S. *et al.* 1990. Flame chlorosis: a new, soil-transmitted virus-like disease of barley in Manitoba, Canada. J. Phytopath. 129: 245-256.

4. Haber, S. *et al.* 1992. 1992 survey of flame chlorosis in Manitoba and eastern Saskatchewan. Can. Plant Dis. Surv. 73: 1, 73-74.

5. Haber, S. and Kurz, R. 2004. Cereal virus situration in Manitoba in 2003. Can. Plant Dis. Surv. 84: 54.

FUSARIUM HEAD BLIGHT (SCAB)

Fusarium graminearum, F. poae, other *Fusarium* spp.

Cultural: Incorporation of straw and stubble and rotations away from barley, oats, wheat and corn (also hosts) should reduce disease levels. Barnyard grass and quackgrass should be controlled as they are non-crop hosts.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
none	AC Bacon, CDC Candle, Conlon, Condor, CDC Cowboy, CDC Dawn, CDC Dolly, CDC Freedom, Harrington, CDC McGwire, CDC Mindon, Phoenix, CDC Rattan, Seebe, Xena (See Note 3)	CDC Aurora Nijo, Bedford, AC Bountiful, Bronco, Calder, Champion, CDC Coalition, CDC Copeland, Enduro, CDC Fibar, CDC Gainer, HB805, CDC Kendall, CDC Landis, McLeod, Manley, Merlin, AC Metcalfe, Merit, CDC Meredith, Millhouse, Newdale, AC Oxbow, Ponoka, CDC Sisler, CDC Stratus, Tercel, CDC Thompson, CDC Tisdale, CDC Trey, Trochu	CDC Alamo, Bentley, CDC Helgason, AC Harper, Legacy, Manny, CDC Mayfair, Niobe, CDC Reserve, CDC Select, Stockford, Tyto,	Alston, B1602, CDC Battleford, Binscarth, CDC Bold, Chigwell, CDC Clyde, Desperado, Dillon, CDC Earl, Excel, Falcon, Jaeger, CDC Kamsack, Kasota, Lacey, AC Lacombe, CDC Laurence, Mahigan, Niska, Peregrine, AC Ranger, Robust, AC Rosser, Selkirk, CDC Silky, CDC Springside, Stander, Sundre, Tradition, Virden, Vivar, Westford, CDC Yorkton

Chemical: Spray foliage with - prothioconazole (COM) SC.

Limitations: Preharvest interval - 30 days (prothioconazole).

Notes:

1. The disease is most prevalent and severe in Manitoba and south-eastern Saskatchewan; it is less prevalent in central and western Saskatchewan and rare in Alberta.

2. Compared to wheat, barley crops generally show a greater incidence (number of spikes affected) but a lower severity (proportion of spike affected by blight) to fusarium head blight.

3. No ratings given for Conrad, Formosa and Stein because of insufficient data.

References:

1. Tekauz, A. 2008. Personal communication. Agric. and Agri-Food Can., Cereal Research Centre, Winnipeg, MB.

2. Tucker, J. 2008. Personal communication. Agric. and Agri-Food Can., Brandon Research Centre, Brandon MB.

LEAF STRIPE

Pyrenophora graminea

Cultural: Delaying seeding until soil is warm will often reduce the number of affected plants grown from infected seed. Do not plant seed harvested from infested fields, unless treated with a registered fungicide.

Resistant Cultivars:

Resistant	Intermediate	Susceptible
Condor, Seebe, Virden	B1602, Bedford, Manley, Stein	Harrington (see Notes)

Chemical: Treat seed with - carbathiin + thiram (COM) SU; tebuconazole (COM) SU; triadimenol (COM) SU.

Limitations: As per label.

Notes: The resistance status of most currently-grown cultivars is unknown as no testing for barley cultivar reaction to leaf stripe has been undertaken for many years. The cultivars shown are listed only in the three broad categories of 'resistant', 'intermediate' and 'susceptible' since there has been no testing done with current pathogen pathotypes.

References:

1. Tekauz, A. 2007. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg, MB.

2. Tekauz, A. 1991. Determination of barley cultivar reaction to *Pyrenophora graminae* using disease nurseries. Can. J. Plant Pathol. 12: 57-62.

3. Tekauz, A., F.R. Harper and J.G.N. Davidson. 1985. Effect of date of seeding and seed treatment fungicides on infection of barley by *Pyrenophora graminea*. Can. J. Plant Pathol. 7: 408-416.

LOOSE SMUT

Ustilago nuda

Cultural: None.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
AC Bountiful, Calder, CDC Coalition, CDC Helgason, CDC Meredith, AC Metcalfe, CDC Mindon, AC Oxbow, Ponoka (See Note 3)	CDC Alamo, CDC Rattan, CDC Select, CDC Springside	Conlon, CDC Clyde, HB 805, CDC Kamsack, Lacey, Legacy, Robust, CDC Silky, CDC Tisdale, Vivar	Alston, B1602, AC Bacon, CDC Battleford, Bedford, Bentley, CDC Bold, Bronco, Chigwell, Condor, Conrad, CDC Copeland, CDC Cowboy, CDC Dawn, Desperado, CDC Earl, Excel, Falcon, CDC Freedom, CDC Gainer, AC Harper, Harrington, Jaeger, CDC Kendall, AC Lacombe, CDC Laurence, CDC McGwire, Manley, Merit, Merlin, Niobe, Niska, Peregrine, Phoenix, AC Ranger, AC Rosser, Selkirk, CDC Sisler, Stander, Stein, CDC Stratus, Sundre, Tercel, CDC Thompson, CDC Trey, Trochu, Virden, Xena, CDC Yorkton	CDC Aurora Nijo, Binscarth, CDC Candle, Champion, CDC Dolly, Enduro, Kasota, CDC Landis, McLeod, Mahigan, CDC Mayfair, Millhouse, Newdale, CDC Reserve, Seebe, Stockford, Tradition, Tyto (See Note 1)

Chemical: Treat seed with - carbathiin + thiram (COM) SU; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; triadimenol (COM) SU; triticonazole (COM) SU; triticonazole + thiram (COM) SU. (See Note 3).

Limitations: Treated grain must not be mixed with untreated grain for feed or sale. Treated left-over seed may be saved for planting the following year unless it has been treated with a dual-purpose (fungicide/ insecticide) formulation; otherwise, it should be buried to a depth and location where it will not be accessible to animals or birds and will not contaminate water supplies, or double seeded if left-over quantities are limited.

Notes:

1. The resistance status of cvs. is assessed by artificial inoculation and is therefore genetic. Some cvs., particularly two-rowed types, have good field resistance, based on exclusion of spores to the flowers; but at this time, there is no practical means to measure this type of resistance.

2 No ratings given for Dillon, CDC Fibar, Formosa, Manny and Westford because of insufficient data.

3. Seed of resistant and moderately resistant cvs. and seed of any cultivar observed to be free of smut should not require chemical treatment. If smut was observed in a crop which is being used for seed, or is detected in a seed test, it should be treated. When using seed of a cv. that is susceptible or moderately susceptible to smut and the presence of smut is uncertain, it would be wise to treat the seed.

References:

1. Menzies, J.G. 2008. Personal Communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

NETTED NET BLOTCH

Pyrenophora teres f. *teres*

Cultural: Turning under of straw and stubble, on which the fungus may over-winter, reduces the amount of available inoculum for the following year's crop. Barley should not follow barley in heavily infested fields.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
Vivar	CDC Earl, CDC Freedom, CDC Helgason	Alston, Binscarth, AC Bountiful, Calder, Chigwell, CDC Clyde, Conlon, CDC Copeland, CDC Cowboy, Falcon, CDC Gainer, AC Harper, CDC Kendall, CDC Landis, CDC McGwire, Mahigan, Merit, Newdale, AC Oxbow, AC Ranger, AC Rosser, CDC Stratus, Tercel, CDC Tisdale, CDC Trey, CDC Yorkton	CDC Aurora Nijo, CDC Battleford, Bentley, CDC Candle, Condor, CDC Dawn, Dillon, HB805, Kasota, AC Lacombe, CDC Laurence, Manley, Manny, CDC Mayfair, CDC Meredith, Merlin, Millhouse, Niobe, Ponoka, CDC Rattan, CDC Select, Selkirk, Stockford, Sundre, Virden, Westford	CDC Alamo, B1602, AC Bacon, Bedford, CDC Bold, Bronco, Champion, CDC Coalition, Conrad, Desperado, CDC Dolly, Excel, CDC Fibar, Formosa, Harrington, Jaeger, CDC Kamsack, McLeod, Lacey, Legacy, AC Metcalfe, CDC Mindon, Niska, Pergrine, Phoenix, CDC Reserve, Robust, Seebe, CDC Silky, CDC Sisler, CDC Springside, Stander, Stein, CDC Thompson, Tradition, Trochu, Tyto, Xena (See Note 3)

Chemical: Treat seed with - carbathiin + thiram (COM) SU; triadimenol (COM) SU (see Notes 4, 5).

Spray foliage with - azoxystrobin + propiconazole (COM) SU; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SU; pyraclostrobin (COM) EC.

Limitations: Pre-harvest interval - 30 days (prothioconazole); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than flowering.

Notes:

1. The disease is also known as 'the net-form of net blotch'.

2. Casual observations suggest that netted net blotch currently is more common and widespread in the prairie provinces than is spotted net blotch. The resistance status of barley cultivars to netted net blotch and spotted net blotch often is different and it is therefore difficult to assign a rating for 'net blotch' as this will vary depending on the prevalence of the two forms in a particular region.

3 In farm fields, six-rowed barley cultivars generally show less damage from this disease than do the two-rowed types.

4. Seed treatment reduces the chances of introducing new races of the pathogen to barley fields and may reduce the incidence of seedling blight.

5. Seed treatment will not protect post-seedling plants from infection.

References:

1. Piening, L.J. 1968. Development of barley net blotch from infested straw and seed. Can. J. Plant Sci. 48: 623-625.

2. Tekauz, A. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

3. Tekauz, A. 1990. Characterization and distribution of pathogenic variation in *Pyrenophora teres* f. *teres* and *P. teres* f. *maculata* from western Canada. Can J. Plant Pathol. 12: 141-148.

SCALD

Rhynchosporium secalis

Cultural: Turning under of crop remains or a 1-year rotation from barley reduce the available inoculum. Bromegrass should not be used in the rotation as it is susceptible to scald. Continuous production of the same resistant variety under intensive management should be avoided to reduce the risk of virulent pathotype selection that can lead to breakdown of resistance.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
CDC Dawn, Dillon, CDC Earl, CDC Gainer, AC Harper, Kasota, Mahigan, Manny, Sundre, CDC Silky	AC Bacon, CDC Bold, Chigwell, CDC Fibar, Jaeger, Niska, Ponoka, Seebe, Westford	CDC Alamo, CDC Dolly, Enduro, Falcon, CDC McGwire, Niobe, Peregrine, CDC Rattan, Trochu, Vivar	Alston, CDC Battleford, Binscarth, Bronco, CDC Cowboy, CDC Clyde, CDC Freedom, HB805, CDC Kamsack, AC Lacombe, Millhouse, Newdale, AC Ranger, CDC Sisler, Stockford, CDC Thompson, CDC Trey, Tyto, CDC Yorkton	CDC Aurora Nijo, B1602, Bedford, AC Bountiful, Calder, CDC Candle, Champion, CDC Coalition, Condor, Conlon, Conrad, CDC Copeland, Excel, Formosa, Harrington, CDC Helgason, CDC Kendall, Lacey, Legacy, CDC Laurence, McLeod, Manley, Merit, Merlin, AC Metcalfe, CDC Mindon, AC Oxbow, Phoenix, Robust, AC Rosser, CDC Select, Selkirk, CDC Springside, Stander, Stein, CDC Stratus, Tercel, CDC Tisdale, Tradition, Virden, Xena

Chemical: Treat seed with - triadimenol (COM) SU (see Note 3).

Spray foliage with - azoxystrobin + propiconazole (COM) SU; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SC; pyraclostrobin (COM) EC.

Limitations: Preharvest interval - 30 days (prothioconazole); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than end of flowering.

Notes:

1. Pathotypes of *R. secalis*, capable of attacking several of the resistant cultivars, exist in western Canada. Presently, these are not predominant nor widespread, but they can occur in individual fields.

2. Some herbicides inhibit the sporulation of the pathogen and may reduce infections within a field (4).

3. Seed treatment with triadimenol may provide some early season disease suppression.

References:

1. Orr, D.D. and Turkington, T.K. 1997. Foliar disease development on Harrington barley - Lacombe 1997. PMRR, 1997.

2. Orr, D.D. and Turkington, T.K. 1996. The effect of seed dressing on early scald infection - Lacombe 1996. PMRR, 1996.

3. Skoropad, W.P. 1960. Barley scald in the Prairie Provinces of Canada. Phytopathol. News 6: 25-27.

4. Skoropad, W.P. and Kao, W.W. 1965. The effect of some herbicides on sporulation of *Rhynchosporium secalis*. Phytopathology 55: 43-45.

5. Tekauz, A. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

6. Turkington, T.K. 2008. Personal communication. Agric. & Agri-Food Canada, Res. Centre, Lacombe AB.

7. Xi, K. 2008. Personal communication. Alberta Agric., Food and Rural Dev., Lacombe AB.

8. Xi, K., Turkington, T.K., Helm, J.H., Briggs, KG., Tewari, J.P., Ferguson, J., and Kharbanda, P.D. 2003. Distribution of pathotypes of *Rhynchosporium secalis* and cultivar reaction on barley in Alberta. Plant Dis. 87: 391-396.

SEEDLING BLIGHT, DAMPING OFF

Cochliobolus sativus, Fusarium spp.*, Pyrenophora teres, Pythium* spp., other fungi

Cultural: None.

Resistant Cultivars: None.

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; fludioxonil (COM) SN; maneb (COM) LI; metalaxyl (COM) SN; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triticonazole (COM) SU; triticonazole + thiram (COM) SU.

Limitations: As per label.

Notes: Chemical seed treatment reduces infection at early stages of plant growth, but will not protect post-seedling plants from infection by these same fungi.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

SPECKLED LEAF BLOTCH

Septoria passerinii, Stagonospora avenae

Cultural: Rotation to crops other than barley and turning under of barley straw and stubble help to reduce infection.

Resistant Cultivars:

Resistant	Intermediate	Susceptible
Falcon (see Note 1)	AC Bacon, CDC Cowboy, Kasota, AC Lacombe, Mahigan, CDC Silky	all others

Chemical: Treat seed with - difenoconazole + metalaxyl-M (COM) SU (see Note 2).

Spray foliage with - azoxystrobin + propiconazole (COM) SU; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC.

Limitations: Preharvest interval - 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin).

Notes:

1. Resistance status is based on the presence (S), absence (R) or only limited development (I) of visible pycnidia (dark dot-sized fruiting bodies containing the pycnidiospores that spread the disease within and among plants) on foliage; damage to foliage, i.e. yellow blotches, may still develop in 'resistant' cultivars.

2. Seed treatment will not protect post-seedling plants from infection.

References:

1. Tekauz, A. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

SPOT BLOTCH

Cochliobolus sativus

Cultural: Turning under of crop residue and several years rotation with non-cereal crops helps to reduce infection.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
CDC Battleford, CDC Clyde, Lacey, CDC Springside, CDC Tisdale	Alston, B1602, Binscarth, Desperado, Excel, CDC Kamsack, Legacy, Niska, Peregrine, AC Ranger, Robust, AC Rosser, CDC Silky, CDC Sisler, Stander, Tradition, Virden, CDC Yorkton	CDC Alamo, AC Bacon, Bedford, Bentley, AC Bountiful, Bronco, Calder, Chigwell, CDC Coalition, CDC Cowboy, CDC Earl, Falcon, Formosa, AC Harper, Jaeger, CDC Helgason, Kasota, AC Lacombe, CDC Landis, CDC Laurence, CDC McGwire, Mahigan, CDC Mayfair, AC Metcalfe, CDC Mindon, Newdale, AC Oxbow, CDC Rattan, Selkirk, Stockford, Sundre, CDC Trey, Trochu, Tyto, Vivar	Champion, Conlon, CDC Dawn, Dillon, Enduro, CDC Freedom, Manley, Manny, CDC Meredith, Merit, Millhouse, Phoenix, Ponoka, CDC Reserve, CDC Select, CDC Stratus	CDC Aurora Nijo, CDC Bold, Condor, CDC Copeland, CDC Dolly, CDC Fibar, CDC Gainer, Harrington, HB805, CDC Kendall, McLeod, Niobe, Seebe, Stein, Tercel, CDC Thompson, Xena

Chemical: Spray foliage with – azoxystrobin + propiconazole (COM) SU; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SC; pyraclostrobin (COM) EC.

Limitations: Preharvest interval - 30 days (prothioconazole); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than the end of flowering.

Notes: No ratings for CDC Candle, Conrad, Merlin and Westford because of insufficient data.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

2. Tekauz, A. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

3. Tucker, J. 2008. Personal communication. Agric. & Agri-Food Can. Brandon Res. Centre.

SPOTTED NET BLOTCH

Pyrenophora teres f. *maculata*

Cultural: Turning under of straw and stubble, on which the fungus may over-winter, reduces the amount of available inoculum for the following year's crop. Barley should not follow barley in heavily infested fields.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
CDC Battleford, Bentley, Calder, CDC Landis, CDC Meredith, Niobe, CDC Reserve, CDC Tisdale, CDC Trey	Alston, Binscarth, AC Bountiful, Bronco, Chigwell, CDC Coalition, Conlon, CDC Clyde, CDC Cowboy, CDC Dawn, Desperado, Dillon, CDC Earl, Enduro, CDC Freedom, HB805, CDC Helgason, CDC Kendall, AC Lacombe, Legacy, CDC Laurence, CDC McGwire, Manley, CDC Mayfair, Merit, CDC Mindon, Newdale, Niska, Ponoka, AC Ranger, AC Rosser, CDC Select, Stander, CDC Stratus, CDC Thompson, Trochu, Virden, Vivar, CDC Yorkton	CDC Aurora Nijo, Bedford, CDC Bold, CDC Candle, Champion, CDC Copeland, Excel, Falcon, Formosa, CDC Gainer, AC Harper, CDC Kamsack, Kasota, Lacey, McLeod, Mahigan, Manny, Merlin, AC Metcalfe, AC Oxbow, Peregrine, CDC Rattan, Selkirk, CDC Silky, CDC Sisler, CDC Springside, Stein, Sundre, Tradition, Tyto, Xena	CDC Alamo, B1602, AC Bacon, Condor, Conrad, CDC Dolly, Harrington, Jaeger, Millhouse, Phoenix, Robust, Seebe, Stockford, Westford	CDC Fibar, Tercel

Chemical: Treat seed with - carbathiin + thiram (COM) SU; triadimenol (COM) SU (see Notes 3, 4).

Spray foliage with - azoxystrobin + propiconazole (COM) SU; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SC; pyraclostrobin (COM) EC.

Limitations: Pre-harvest interval - 30 days (prothioconazole); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than flowering.

Notes:

1. The disease is also known as ‘the spot-form of net blotch’.

2. Casual observations suggest that spotted net blotch may not be as common as in the past; however, it may still be prevalent in specific locations or certain regions. The resistance status of barley cultivars to spotted net blotch and netted net blotch often is different and it is therefore difficult to assign a rating for ‘net blotch’ as this will vary depending on the prevalence of the two forms in a particular region.

3. Seed treatment reduces the chances of introducing new races of the pathogen to barley fields and may reduce the incidence of seedling blight.

4. Seed treatment will not protect post-seedling plants from infection.

References:

1. Piening, L.J. 1968. Development of barley net blotch from infested straw and seed. Can. J. Plant Sci. 48: 623-625.

2. Tekauz, A. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

3. Tekauz, A. 1990. Characterization and distribution of pathogenic variation in *Pyrenophora teres* f. *teres* and *P. teres* f. *maculata* from western Canada. Can. J. Plant Pathol. 12: 141-148.

STEM RUST

Puccinia graminis f. sp. *tritici*, *P. graminis* f. sp. *secalis*,

Cultural: Early seeding usually will reduce the levels of rust damage in the more susceptible cultivars.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
none (see Notes)	CDC Battleford, Bedford, Bentley, CDC Bold, AC Bountiful, Bronco, CDC Candle, CDC Clyde, CDC Coalition, Condor, Conlon, CDC Copeland, CDC Cowboy, Desperado, CDC Earl, Excel, Falcon, CDC Gainer, CDC Kamsack, Kasota, Lacey, AC Lacombe, CDC Landis, Legacy, Mahigan, Manley, CDC Mayfair, CDC Meredith, AC Metcalfe, Millhouse, Newdale, Niska, AC Oxbow, AC Ranger, AC Rosser, Robust, Selkirk, CDC Silky, CDC Sisler, Stander, Stein, CDC Stratus, Tercel, CDC Thompson, Tradition, CDC Trey, Trochu, Virden, Vivar, Westford, CDC Yorkton, Xena	Alston, CDC Aurora Nijo, B1602, AC Bacon, Calder, Champion, CDC Dawn, CDC Freedom, HB 805, AC Harper, CDC Helgason, Jaeger, CDC McGwire, Merit, CDC Mindon, Niobe, Peregrine, CDC Rattan, CDC Select, Selkirk, Sundre, CDC Tisdale, Tyto	CDC Alamo, Binscarth, Conrad, CDC Dolly, CDC Fibar, Harrington, CDC Kendall, CDC Laurence, McLeod, Manny, Merlin, Phoenix, Seebe, CDC Springside, Stockford	Enduro, Ponoka

Chemical: Spray foliage with - propiconazole (COM) EC.
Limitations: Preharvest interval - 45 days (propiconazole).

Notes:

1. The resistance conferred by the rpg4 gene is host-genotype-environment sensitive and may under certain situations result in abnormally high infection, particularly at higher temperatures.

2. A race of stem rust (QCCJ) virulent to gene Rpg1 is now common in western Canada. All barley cultivars are susceptible to this race, and may be damaged in epidemic years. However, no widespread outbreaks of the disease and no substantive losses have occurred in barley in the past 15 years, likely due to the fact that most spring wheats are resistant to stem rust and as such natural inoculum levels have remained low.

3. No rating given for Formosa due to insufficient data.

References:

1. Fetch, T. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

OTHER DISEASES

The following diseases of barley are generally of minor importance and/or are diseases for which no practical control measures are currently recommended:

Aster Yellows (aster yellows phytoplamsa)

Brome Mosaic (brome mosaic virus)

Halo Spot (*Pseudoseptoria stomaticola*)

Leaf Rust (*Puccinia hordei*)

Leaf Spot (physiological)

Powdery Mildew (*Erysiphe graminis*)

Stripe Rust (*Puccinia striiformis*)

Take-all (*Gaeumannomyces graminis* var. *tritici*)

Wheat Streak Mosaic (Wheat streak mosaic virus, WSMV)

OAT (*Avena sativa*)

Oat is subject to a number of diseases, the severity of which varies with region, prevailing weather, and choice of cultivars. For a more comprehensive treatment of oat diseases, see Harder, D.E. and S. Haber. 1992. Oat diseases and pathologic techniques. pp. 307-425. *In* H.G. Marshall and M. Sorrells (eds.). Oat Science and Technology. Agronomy Monogram No. 33, ASA/CSSA, Madison, WI.

ANTHRACNOSE

Colletotrichum graminicola

Cultural: Turning under of straw and stubble to incorporate organic matter into the soil, fertilizer application at recommended levels, and rotations that include several years of non-cereal crops should reduce disease incidence.

Resistant Cultivars: None.

Chemical: None.

Notes:

1. Anthracnose may be found in any field where oats have been grown successively for several years. In Western Canada it is found primarily in the north-central and western regions of Alberta where soils may be of degraded type and/or poor fertility.

2. Barley, rye, and wheat are also susceptible.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

2. Boewe, G.H. 1960. Diseases of wheat, oats, barley and rye. Ill. Nat. Hist. Surv., Circ. 48.

3. Harder, D.E. and Skoropad, W.P. 1968. The occurrence of cereal anthracnose in Alberta. Can. Plant Dis. Surv. 48: 39-42.

BARLEY YELLOW DWARF (RED LEAF)

Barley yellow dwarf virus

Cultural: Seed early to avoid aphid infestation and virus damage.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
none	Boudrias, Furlong, Lee Williams, AC Rebel, AC Ronald, Stainless	AC Assiniboia, AC Gwen, Robert, OT2046 (Summit)	AC Belmont, SW Exactor, CDC Minstrel, AC Morgan, AC Pinnacle, AC Preakness, CDC ProFi, Souris, CDC Weaver	SW Betania, Bullion, CDC Boyer, Calibre, Cascade, CDC Dancer, Derby, Dumont, Gehl, Hi-Fi, Jordan, Kaufman, Leggett, Lu, AC Medallion, AC Mustang, CDC Orrin, CDC Sol-Fi, Triactor, Triple Crown, Waldern

Chemical: None.

References:

1. Gill, C.C. 1970. Epidemiology of barley yellow dwarf in Manitoba and effect of the virus on yield of cereals. Phytopathology 60: 1826-1830.

2. Haber, S. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

COVERED SMUT and LOOSE SMUT

Ustilago kolleri and *U. avenae*

Cultural: None (see Note 1).

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
AC Assiniboia, AC Belmont, SW Betania, Boudrias, CDC Dancer, Dumont, Furlong, Gehl, AC Gwen, Jordan, Kaufmann, Lee Williams, Leggett, Lu, AC Medallion, CDC Minstrel, CDC Orrin, Pinnacle, AC Preakness, Riel, Robert, Ronald, CDC Sol-Fi, Souris, Stainless, CDC Weaver, 7600M, OT2046 (Summit)	Triple Crown	SW Exactor, AC Juniper, AC Mustang	Calibre, Derby, Hi-Fi, AC Morgan, CDC ProFi	CDC Baler, Bullion, CDC Boyer, Cascade, Murphy, Waldern (See Note 2)

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; triticonazole (COM) SU; triticonazole + thiram (COM) SU. Covered smut only - maneb (COM) LI. Loose smut only - tebuconazole (COM) SU; tebuconazole + thiram (COM) SU (See Note 3).

Limitations: Treated grain must not be mixed with untreated grain for feed or sale. Left over treated grain may be double seeded. If treated seed has been stored longer than the time specified on the label, it should be buried at a depth and location where it will not be accessible to animals, and will not contaminate water supplies.

Notes:

1. There are presently no standards in the Seeds Act for covered and loose smut in pedigreed oat seed.

2. No rating given for Triactor because of insufficient data.

3. Seed of resistant and moderately resistant cvs. and seed of any cultivar observed to be free of smut should not require chemical treatment. If smut was observed in a crop which is being used for seed, or is detected in a seed test, it should be treated. When using seed of a cv. that is susceptible or moderately susceptible to smut and the presence of smut is uncertain, it would be wise to treat the seed.

References:

1. Menzies, J.G. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

CROWN RUST

Puccinia coronata f. sp. *avenae*

Cultural: European buckthorn, an alternate host of the crown rust fungus, gets infected by basidiospores released from telia, the overwintering stage of crown rust on straw and stubble, during late spring each year. Resulting aeciospores produced on this host provide the primary source of inoculum for infection of oats in early summer. Therefore, the woody shrub, when near farm fields, should be eradicated.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
Hi-Fi, Leggett, Stainless, OT2046 (Summit)	Triactor	CDC Dancer	CDC Minstrel	all others

Chemical: Spray foliage with - propiconazole (COM) EC, propiconazole + trifloxystrobin (COM) EC; pyraclostrobin (COM) EC.
Limitations: Preharvest interval - 45 days (propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than the end of flowering.

Notes: Cultivars with the resistance gene combination *Pc38, Pc39, and Pc68,* such as Boudrias, Furlong, AC Gwen, Kaufman, AC Medallion, AC Pinnacle and Ronald, are susceptible to over 60% of the isolates in the crown rust population as of 2006. Planting these cultivars early may decrease the level of rust damage.

References:

1. Chong, J., J. Gruenke, R. Dueck, W. Mayert, and S. Woods. 2008. Virulence of oat crown rust (*Puccinia coronata* f. sp. *avenae*) in Canada during 2002-2006. Can. J. Plant Pathol. 30 (in press).

2. Chong, J. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg, MB.

3. Simons, M.D. 1985. Crown rust. *in* The Cereal Rusts, Vol. II, Roelfs, A.P. and Bushnell, W.R. (eds.), Academic Press, N.Y. pp. 131-172.

ERGOT

(See under Rye, page 1-27)

LEAF BLOTCH

Pyrenophora avenae, Stagonospora avenae

Cultural: Burial of crop debris and rotations of one to two years between oat crops should help reduce inoculum carryover and subsequent disease severity. (See Note 1).

Resistant Cultivars: (See Note 2).

Chemical: Spray foliage with - propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC (See Note 3).

Limitations: Preharvest interval - 45 days (propiconazole, propiconazole + trifloxystrobin).

Notes:

1. Pyrenophora and Stagonospora leaf blotches caused by these fungi generally have not been damaging to oat crops in western Canada. However, recent more widespread planting of oat in the moister eastern prairie region has resulted in the more common occurrence of these diseases, and moderate damage to some crops.

2. The resistance status of registered oat cultivars grown in western Canada is unknown.

3. Foliar fungicides are registered for control of Stagonospora (Septoria) leaf blotch only.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

2. Tekauz, A. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg, MB.

SEEDLING BLIGHT, DAMPING-OFF

Cochliobolus sativus, Pyrenophora chaetomioides, Fusarium spp., *Pythium* spp., other fungi

Cultural: None.

Resistant Cultivars: None.

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; fludioxonil (COM) SN; maneb (COM) LI; metalaxyl (COM) SN; tebuconazole + thiram (COM) SU; triticonazole (COM) SU.

Limitations: As per label.

Notes:

1. Chemical seed treatment reduces infection at early stages of plant growth but will not protect post-seedling plants from infection by these fungi.

2. Seed treatment products may be registered and effective only against specific fungi, e.g. *Fusarium* or *Pythium*; see label(s).

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

STEM RUST

Puccinia graminis f. sp. *avenae*

Cultural: Seeding early will usually decrease the level of rust damage.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
none	none	AC Assiniboia, AC Belmont, AC Boudrias, CDC Boyer, CDC Dancer, Dumont, Furlong, AC Gwen, Hi-Fi, Jordan, Kaufmann, Lee Williams, Leggett, AC Medallion, Pinnacle, AC Preakness, CDC Pro-Fi, Riel, Robert, AC Ronald , CDC Weaver, 7600M	Gehl	SW Betania, Bullion, Calibre, Cascade, Derby, SW Exactor, Lu, AC Mustang, CDC Orrin, CDC Sol-Fi, Triple Crown, Waldern

Chemical: None.

Notes: All cultivars are susceptible to race NA67, which first appeared in 1998 and is now present in western Canada.

References:

1. Fetch, T. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

2. Martens, J.W. 1985. Oat stem rust. *in* The Cereal Rusts, Vol. II. Roelfs, A.P. and Bushnell, W.R. (eds.), Academic Press, N.Y. pp. 103-129.

OTHER DISEASES

The following diseases of oat are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

Blast (physiological)

Brome Mosaic (brome mosaic virus)

Common Root Rot (*Cochliobolus sativus, Fusarium* spp.)

Flame Chlorosis (soil transmitted virus-like agent)

Fusarium Head Blight (*Fusarium* spp.)

Gray Speck (manganese deficiency)

Halo Blight (*Pseudomonas syringae* pv. *coronafaciens*)

Oat Blue Dwarf (oat blue dwarf virus)

Oat Necrotic Mottle (oat necrotic mottle virus)

Wheat Streak Mosaic (wheat streak mosaic virus; WSMV)

RYE (*Secale cereale*)
FALL AND SPRING-SOWN CULTIVARS

ERGOT

Claviceps purpurea

Cultural: Avoid sowing wheat, rye, triticale, or barley on land where an ergoty crop was harvested the preceding year or near headlands and roadsides unless they were mowed at anthesis (flowering) the previous year to prevent sclerotia formation. Ergots do not usually remain viable for more than a year or so. Delayed swathing allows most if not almost all of the ergots to "shell out" (fall to the ground).

Resistant Cultivars: None.

Chemical: None.

Notes:

1. Copper availability or deficiency is not known to have any effect on the incidence of ergot in rye or other open pollinated cereal or grass.

2. Although rye generally does not suffer losses from infection with barley yellow dwarf virus (BYDV), autumn infection with BYDV has been observed to increase dramatically the susceptibility of fall rye to natural infection by ergot (4).

References:

1. Seaman, W.L. 1980. Ergot of grains and grasses. Can. Dep. Agric., Publ. 1438 (rev.) 16 pp.

2. Agri-fax. 1995. Copper deficiency: diagnosis and correction. Agdex 532-2, 8 pp. Alberta Agr., Food and Rural Development, Edmonton AB.

3. Evans, I.R. 2000. Personal communication. Alberta Agriculture Food & Rural Dev., Edmonton AB.

4. Haber, S. 1995. Interactions of barley yellow dwarf viruses. Pp 145-161, *in* Barley Yellow Dwarf - 40 Years of Progress, D'Arcy and Burnett, eds., APS Press, St. Paul MN.

SEEDLING BLIGHT, DAMPING-OFF

Cochliobolus sativus, Fusarium spp., *Pythium* spp., other fungi

Cultural: None.

Resistant Cultivars: None.

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; fludioxonil (COM) SN; maneb (COM) LI; metalaxyl (COM) SN (See Notes 1, 2, 3).

Limitations: As per label.

Notes:

1. Chemical seed treatment reduces infection at early stages of plant growth but will not protect post-seedling plants from infection by these fungi.

2. Rye seed should be treated annually with a fungicide as it is more susceptible to damping-off than wheat, barley, and oats.

3. Metalaxyl for *Pythium* is registered for export use only.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

SNOW SCALD AND COTTONY SNOW MOLD

Myriosclerotinia borealis, Coprinus psychromorbidus

Cultural: Sow early and apply ample fertilizers, especially phosphorus, since vigorous, well stooled out plants are more resistant. Avoid using fields where snow builds up during the winter or where it lies longer in the spring (see Notes).

Resistant Cultivars: None (see Notes).

Chemical: None.

Notes: Recommended varieties are generally very cold hardy in the Peace River region and the Northern Parklands where snow molds are most likely to be a problem. They are, however, susceptible to snow molds, and damage depends on the vigour of the plants and the depth and duration of the snow cover: the deeper and longer, generally the greater the damage.

References:

1. Davidson, J.G.N. 1978. Plant diseases. Pp 3-5 in Tests on Cereal and Oilseed Crops in the Peace River Region. Agric. & Agri-Food Can. Res. Centre, Beaverlodge AB.

2. Gaudet, D. 2000. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge, AB.

3. Smith, J.D. 1975. Snow molds on winter cereals in northern Saskatchewan in 1974. Can. Plant Dis. Surv. 55: 91-96.

STEM SMUT

Urocystis occulta

Cultural: Rotate rye with any other crop to prevent build-up of soil-borne spores (see Notes). Use clean seed. Spring rye cultivars are resistant.

Resistant Cultivars: AC Rifle.

Intermediate: Musketeer, Prima, RT 178.

Susceptible: All others.

Chemical: Treat seed with carbathiin + thiram (COM) SU.

Limitations: As per label.

Notes:

1. Farmer experience in a dry soil area of southern Alberta, where a crop:fallow:crop sequence is used, indicates that soil-borne inoculum will survive one fallow year. If wheat or barley alternates with rye in the above cropping sequence, the soil-borne inoculum is not a problem. Seed fall rye early to reduce risk of infection.

2. There is currently no testing of new varieties for stem smut -reaction conducted in western Canada.

References:

1. Degenhardt, K.J. *et al.* 1983. Evaluation of seed treatment fungicides for control of seed- and soil-borne stem smut of fall rye. Pp. 288 *in* Pesticide Research Report. ECPUA, Ottawa.

2. Evans, I.R. 2000. Personal communication. Alberta Agriculture, Food & Rural Dev., Edmonton AB.

OTHER DISEASES

The following diseases of rye are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

Bacterial Blight (*Xanthomonas translucens*)

Barley Yellow Dwarf (barley yellow dwarf virus)

Brome Mosaic (brome mosaic virus)

Common Root Rot (*Cochliobolus sativus* + *Fusarium* spp.)

Leaf Rust (*Puccinia recondita*)

Powdery Mildew (*Erysiphe graminis*)

Stem Rust (*Puccinia graminis* f. sp. *secalis*)

TRITICALE (*Triticale hexaploide*)

COMMON BUNT

Tilletia tritici, T. laevis

Cultural: None.

Resistant Cultivars: AC Alta, Banjo, Bobcat, AC Certa, AC Copia, Pronghorn, AC Ultima.

Chemical: None.

Notes: There is presently no standard in the Seeds Act for common bunt in pedigreed seed.

References:

1. Gaudet, D.A. 2004. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

COMMON ROOT ROT

Cochliobolus sativus, Fusarium spp.

Cultural: Rotations that include several years of non-host crops (rapeseed, flax, legumes) reduce levels of *C. sativus*, and possibly disease. Deep seeding enhances disease severity and should be avoided where possible. Reduced tillage reduces disease severity.

Resistant Cultivars: None (see Notes).

Intermediate: AC Alta, Banjo, AC Certa, AC Copia, Pronghorn, AC Ultima.

Susceptible: Welsh.

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU.
Limitations: As per label.

Notes: There is currently no testing of new varieties for common root rot reaction conducted in western Canada.

References:

1. Conner, R.L. 2000. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge, AB.

ERGOT

Claviceps purpurea

Cultural: Avoid sowing rye or triticale on land where an ergoty crop was harvested the preceding year or near headlands and roadsides unless they were mowed at anthesis (flowering) the previous year to prevent sclerotia formation.

Resistant Cultivars: None (see Notes).

Chemical: None.

Notes: Resistance to ergot in triticale as in barley and oat, is by exclusion of inoculum from the floret until fertilized, i.e. the florets remain closed. Factors such as late application of herbicides or low soil-available copper, both of which reduce pollen fertility causing florets to open, may increase susceptibility to ergot in any cultivar.

References:

1. Evans, I.R. 2000. Personal communication. Alberta Agric., Food and Rural Dev., Edmonton, AB.

2. Menzies, J. 2003. Personal communication. Agric. & Agri-Food Canada, Cereal Res. Centre, Winnipeg, MB.

3. Seaman, W.L. 1980. Ergot of grains and grasses. Can. Dep. Agric. Publ. 1438 (rev.) 16 pp.

LEAF RUST

Puccinia recondita

Cultural: None.

Resistant Cultivars:

Resistant	Intermediate	Susceptible
AC Alta, Banjo, AC Certa, AC Copia, Pronghorn, AC Ultima	none	all others

Chemical: None.

Notes: There is currently no testing of new varieties for leaf rust reaction conducted in western Canada.

References:

1. Kolmer, J.A. 1996. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

STEM RUST

Puccinia graminis f. sp. *tritici*

Cultural: No susceptible barberry species should be imported into Canada and all bushes, whether native species or susceptible imported cultivars found should be eradicated (see Notes).

Resistant Cultivars:

Resistant	Intermediate	Susceptible
AC Alta, Banjo, AC Certa, AC Copia, AC Ultima	Pronghorn	

Chemical: None.

Notes:

1. The sexual stages of the life cycle of the stem rust fungus develop on barberry. Infection of this host results in the production of early spring inoculum and new physiological races. Barberry consequently threatens the production of both cereal grains and various grass species in Canada.

2. There is currently no testing of new varieties for stem rust reaction conducted in western Canada.

References:

1. Fetch, T. 2003. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

OTHER DISEASES

The following diseases of triticale are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

Barley Yellow Dwarf (barley yellow dwarf virus)

Brome Mosaic (brome mosaic virus)

Flame Chlorosis (soil-transmitted virus-like agent)

Fusarium Head Blight (*Fusarium* spp.)

WHEAT, COMMON AND DURUM (*Triticum aestivum* and *T. durum*)

BARLEY YELLOW DWARF

Barley yellow dwarf virus

Cultural: Seed early to avoid aphid infestation and damage.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
none	none	Superb, AC Vista, Waskada	all others	none

Chemical: None.

Notes:

1. Unless seeded very late (i.e. after June 1 in western Canada), substantive losses in wheat specifically due to BYD are quite rare.

2. In contrast to barley and oat, the effect of BYD on yield and quality in producing a wheat crop in western Canada are not measurably affected by cultivar choice.

References:

1. Gill, C.C. 1970. Epidemiology of barley yellow dwarf in Manitoba and effect of the virus on yield of cereals. Phytopathology 60: 1826-1830.

2. Haber, S. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

BLACK POINT, KERNEL SMUDGE

Alternaria alternata, Cochliobolus sativus

Cultural: Avoid irrigation during the milk stage and the dough stage. High application rates of nitrogen should be avoided.

Resistant Cultivars: (see Notes)

Resistant	Intermediate	Susceptible
Glenlea, Park	AC Nanda, AC Phil, AC Reed	AC Andrew and all durum wheats

Chemical: None.

Notes: There is currently no testing of new varieties for black point/kernel smudge reaction conducted in western Canada.

References:

1. Conner, R.L. 2002. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

2. Wiese, M.V. 1977. Compendium of wheat diseases. Am. Phytopathol. Soc., St. Paul, Minn. pp. 12-13.

3. Fernandez, M.R., J.M. Clarke, and R.M. DePauw. 2000. Black point reaction of durum and common wheat cultivars grown under irrigation in southern Saskatchewan. Plant Dis. 84: 892-894.

BROWNING ROOT ROT

Pythium arrhenomanes, *P. volutum*, other *Pythium* spp.

Cultural: Return cereal residues to soil and maintain adequate phosphorus levels to assure vigorous seedling growth (1).

Resistant Cultivars: None.

Chemical: None.

Notes: This disease is much less important since the application of phosphate fertilizers came into general use (2).

References:

1. Vanterpool, T.C. 1940. Studies on browning root rot of cereals VI. Further contributions on the effects of various soil amendments on the incidence of the disease in wheat. Can. J. Res. C. 18: 240-257.

2. Vanterpool, T.C. 1952. The phenomenal decline of browning root rot on the Canadian prairies. Sci. Agric. 32: 443-458.

COMMON BUNT

Tilletia tritici, T. laevis

Cultural: Seed into warm soil. Use seed from a disease free source.

Resistant Cultivars:

	Resistant	**Mod. Resistant**	**Intermediate**	**Mod. Susceptible**	**Susceptible**
Common	AC Cadillac, AC Cora, AC Crystal, AC Foremost, AC Karma, McKenzie, Peace, Snowhite 475, Snowhite 476, AC Taber, Unity VB, AC Vista, Waskada, 5500HR, 5600HR	AC Abbey, CDC Alsask, Alvena, AC Domain, AC Eatonia, CDC Go, CDC Imagine, AC Intrepid, Helios, Journey, Katepwa, Lillian, AC Majestic, CDC Osler, Prodigy, CDC Rama, Stettler, Superb, Waskada, 5601HR, 5602HR, 5700PR	CDC Abound, Amazon, AC Barrie, CDC Bounty, Burnside, AC Corinne, AC Elsa, Fieldstar VB, Glencross VB, Harvest, Infinity, Invader, Kane, Lovitt, Neepawa, Oslo, Pasqua, Snowbird, Somerset, AC Splendor, CDC Teal, CDC Walrus, 5701PR, 5702PR	Genesis, Glenlea, Goodeve VB, Kanata, Snowstar	Biggar, Laser, Laura, Roblin
Durum	AC Avonlea, Brigade, Commander, Eurostar, Kyle, AC Melita, AC Morse, Napoleon, AC Navigator, Plenty, Sceptre, CDC Verona	Strongfield	none	none	none
Soft White	none	none	none	AC Andrew	Bhishaj, AC Phil, AC Reed
Winter	none	AC Bellatrix	Readymade	Radiant	Accipiter, CDC Buteo, CDC Clair, CDC Falcon, CDC Harrier, CDC Kestrel, McClintock, Norstar, CDC Osprey, Peregrine, CDC Ptarmigan, CDC Raptor

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; maneb (COM) LI; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triadimenol (COM) SU; triticonazole (COM) SU; triticonazole + thiram (COM) SU.

Limitations: Treated grain must not be mixed with untreated grain for feed or sale. If treated seed has been stored longer than the time specified on the label, it should be buried at a depth and location where it will not be accessible to animals and birds, and will not contaminate water supplies.

Notes:

1. There is presently no standard in the Seeds Act for common bunt in pedigreed wheat seed.

2. As are most other smut diseases, common bunt is usually seed-borne. However, unlike other cereal smuts, bunt is hard to recognize in the field, and a low level of infection may go undetected. Therefore, to control infections, it is wise to treat seed of susceptible cvs. every year and of intermediate cvs. every 2 years. Seed of resistant cvs. does not require treatment specifically for this disease.

3. Soil-borne infections may be important. If bunt is present, rotate to non-susceptible crop(s) for at least one year.

4. A 1% bunt infection in wheat can downgrade a potential #1 grain lot to feed or sample.

References:

1. Gaudet, D.A. 2004. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

2. Gaudet, D.A., and Puchalski, B.L. 1989. Status of bunt resistance in western Canadian spring wheat and triticale. Can. J. Plant Sci. 69: 797-804.

3. Gaudet, D.A. *et al*. 1989. Effect of environment on efficacy of seed treatment fungicides for control of common bunt in spring and winter wheat. Pesticide Sci. 26: 241-252.

4. Gaudet, D.A. and Puchalski, B.L. 1989. Races of common bunt (*Tilletia caries and T. foetida*) of wheat in western Canada. Can J. Plant Path. 11: 415-418.

5. Gaudet, D.A. *et al*. 1993. Susceptibility and resistance in Canadian spring wheat cultivars to common bunt (*Tilletia tritici* and *T. laevis*). Can. J. Plant Sci. 73: 1217-1224.

6. Knox, R.E. 2008. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

7. Puchalski, B. 2004. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

COMMON ROOT ROT

Cochliobolus sativus, Fusarium spp.

Cultural: Minimum and zero tillage practices and maintaining adequate and balanced soil fertility may reduce the severity of the disease. Rotations that include several years of non-host crops (rapeseed, flax, legumes) reduce levels of disease. Deep seeding enhances disease severity and should be avoided where possible.

Resistant Cultivars: (See Note 1)

	Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
Common	Amazon, Glenlea, AC Intrepid, Laura, Roblin		AC Abbey, Alikat, AC Barrie, AC Cadillac, AC Cora, AC Corinne, AC Crystal, Cutler, AC Eatonia, AC Elsa, AC Foremost, Glenavon, AC Karma, Katepwa, Laser, AC Majestic, AC Michael, AC Minto, Park, Prodigy, AC Splendor, AC Taber, CDC Teal, AC Vista		
Durum			AC Avonlea, AC Morse, Kyle, AC Melita, AC Napoleon, AC Navigator, AC Pathfinder, Plenty, Sceptre		none
Soft White	none		AC Nanda, AC Phil, AC Reed		
Winter	none		CDC Clair, CDC Osprey		Norstar

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl (COM) SU; maneb (COM) LI; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triticonazole (COM) SU; triticonazole + thiram (COM) SU (see Note 2).
Limitations: As per label.

Notes:

1. No testing of new cultivars for their reactions to common root rot is currently being conducted in Western Canada; the list presented is therefore incomplete.

2. Seed treatment reduces seedling blight caused by these fungi but does not control root rot in post-seedling plants.

References:

1. Bailey, K.L. and L.J. Duczek. 1995. Managing cereal diseases under reduced tillage. Can. J. Plant Pathol. 18: 159-167.

2. Bailey, K.L. *et al.* 1992. Effects of tillage systems and crop rotations on root rot and foliar diseases of wheat, flax and peas in Saskatchewan. Can. J. Plant Sci. 72: 583-591.

3. Conner, R.L. 2000. Personal communication. Agric. & Agri-Food Can., Res. Centre, Lethbridge AB.

4. Conner, R.L. *et al.* 1996. Influence of crop rotation on common root rot of wheat and barley. Can. J. Plant Pathol. 18: 247-254.

5. Ledingham, R.J. 1961. Crop rotations and common root rot in wheat. Can. J. Plant Sci. 41: 479-486.

6. Ledingham, R.J. 1969. Effects of straw and nitrogen on common root rot of wheat. Can. J. Plant Sci. 50: 175-179.

DWARF BUNT

Tilletia controversa

Cultural: Avoid sowing winter wheat on land that has raised a dwarf bunt-infected crop in the last five to ten years. Late planted wheat may escape high levels of infection.

Resistant Cultivars: None.

Chemical: To prevent soil-borne or seed-borne dwarf bunt, treat seed with carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU. **Limitations:** As per label.

Notes: Dwarf bunt is known to occur only in the north Okanagan and Creston valleys of British Columbia and in Ontario. None has ever been found on prairie grown wheat in Canada.

References:

1. Gaudet, D. 1998. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

2. Jesperson, G.D. 2002. Personal communication. BC Ministry of Agric., Fish. and Food, Kelowna BC.

ERGOT

Claviceps purpurea

Cultural: Avoid sowing wheat, rye, triticale or barley on land where an ergoty crop was harvested the preceding year or near headlands and roadsides unless they were mowed the previous year to prevent sclerotia formation. Mowing grass in headlands during the current year should prevent honey dew development and subsequent spread into cereal crops.

Resistant Cultivars: None.

Chemical: None.

Notes:

1. Factors such as low soil-available copper and late application of herbicides, both of which reduce pollen fertility causing normally self-pollinated flowers to open, will greatly increase susceptibility to ergot in any cultivar.

2. In certain cultivars, e.g. Glenlea, dry growing conditions despite adequate copper may result in elevated levels of ergot infection.

References:

1. Evans, I.R. 2000. Personal communication. Alberta Agric., Food & Rural Dev., Edmonton, AB.

2. Evans, I.R., *et al.* 1990. Ergot control in wheat and barley with soil applied copper sulphate. Can. J. Plant Pathol. 12: 333.

3. Menzies, J. 2003. Personal communication. Agric. & Agri-Food Canada, Cereal Res. Centre, Winnipeg, MB.

4. Seaman, W.L. 1980. Ergot of grains and grasses. Can. Dep. Agric. Publ. 1438 (rv.) 16 pp.

EYESPOT

Pseudocercosporella herpotrichoides

Cultural: Rotation to crops other than cereals and turning under barley straw and stubble is an effective means of keeping the disease under control.

Resistant Cultivars: None.

Chemical: None.

References:

1. Slopek, S.W. *et al.* 1990. First report of eyespot (*Pseudocercosporella herpotrichoides*) in wheat in the prairie provinces. Can. Plant Dis. Surv. 70(2): 119-121.

FLAME CHLOROSIS

Soil transmitted virus-like agent

Cultural: If flame chlorosis is identified infecting more than 5% of plants in a field, rotate that field out of cereals for one year or more (1, 2). Flame chlorosis reaches its most damaging levels in fields with many years of continuous cultivation in barley (or barley and wheat), and where seed type, seeding practices and early season conditions result in slow germination and emergence. To reduce the risk of flame chlorosis, use vigorous seed and avoid deep seeding.

Resistant Cultivars: None.

Chemical: None.

References:

1. Haber, S. 2003. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

2. Haber, S., Barr, D.J.S., and Platford, R.G. 1991. Observations on the distribution of flame chlorosis in Manitoba and its association with certain zoosporic fungi and the intense cultivation of cereals. Can. J. Plant Pathol. 13: 241-246.

3. Haber, S. *et al.* 1990. Flame chlorosis: a new, soil-transmitted virus-like disease of barley in Manitoba, Canada. J. Phytopath. 129: 245-256.

FUSARIUM FOOT ROT, CROWN ROT, PREMATURITY BLIGHT

Fusarium spp., *Cochliobolus sativus*

Cultural: Incorporation of crop residue into the soil and the addition of fertilizer to maintain adequate and balanced soil fertility may decrease disease severity. Other small grains, particularly oats, should not precede wheat in rotations (see Notes 1, 2).

Resistant Cultivars: None (see Note 2).

Chemical: Seed treatment - thiamethoxam + difenoconazole + metalaxyl-M (COM) SU (suppression only). **Limitations:** As per label.

Notes:

1. *Fusarium* spp. and *Cochliobolus sativus* are also part of the "complex" that causes common root rot in cereals.

2. Durum wheats and winter wheats, in general, appear to be more susceptible than hard red spring types (1, 3).

References:

1. Cook, R.J. 1968. Fusarium root and foot rot of cereals in the Pacific Northwest. Phytopathology 58: 127-131.

2. Tinline, R.D. 1994. Etiology of prematurity blight of hard red spring wheat and durum wheat in Saskatchewan. Can. J. Plant Pathol. 16: 87-92.

3. Warren, H.L. and Kommedahl, T. 1973. Fertilization and wheat refuse effects on *Fusarium* species associated with wheat roots in Minnesota. Phytopathology 63: 103-108.

FUSARIUM HEAD BLIGHT (FHB, 'Fusarium', Scab)

Fusarium graminearum, other *Fusarium* spp.

Cultural: Incorporation of straw and stubble and rotations away from cereals and corn will reduce inoculum levels locally but will not protect crops from wind-borne inoculum (the pathogen spreads via wind) originating from more distant locations. Potential introduction of FHB to new locations via movement of *Fusarium*-infested seed can be minimized by dry heat treatment (70^{o}C for 5 days) or treatment of seed with a registered seed-treatment fungicide.

Resistant Cultivars:

	Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
Common	none	Waskada, 5602HR	Alikat, AC Barrie, CDC Bounty, AC Cadillac, AC Cora, Fieldstar VB, CDC Go, Helios, Kanata, Kane, Katepwa, AC Majestic, CDC Rama, McKenzie, 5601HR	CDC Alsask , Alvena, Amazon, Burnside, AC Corinne, AC Domain, AC Elsa, Glenavon, Glenlea, AC Intrepid, Journey, AC Karma, AC Michael, Snowstar , Somerset, AC Splendor, Stettler, Superb, 5600HR, 5702PR	AC Abbey, AC Crystal, AC Foremost, Glencross VB, Goodeve VB, Harvest, CDC Imagine, Infinity, Laser, Lillian, Lovitt, CDC Osler, Peace, Prodigy, Roblin, Snowhite 475, Snowhite 476, AC Taber, CDC Teal, CDC Trilogy, Unity VB, AC Vista, CDC Walrus, 5700PR, 5701PR
Durum	none	none	none	AC Avonlea, Brigade, Eurostar, Kyle, Napoleon, Plenty, CDC Verona	Commander, AC Melita, AC Morse, AC Navigator, Sceptre, Strongfield
Winter	none	none	CDC Buteo, CDC Kestrel, Norstar	AC Bellatrix, CDC Clair, Tempest	CDC Falcon, CDC Harrier, McClintock, CDC Osprey, Radiant, CDC Raptor, AC Readymade (see Notes 3,4)
Soft White Spring	n/a (see Note 5)	n/a	n/a	n/a	n/a

Chemical: Spray heads/foliage with - chlorothalonil (COM) SU; prothioconazole (COM) SC; tebuconazole (COM) SU.

Limitations: Pre-harvest interval - 30 days (chlorothalonil, prothioconazole); 36 days (tebuconazole).

Notes:

1. The disease is most severe in Manitoba and adjacent areas of SE Saskatchewan.

2. Wheat classes and cultivars differ in susceptibility. Most CPS, durum and winter wheats are moderately susceptible or susceptible; common wheats with 'Neepawa' in their background are more tolerant.

3. Winter wheats, which flower earlier (late June-early July) than spring wheat, can escape damage in some years, as rain (moisture) events, necessary for successful infection, may be less frequent during this period.

4. FHB reaction data fro Accipiter, Peregrine and CDC Ptarmigan winter wheats are currently not available.

5. Only limited data on the reactions of registered soft white spring wheat cultivars to FHB are available; definitive ratings cannot presently be generated.

References:

1. Gilbert, J. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

2. Gilbert, J. and A. Tekauz. 1995. Effects of fusarium head blight and seed treatment on germination, emergence and seedling vigour of spring wheat. Can J. Plant Pathol. 17: 252-259.

3. Gilbert, J. and A. Tekauz. 2000. Review: Recent developments in research on fusarium head blight of wheat in Canada. Can. J. Plant Pathol. 22: 1-8.

4. Gilbert, J., A. Tekauz, R. Kaethler, E. Mueller, M. Stulzer, M. Beyene, D. Czarnecki, N. Lewis, A. Maurice, and P. Goze. 2006. Survey of fusarium head blight of spring wheat in Manitoba in 2006. Can. Plant Dis. Surv. 87: 95.

5. Gilbert, J., S.M. Woods, T.K. Turkington, and A. Tekauz. 2005. Effect of heat treatment to control *Fusarium graminearum* on infested wheat seed. Can. J. Plant. Pathol. 27: 448-452.

6. Martin, R.A., and H.W. Johnston. 1982. Effects and control of fusarium diseases of cereal grains in the Atlantic Provinces. Can. J. Plant Pathol. 4: 210-216.

7. Morrall, R.A.A., B. Carriere, B. Ernst, C. Pearse, D. Schmeling, and L. Thomson. 2007. Seed-borne *Fusarium* on cereals in Saskatchewan in 2006. Can. Plant Dis. Surv. 87: 63-65.

8. Sutton, J.C. 1982. Epidemiology of wheat blight and maize ear rot caused by *Fusarium graminearum*. Can. J. Plant Pathol. 4: 195-209.

9. Wong, L.S.L. *et al.* 1992. Prevalence, distribution and importance of fusarium head blight in wheat in Manitoba. Can. J. Plant Pathol. 14: 233-238.

10. Wong, L.S.L., *et al.* 1995. Pathogenicity and mycotoxin production of *Fusarium* species causing head blight in wheat cultivars varying in resistance. Can J. Plant Sci. 75: 261-267.

LEAF RUST

Puccinia triticina

Cultural: Seeding early will usually decrease the level of rust damage.

Resistant Cultivars:

	Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
Common	CDC Alsask , Burnside, AC Cora, Fieldstar VB, Infinity, Kane, Lillian, McKenzie, CDC Osler, Prodigy, Unity VB, 5500HR, 5600HR, 5602HR, 5701PR	AC Abbey, Amazon, AC Cadillac, AC Corinne, AC Eatonia, AC Elsa, Glenavon, Glencross VB, Goodeve VB, Harvest, AC Intrepid, Laura, Lovitt, Peace, CDC Rama, Snowstar, Somerset, AC Splendor, CDC Teal, CDC Walrus, 5601HR, 5700PR	Alvena, CDC Bounty, AC Domain, Glenlea, CDC Go, CDC Imagine, Journey, Roblin, Snowbird, Snowhite 476, AC Taber, Waskada	CDC Abound, Alikat, AC Barrie, AC Crystal, AC Foremost, Helios, Kanata, AC Karma, Katepwa, Laser, AC Majestic, AC Michael, Snowhite 475, Stettler, AC Vista	Park, Superb
Durum	AC Avonlea, Brigade, Commander, Eurostar, Kyle, AC Melita, AC Morse, AC Napoleon, AC Navigator, Plenty, Sceptre, Strongfield	n/a	n/a	n/a	n/a
Soft White	none	none	none	none	AC Andrew, Bhishaj, AC Meena, AC Nanda, AC Phil, AC Reed
Winter	none	CDC Buteo, CDC Falcon, McClintock, Peregrine, CDC Raptor	Accipiter, CDC Clair	CDC Harrier, CDC Kestrel, CDC Osprey	AC Bellatrix, Norstar, CDC Ptarmigan, Radiant, AC Readymade, AC Tempest

Chemical: Spray foliage with - azoxystrobin + propiconazole (COM) SU; mancozeb (COM) WG, WP; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SU; pyraclostrobin (COM) EC; tebuconazole (COM) SU.

Limitations: Pre-harvest interval - 30 days (prothioconazole); 36 days (tebuconazole); 40 days (mancozeb); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, do not apply later than the end of flowering.

References:

1. McCallum, B. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

LEAF SPOT COMPLEX

Cochliobolus sativus, Mycosphaerella graminicola, Phaeosphaeria nodorum, P. avenaria f.sp. *triticea, Pyrenophora tritici-repentis*

Cultural: Rotation with crops other than cereals (flax, lentil, etc.) for one or more years, and spring plowing to bury crop residue, help to reduce disease incidence (See Note 1).

Resistant Cultivars: (See Notes 2, 3)

	Resistant	**Mod. Resistant**	**Intermediate**	**Mod. Susceptible**	**Susceptible**
Common	n/a	n/a	Fieldstar VB, Kane, Snowstar, 5702PR (See Note 3)	CDC Abound, Glencross VB, Goodeve VB, Helios, Infinity, Snowhite 475, Snowhite 476, Stettler, Unity VB, Waskada, 5602HR	CDC Alsask, Kanata, Snowbird, Somerset
Durum	n/a	n/a	Brigade, Eurostar	Commander, CDC Verona	n/a
Soft White	n/a	n/a	n/a	n/a	n/a
Winter	n/a	n/a	n/a	n/a	n/a

Chemical: Treat seed with - difenoconazole + metalaxyl-M (COM) SU; tebuconazole + thiram (COM) SU (see Note 4).
Spray foliage with - azoxystrobin + propiconazole (COM) SU; chlorothalonil (COM) SU; mancozeb (COM) WG, WP; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SC; pyraclostrobin (COM) EC; tebuconazole (COM) SU (see Note 5).

Limitations: Preharvest interval - 30 days (chlorothalonil, prothioconazole); 36 days (tebuconazole); 40 days (mancozeb); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than the end of flowering.

Notes:

1. Cultural control of 'leaf spot' caused by *Cochliobolus sativus* requires rotations of two or more years as the condial inoculum can survive in the soil over several growing seasons.

2. Resistance ratings are based primarily on non-inoculated field trials which likely differ regionally and temporally for the presence and/or mix of the various causal organisms and therefore the results obtained. Thus, cultivar responses to the 'leaf spot complex' for any single location and/or year may vary from those listed.

3. Reactions to the 'leaf spot complex' are available only for recently-registered spring wheat and durum cultivars. Reactions (when available) for 'older' cultivars, are listed under the individual foliar diseases, i.e. septoria tritici blotch, stagonospora nodorum leaf and glume blotch, spot blotch, tan spot.

4. Seed treatment will not protect post-seedling plants from infection.

5. Chemicals are registered for individual diseases (see diseases listed under Note 3 and/or product labels), and most should provide a level of 'leaf spot complex' control. For leaf spot caused by *Cochliobolus sativus* (i.e. spot blotch), pyraclostrobin is the only chemical registered.

References:

1. Gilbert, J. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

2. Tekauz, A. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

LOOSE SMUT

Ustilago tritici

Cultural: None (see Note 1).

Resistant Cultivars:

	Resistant	**Mod. Resistant**	**Intermediate**	**Mod. Susceptible**	**Susceptible**
Common	Amazon, Burnside, AC Cadillac, AC Corinne, AC Domain, Glenavon, Glencross VB, Glenlea, Helios, Laser, Peace, CDC Rama, Snowhite 476, Somerset, Stettler, AC Vista, CDC Walrus, 5600HR, 5602HR	Alikat, Alvena, CDC Alsask, AC Barrie, CDC Bounty, AC Cora, AC Elsa, Goodeve VB, Harvest, CDC Imagine, Infinity, Katepwa, Lovitt, AC Michael, AC Minto, CDC Osler, Park, Roblin, Snowbird, CDC Teal, Waskada	AC Abbey, CDC Abound, CDC Alsask, AC Crystal, Fieldstar VB, AC Foremost, AC Intrepid, Journey, Kanata, AC Karma, Laura, Lillian, AC Majestic, Prodigy, Snowhite 475, AC Splendor, Superb, 5500HR, 5601HR, 5701PR	AC Eatonia, Kane, CDC Go, McKenzie, Snowstar, AC Taber, Unity VB, 5700PR, 5702PR	none
Durum	none	none	Commander	CDC Verona	AC Avonlea, Brigade, Eurostar, Kyle, AC Melita, AC Morse, AC Napoleon, AC Navigator, AC Pathfinder, Plenty, Sceptre, Strongfield
Soft White	none		none		all
Winter	none		none		all

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triadimenol (COM) SU; triticonazole (COM) SU; triticonazole + thiram (COM) SU (see Note 2).

Limitations: Treated grain must not be mixed with untreated grain for feed or sale. Treated left-over seed may be saved for planting the following year, unless it has been treated with a dual-purpose (fungicide/insecticide) formulation; otherwise, it should be buried to a depth and location where it will not be accessible to animals and will not contaminate water supplies, or double seeded if quantities permit.

Notes:

1. There is presently no standard in the Seeds Act for loose smut in pedigreed wheat seed.

2. Seed of resistant and moderately resistant cvs. and seed of any cultivar observed to be free of smut should not require chemical treatment. If smut was observed in a crop which is being used for seed, or is detected in a laboratory seed test, it should be treated. When using seed of a cv. that is susceptible or moderately susceptible to smut and the presence of smut is uncertain, it would be wise to treat the seed.

3. Treatment with carbathiin at currently recommended rates does not provide effective disease control in all situations.

References:

1. Menzies, J.G. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

POWDERY MILDEW

Erysiphe graminis

Cultural: Avoid heavy unbalanced applications of nitrogen fertilizer. Destroy nearby volunteer wheat.

Resistant Cultivars:

Resistant	Mod. Resistant	Intermediate	Mod. Susceptible	Susceptible
Soft White Spring - AC Nanda (see Notes 1, 3)	none	Soft White Spring - AC Andrew, AC Phil, AC Reed	none	none

Chemical: Treat seed with - triadimenol (COM) SU (see Note 2).

Spray foliage with - propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; pyraclostrobin (COM) EC; tebuconazole (COM) SU.

Limitations: Preharvest interval - 36 days (tebuconazole); 45 days (propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, do not apply later than the end of flowering.

Notes:

1. This disease is rarely a problem on hard red spring or durum wheats.

2. Seed treatment will not provide control throughout the entire growing season.

3. Reactions of soft spring wheats Bhishaj and AC Meena are undetermined.

References:

1. Atkinson, T.G. 1979. Seed treatment and foliar fungicides for the control of powdery mildew on soft white spring wheat. Pp. 518-519 *in* Pesticide Research Report, CCPUA, Ottawa.

2. Conner, R.L. 2002. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

3. Wiese, M.V. 1987. Compendium of wheat diseases. 2nd ed. Am. Phytopathol. Soc., St. Paul, Minn. pp. 30-36.

RED SMUDGE

Pyrenophora tritici-repentis

Cultural: Avoid irrigation during kernel development. Severe levels of tan spot on the foliage contribute to the development of red smudge on the seed (see Tan Spot, page 54).

Resistant Cultivars: See Notes.

Chemical: None.

Notes: Durum and white CPS wheats are the most susceptible to red smudge. Most hard red spring wheats have good to moderate resistance.

References:

1. Fernandez, M.R., DePauw, R.M., Clarke, J.M. and L.P. Lefkovitch. 1998. Discoloration of wheat kernels by *Pyrenophora tritici-repentis*. Can. J. Plant Pathol. 20: 380-383.

2. Fernandez, M.R., Clarke, J.M., DePauw, R.M., and L.P. Lefkovitch. 1997. Emergence and growth of durum wheat derived from red smudge-infected seed. Crop Science 37: 510-514.

3. Fernandez, M.R. 2000. Personal communication. AAFC, Semi-Arid Prairie Research Centre, Swift Current, SK.

4. Fernandez, M.R. *et al*. 1994. Black point and red smudge in irrigated durum wheat in southern Saskatchewan. Can. J. Plant Pathol. 16: 221-227.

SEEDLING BLIGHT, DAMPING-OFF

Cochliobolus sativus, Fusarium spp., *Pythium* spp., other fungi

Cultural: None.

Resistant Cultivars: None.

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; fludioxionil (COM) SN; maneb (COM) LI; metalaxyl (COM) SN; tebuconazole (COM) SU; tebuconazole + thiram (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triticonazole (COM) SU; triticonazole + thiram (COM) SU.

Limitations: As per label.

Notes: Chemical seed treatment reduces infection at early stages of plant growth, but will not protect post-seedling plants from infection by these same fungi.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

SEPTORIA TRITICI BLOTCH

Mycosphaerella graminicola.

Cultural: Rotation with crops other than wheat, such as flax and oats helps to reduce disease incidence.

Resistant Cultivars:

	Resistant	Intermediate	Susceptible
Common	none (see Notes 1, 2)	AC Cadillac, AC Cora, AC Crystal, AC Elsa, AC Karma, Laura, AC Majestic, AC Taber, CDC Teal, AC Vista	all others
Durum	AC Avonlea, Kyle, Sceptre (see Note 3)	AC Melita, AC Morse, Napoleon, AC Navigator, Plenty	Strongfield
Soft White	none	n/a	n/a

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; tebuconazole + thiram (COM) SU (see Note 4).

Spray foliage with - azoxystrobin + propiconazole (COM) SU; chlorothalonil (COM) SU; mancozeb (COM) WG, WP; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SU; pyraclostrobin (COM) EC; tebuconazole (COM) SU.

Limitations: Preharvest interval - 30 days (chlorothalonil, prothioconazole); 36 days (tebuconazole); 40 days (mancozeb); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than the end of flowering.

Notes:

1. Information based on tests under controlled conditions.

2. Limited comparative data is being generated on the reactions of new wheat cultivars to individual leaf spot diseases, and the lists presented under each category may not be comprehensive. In future editions of the Guidelines, the various leaf spots may be incorporated into a single entity, the 'Leaf Spot Complex'.

3. Under controlled conditions, AC Avonlea, Kyle, and Sceptre are resistant to bread wheat isolates of *S. tritici* found in the Canadian prairies; they may however be susceptible to *S. tritici* isolates from durum.

4. Seed treatment will not protect post-seedling plants from infection.

References:

1. Gilbert, J. 2007. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

2. Gilbert, J., and S.M. Woods. 2001. Leaf spot diseases of spring wheat in southern Manitoba farm fields under conventional and conservation tillage. Can. J. Plant Pathol. 81: 551-559.

3. Hosford, R.M. Jr. 1976. Fungal leaf spot diseases of wheat in North Dakota (Nature, importance and control). N.D. Agric. Exp. Sta., Bull. 500. 12 pp.

4. Pederson, E.A. and G.R. Hughes. 1992. The effect of crop rotation on development of the septoria complex on spring wheat in Saskatchewan. Can. J. Plant Pathol. 14: 152-158.

SPOT BLOTCH

Cochliobolus sativus

Cultural: Spring plowing to bury crop residue and several years rotation with non-cereal crops helps to reduce infection.

Resistant Cultivars:

	Resistant	Intermediate	Susceptible
Common	AC Corinne (see Note)	Amazon , AC Cora, AC Elsa, Glenlea, AC Intrepid, Laura	n/a
Durum	Kyle	AC Avonlea, AC Melita	n/a
Soft White	none	AC Nanda	n/a

Chemical: Spray foliage with pyraclostrobin (COM) EC.

Limitations: Preharvest interval – For pyraclostrobin, apply no later than the end of flowering.

Notes: Limited comparative data is being generated on the reactions of new wheat cultivars to individual leaf spot diseases, and the lists presented under each category are not comprehensive. In this and future editions of the Guidelines, the reactions of newer cultivars to the various leaf spots have been listed under a single entity, the 'Leaf Spot Complex'.

References:

1. Bailey, K.L., B.D. Gossen, R.K. Gugel and R.A.A. Morrall. 2003. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 290 pp.

2. Conner, R.L. 1990. Interrelationship of cultivar reaction to common root rot, black point, and spot blotch in spring wheat. Plant Dis. 74: 224-227.

3. Gold, J. 2000. Personal communication. Agric. & Agri-Food Canada, Cereal Res. Centre, Winnipeg MB.

STAGONOSPORA NODORUM LEAF AND GLUME BLOTCH, STAGONOSPORA AVENAE BLOTCH

Phaeosphaeria nodorum, P. avenaria f.sp. *triticea* (See Note 1)

Cultural: Rotation with crops other than wheat, such as flax and oats helps to reduce disease incidence.

Resistant Cultivars: (see Notes 2, 3)

	Resistant	Intermediate	Susceptible
Common	none (see Note 4)	AC Barrie, CDC Bounty, AC Cadillac, AC Corinne, AC Elsa, Glenavon, AC Karma, Katepwa, Laura, AC Majestic, AC Splendor, AC Taber, CDC Teal, AC Vista, 5600HR	n/a
Durum	none	AC Avonlea, Kyle, AC Melita, AC Morse, Napoleon, AC Navigator, Plenty, Sceptre	Commander, Strongfield
Winter	AC Bellatrix	n/a	n/a

Chemical: Treat seed with - carbathiin + thiram (COM) SU; difenoconazole + metalaxyl-M (COM) SU; tebuconazole + thiram (COM) SU (see Note 5).

Spray foliage with - azoxystrobin + propiconazole (COM) SU; chlorothalonil (COM) SU; mancozeb (COM) WG; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SU; pyraclostrobin (COM) EC; tebuconazole (COM) SU.

Limitations: Preharvest interval - 30 days (chlorothalonil, prothioconazole); 36 days (tebuconazole); 40 days (mancozeb); 45 days (azoxystrobin + propiconazole; propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than the end of flowering.

Notes:

1. *Phaeosphaeria nodorum* is the principal causal agent; *P. avenaria* f.sp. *triticea*, while part of the leaf spot complex in wheat, is usually found at low levels.

2. Some wheat cvs. may be tolerant to stagonospora nodorum blotch; e.g. yield losses of Katepwa may be minimal despite foliar symptoms.

3. Under severe disease pressure cultivars suffer significant thousand kernel weight reduction.

4. Limited comparative data is being generated on the reactions of new wheat cultivars to individual leaf spot diseases, and the lists presented under each category are not comprehensive. In this and future editions of the Guidelines, the reactions of newer cultivars to the various leaf spots have been listed under a single entity, the 'Leaf Spot Complex'.

5. Seed treatment will not protect post-seedling plants from infection.

References:

1. Fernandez, M.R., and R.M. DePauw. 1998. Reaction of common wheat cultivars to leaf spots in southern Saskatchewan. Proc. of 'Soils and Crops '98', Saskatoon, SK. pp. 436-439.

2. Gilbert, J. 2007. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg MB.

3. Gilbert, J. and A. Tekauz 1993. Reaction of Canadian spring wheats to *Septoria nodorum* and the relationship between disease severity and yield components. Plant Dis. 77: 398-402.

4. Gilbert, J., S.M. Woods, and A. Tekauz. 1998. Relationship between environmental variables and the prevalance and isolation frequency of leaf-spotting pathogens in spring wheat. Can. J. Plant Pathol. 20: 158-164.

5. Hosford, R.M. Jr. 1976. Fungal leaf spot diseases of wheat in North Dakota (Nature, importance and control). N.D. Agric. Exp. Sta., Bull. 500. 12 pp.

6. Hughes, G. 1992. Personal communication. Crop Dev. Centre, U. of Sask., Saskatoon, SK.

7. Pederson, E.A. and G.R. Hughes. 1992. The effect of crop rotation on development of the septoria complex on spring wheat in Saskatchewan. Can. J. Plant Pathol. 14: 152-158.

STEM RUST

Puccinia graminis f. sp. *tritici*

Cultural: No susceptible barberry species may be imported into Canada and all susceptible species of barberry found should be eradicated (see Note 1).

Resistant Cultivars:

	Resistant	**Mod. Resistant**	**Intermediate**	**Mod. Susceptible**	**Susceptible**
Common	CDC Abound, CDC Alsask, Burnside, AC Cadillac, AC Cora, AC Crystal, AC Domain, AC Corinne, AC Elsa, Fieldstar VB, AC Foremost, Glencross VB, Glenlea, CDC Go, Harvest, Journey, AC Karma, Katepwa, Laura, Lovitt, AC Majestic, McKenzie, CDC Osler, Prodigy, Peace, CDC Rama, Roblin, Snowhite 476, Somerset, Snowstar, AC Splendor, Superb, AC Taber, Unity VB, AC Vista, CDC Walrus, Waskada, 5601HR, 5602HR, 5700PR, 5701PR	Alikat, Alvena, Amazon, AC Barrie, CDC Bounty, Glenavon, Goodeve VB, Helios, Infinity, CDC Imagine, AC Intrepid, Invader, Kane, Lillian, AC Michael, AC Snowbird, Snowhite 475, Stettler, CDC Teal	AC Abbey, AC Eatonia, Kanata, Laser, 5500HR, 5600HR 5702PR	Park	none
Durum	AC Avonlea, Brigade, Commander, Eurostar, Kyle, AC Melita, AC Morse, AC Napoleon, AC Navigator, Plenty, Sceptre, Strongfield, CDC Verona	none	none	none	none
Soft White	none	AC Andrew	none	AC Meena	Bhishaj, AC Nanda, AC Phil, AC Reed
Winter	Accipiter, McClintock, CDC Raptor	CDC Buteo, CDC Falcon, CDC Harrier	CDC Clair, Peregrine	CDC Osprey, CDC Kestrel	AC Bellatrix, Norstar, CDC Ptarmigan, Radiant, AC Readymade, AC Tempest

Chemical: Spray plants with - propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; tebuconazole (COM) SU.

Limitations: Preharvest interval - 36 days (tebuconazole); 45 days (propiconazole, propiconazole + trifloxystrobin).

Notes:

1. The sexual stages of the life cycle of the stem rust fungus develop on common barberry and other susceptible species. Infection of this host results in the production of early spring inoculum of new physiologic races. Barberry threatens the production of wheat, oats, rye, barley, and various grasses in Canada.

2. CDC Bavaria, a spelt wheat, is susceptible to stem rust.

References:

1. Fetch, T. 2008. Personal communication. Agric. & Agri-Food Can. Cereal Res. Centre, Winnipeg, MB.

2. Roelfs, A. 1995. Wheat and rye stem rust. Pages 4-37 *in* The Cereal Rusts, Volume II. A. Roelfs and B. Bushell (eds.), Academic Press, N.Y.

STRIPE RUST

Puccinia striiformis

Cultural: Seeding early will usually decrease the level of rust damage..

Resistant Cultivars:

	Resistant	**Mod. Resistant**	**Intermediate**	**Mod. Susceptible**	**Susceptible**
Common	5701PR (See Note 1)	AC Corinne, AC Domain, AC Elsa, Glenlea, AC Intrepid, AC Karma, AC Snowbird, CDC Teal	AC Cadillac, Roblin, AC Splendor, AC Vista	AC Barrie, AC Cora, AC Crystal, AC Foremost, Kanata, Katepwa, McKenzie, Superb, AC Taber, 5700PR	n/a
Durum	(see Note 2)				
Soft White	AC Andrew, AC Nanda, AC Phil, AC Reed				
Winter	none				Norstar

Chemical: Spray plants with - azoxystrobin + propiconazole (COM) SU; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; pyraclostrobin (COM) EC; tebuconazole (COM) SU.

Limitations: Preharvest interval - 36 days (tebuconazole); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, do not apply later than the end of flowering.

Notes:

1. Stripe rust reactions are known for only some of the registered wheat cultivars.

2. In the field, durums appear to be quite resistant to stripe rust compared to other wheat classes.

2. Stripe rust is common in southern Alberta but was rare on the rest of the prairies until 2000. Stripe rust has become fairly common in the eastern prairies since 2000 due to stripe rust epidemics in the central USA during this time.

3. Increases in the acreage of winter wheat in the eastern prairies may allow the stripe rust organism to over-winter in this region.

References:

1. Conner, R.L. 2002. Personal communication. Agric. & Agri-Food Canada, Cereal Res. Centre, Morden, MB.

2. Conner, R.L. and Kuzyk, A.D. 1988. Effectiveness of fungicides in controlling stripe rust, leaf rust, and black point in soft white spring wheat. Can. J. Plant Pathol. 10: 321-326.

3. Fetch, T. 2008. Personal communication. Agric. & Agri-Food Canada, Cereal Res. Centre, Winnipeg, MB.

4. McCallum, B. 2008. Personal communication. Agric. & Agri-Food Canada, Cereal Res. Centre, Winnipeg, MB.

TAKE-ALL

Gaeumannomyces graminis var. *tritici*

Cultural: Reduced tillage decreases disease incidence. Rotations of 2 years to resistant crops, such as legumes or oats, or keeping land fallow 1 year will help to reduce disease incidence. Good soil fertility, including adequate phosphorus, potassium, sulphur and micronutrient levels are beneficial. Nitrogen applied in spring will normally support lower levels of disease than autumn applications. In acid soils, nitrogen applied in the ammoniacal form can enhance disease control. Grassy weeds and volunteer wheat plants should be destroyed (see Note 1).

Resistant Cultivars: None.

Chemical: Treat seed with difenoconazole + metalaxyl (COM) SU; thiamethoxam + difenoconazole + metalaxyl-M (COM) SU; triadimenol (COM) SU (See Note 2).

Notes:

1. When wheat follows hay crops, severe levels of take-all may develop.

2. Seed treatment will not provide control throughout the entire growing season.

3. Later seeding of winter wheat tends to enhance incidence of take-all.

4. Copper-deficient crops of wheat, particularly when treated with certain herbicides, may exhibit symptoms resembling severe take-all.

References:

1. Conner, R.L. 2002. Personal communication. Agric. and Agri-Food Can. Res. Centre, Lethbridge AB.

2. Evans, I.R. 1998. Personal communication. Alberta Agr., Food and Rural Development, Edmonton AB.

3. Evans, I.R., D. Penney and K. Briggs. 1995. Effects of soil pH and continuous cropping on take-all root rot of wheat. Proc. Western Canada Agronomy Workshop, Red Deer, AB, July 5-8, pp. 216-220.

4. Evans, I.R., D. Penney and K. Briggs. 1995. Take-all versus fake-all. Can. J. Plant Pathol. 17: 289-291.

5. Martens, J.W., W.L. Seaman and T.G. Atkinson (eds.). 1984. Diseases of Field Crops in Canada. Can. Phytopath. Soc. 160 pp.

6. Huber, D.M. 1981. Role of nutrients and chemicals. Page 317-341 *in* Asher and Shipton (eds.), Biology and Control of Take-All. Academic Press, New York.

7. Wiese, M.V. 1987. Compendium of Wheat Diseases. 2nd ed. Am. Phytopathol. Soc., St. Paul, Minn. 106 pp.

TAN SPOT (YELLOW LEAF BLOTCH)

Pyrenophora tritici-repentis

Cultural: Rotation with crops other than wheat (flax, lentil) for more than one year and the turning under of wheat straw and stubble help reduce disease incidence.

Resistant Cultivars:

	Resistant	**Intermediate**	**Susceptible**
Common	none (see Note 2)	Amazon, AC Barrie, AC Cora, AC Crystal, AC Elsa, Glenavon, AC Taber, AC Vista, 5600HR	n/a
Durum	none	Plenty	n/a

Chemical: Spray foliage with - azoxystrobin + propiconazole (COM) SU; chlorothalonil (COM) SU; mancozeb (COM) WG, WP; propiconazole (COM) EC; propiconazole + trifloxystrobin (COM) EC; prothioconazole (COM) SU; pyraclostrobin (COM) EC; tebuconazole (COM) SU.

Limitations: Preharvest interval - 30 days (chlorothalonil, prothioconazole); 36 days (tebuconazole); 40 days (mancozeb); 45 days (azoxystrobin + propiconazole, propiconazole, propiconazole + trifloxystrobin). For pyraclostrobin, apply no later than the end of flowering.

Notes:

1. Common wheat is generally less susceptible than durum wheat.

2. Limited comparative data is being generated on the reactions of new wheat cultivars to individual leaf spot diseases, and the lists presented under each category are not comprehensive. In this and future editions of the Guidelines, the reactions of newer cultivars to the various leaf spots have been listed under a single entity, the 'Leaf Spot Complex'.

References:

1. Fernandez, M.R., McConkey, B.G., and R.P. Zentner. 1999. Effects of tillage method and fallow frequency on leaf spotting diseases of spring wheat in the semiarid Canadian prairies. Soil Till. Res. 50: 259-269.

2. Fernandez, M.R. 2007. Personal communication. Agric. & Agri-Food Can. Res. Centre, Swift Current SK.

3. Fernandez, M.R. and R.M. DePauw. 1998. Reaction of common wheat cultivars to leaf spots in southern Saskatchewan. Proc. of 'Soils and Crops '98', Saskatoon, SK. pp. 430-439.

4. Fernandez, M.R., J.M. Clark and R.M. DePauw. 1996. Comparison of durum and common wheat cultivars to leaf spotting fungi in the field. Plant Dis. 80: 793-797.

5. Fernandez, M.R., J.M. Clark and R.M. DePauw. 1994. Response of durum wheat kernels and leaves at different growth stages to *Pyrenophora tritici-repentis*. Plant Dis. 78: 597-600.

6. Fernandez, M.R., *et al.* 1998. Effects of crop rotations and fertilizer management on leaf spotting diseases of spring wheat in southern Saskatchewan. Can. J. Plant Sci. 78: 489-496.

7. Gilbert, J., S.M. Woods, and A. Tekauz. 1999. Relationship between environmental variables and the prevalence and isolation frequency of leaf-spotting pathogens in spring wheat. Can. J. Plant Pathol. 20: 158-164.

8. Hosford, R.M. Jr. 1976. Fungal leaf spot diseases of wheat in North Dakota (Nature, importance and control). N.D. Agric, Exp. Sta., Bull. 500. 12 pp.

9. Lamari, L. and Bernier, C.C. 1989. Evaluation of wheat lines and cultivars to tanspot (*Pyrenophora tritici-repentis*) based on lesion type. Can. J. Plant Pathol. 11: 49-56.

WHEAT STREAK MOSAIC

Wheat streak mosaic virus

Cultural: Do not sow winter wheat near spring wheat until the latter is completely ripe. Eradicate volunteer wheat and barley and keep land free of living plants for at least one week before sowing (see Notes 1, 2).

Resistant Cultivars: Radiant winter wheat (see Notes 3, 4, 5).

Chemical: None.

Notes:

1. The virus is spread by the wheat curl mite. Both virus and mite need susceptible living plants to survive and multiply.

2. This disease is a problem only in winter wheat-growing areas.

3. The cvs. AC Barrie, Kyle, and Laura are extremely susceptible; AC Elsa, Superb, and AC Taber have some tolerance, i.e. unless disease pressure is very high, they will not sustain as much damage as non-tolerant cultivars.

4. Radiant is resistant to the mite that is the vector of WSMV.

5. In the absence of specific information, wheat cultivars, in general, should be considered as susceptible to WSMV.

References:

1. Atkinson, T.G. 1972. Wheat streak mosaic control. Alta. Dep. Agric., Publ. 631. 8 pp.

2. Conner, R.L. 2000. Personal communication. Agric. & Agri-Food Can. Res. Centre, Lethbridge AB.

3. Haber, S. 2008. Personal communication. Agric. & Agri-Food Can. Res. Centre, Winnipeg MB.

OTHER DISEASES

The following diseases of wheat are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

Ascochyta Leaf Spot (*Ascochyta sorghi*)

Bacterial Blight (*Xanthomonas campestris* pv. *translucens*, *Pseudomonas syringae* pv. *syringae*)

Bacterial Black Chaff (*Xanthomonas campestris* pv. *translucens*)

Brome Mosaic (brome mosaic virus)

Cottony Snow Mold (*Coprinus psychromorbidus*)

Head Discolorations (genetic, physiological)

Snow Scald (*Myriosclerotinia borealis*)

Stem Melanosis (copper deficiency, *Pseudomonas chichorii*)

QUARANTINE DISEASES

The following diseases are absent, or of limited distribution in Canada and are under strict quarantine regulations:

Dwarf Bunt (*Tilletia controversa*)

Flag Smut (*Urocystis agropyri*)

Karnal Bunt (*Tilletia indica*)

APPENDIX I. Cultivar reaction to specific diseases.

Legend: R = Resistant MR = Moderately Resistant I = Intermediate S = Susceptible MS = Moderately Susceptible - = Unknown

BARLEY

	Barley Yellow Dwarf	Common Root Rot	Covered/ False Loose Smut	Leaf Stripe	Loose Smut	Netted Net Blotch	Scald	Speckled Leaf Blotch	Stem[#] Rust	Fusarium Head Blight	Spot Blotch	Spotted Net Blotch
CDC Aurora Nijo*	S	MS	R	-	S	MS	S	S	I	I	S	I
CDC Alamo*	S	MR	MR	-	MR	S	I	S	MS	MS	I	MS
Alston	S	I	R	-	MS	I	MS	S	I	S	MR	MR
B1602	S	MR	I	I	MS	S	S	S	I	S	MR	MS
AC Bacon	S	I	I	-	MS	S	MR	I	I	MR	I	MS
CDC Battleford	S	MR	MR	-	MS	MS	MS	S	MR	S	R	R
Bedford	S	MR	I	I	MS	S	S	S	MR	I	MR	I
Bentley*	S	I	MR	-	MS	MS	S	S	MR	MS	I	R
Binscarth	S	I	R	-	S	I	MS	S	MS	S	MR	MR
CDC Bold*	S	MR	MR	-	MS	S	MR	S	MR	S	S	I
AC Bountiful*	S	I	MR	-	R	I	S	S	MR	I	I	MR
Bronco	S	I	MR	-	MS	S	MS	S	MR	I	I	MR
Calder	S	I	R	-	R	I	S	S	I	MR	I	R
CDC Candle*	S	I	S	-	S	MS	S	S	MR	MR	-	I
Champion*	S	-	R	-	S	S	S	S	I	I	MS	I
Chigwell	S	S	R	-	MS	I	MR	S	MS	S	I	MR
CDC Clyde	S	MR	R	-	I	R	MS	S	MR	S	R	MR
CDC Coalition	S	I	MR	-	R	S	S	S	MR	I	I	MR
Condor*	S	I	MS	R	MS	MS	S	S	MR	MR	S	MS
Conlon*	S	I	I	-	I	I	S	S	MR	MR	I	MR
Conrad*	S	I	MR	-	MS	S	S	S	MS	-	-	MS
CDC Copeland*	MS	I	I	-	MS	I	S	S	MR	I	S	I
CDC Cowboy*	S	I	MR	-	MS	I	MS	I	MR	MR	I	MR
CDC Dawn*	S	I	MS	-	MS	MS	R	S	I	MR	MS	MR
Desperado	S	MR	R	-	MS	S	S	S	MR	S	MR	MR
Dillon	S	-	-	-	-	MS	R	S	-	S	MS	MR
CDC Dolly*	S	I	I	-	S	S	I	S	MS	I	S	MS
CDC Earl	S	I	MR	-	MS	MR	R	S	MR	S	I	MR
Enduro*	S	I	MR	-	S	S	I	S	S	I	MS	MR
Excel	S	MR	I	-	MS	S	S	S	MR	S	MR	I

* = Two-row barley # All cultivars are susceptible to QCC, which may occur in the prairie region.

BARLEY, continued

	Barley Yellow Dwarf	Common Root Rot	Covered/ False Loose Smut	Leaf Stripe	Loose Smut	Netted Net Blotch	Scald	Speckled Leaf Blotch	Stem[#] Rust	Fusarium Head Blight	Spot Blotch	Spotted Net Blotch
Falcon	S	I	MR	-	MS	I	I	R	MR	S	I	I
CDC Fibar	S	S	-	-	-	S	MR	S	MS	I	S	S
Formosa	S	N/A	-	-	-	S	S	S	-	-	I	I
CDC Freedom*	S	I	MR	-	MS	MR	MS	S	I	MR	MS	MR
CDC Gainer*	S	MR	MS	-	MS	I	R	S	MR	I	S	I
AC Harper	S	I	I	-	MS	I	R	S	I	MS	I	I
Harrington*	S	I	MS	S	MS	S	S	S	MS	MR	S	MS
HB 805*	S	I	MR	-	I	MS	MS	S	I	I	S	MR
CDC Helgason*	S	I	MR	-	R	MR	S	S	I	MS	I	MR
Jaeger	S	MS	MS	-	MS	S	MR	S	I	S	I	MS
CDC Kamsack	S	MS	R	-	I	S	MS	S	MR	S	MR	I
Kasota	S	I	R	-	S	MS	R	I	MR	S	I	I
CDC Kendall*	S	MR	MS	-	MS	I	S	S	MS	I	S	MR
Lacey	S	MR	MR	-	I	S	S	S	MR	S	R	I
AC Lacombe	S	MS	MR	-	MS	MS	MS	I	MR	S	I	MR
CDC Landis*	S	MS	MR	-	S	I	S	S	MR	I	I	R
CDC Laurence	S	MS	MR	-	MS	MS	S	S	MS	S	I	MR
Legacy	S	MR	MR	-	I	S	S	S	MR	MS	MR	MR
Mahigan	S	MS	R	-	S	I	R	I	MR	S	I	I
Manley*	S	MR	MR	I	MS	MS	S	S	MR	I	MS	MR
Manny	S	MS	R	-	-	MS	R	S	MS	MS	S	I
CDC Mayfair	S	MS	R	-	S	MS	S	S	MR	MS	I	MR
CDC McGwire*	S	MR	MR	-	MS	I	I	S	I	MR	I	MR
McLeod*	S	I	R	-	S	S	S	S	MS	MS	S	I
CDC Meredith*	S	I	MR	-	R	MS	S	S	MR	I	MS	R
Merlin	S	I	MR	-	MS	MS	S	S	MS	I	-	I
Merit*	S	I	MR	-	MS	I	S	S	I	I	MS	MR
AC Metcalfe*	MS	I	I	-	R	S	S	S	MR	I	I	I
Millhouse*	S	I	MR	-	S	MS	MS	S	MR	I	MS	MS
CDC Mindon	S	-	R	-	R	S	S	S	I	MR	I	MR
Newdale*	S	MR	MR	-	S	I	MS	S	MR	I	MR	MR
Niobe	S	MS	MR	-	MS	MS	I	S	I	MS	S	R
Niska	S	MS	MR	-	MS	S	MR	S	MR	S	R	MR
AC Oxbow*	S	I	I	-	R	I	S	S	MR	I	I	I

* = Two-row barley

All cultivars are susceptible to QCC, which may occur in the prairie region.

BARLEY, continued

	Barley Yellow Dwarf	Common Root Rot	Covered/ False Loose Smut	Leaf Stripe	Loose Smut	Netted Net Blotch	Scald	Speckled Leaf Blotch	Stem[#] Rust	Fusarium Head Blight	Spot Blotch	Spotted Net Blotch
Peregrine	S	MR	-	-	MS	S	I	S	I	S	MR	I
Phoenix*	S	I	I	-	MS	S	S	S	MS	MR	MS	MS
Ponoka	S	I	R	-	R	MS	MR	S	S	I	S	MR
AC Ranger	S	MR	I	-	MS	I	MS	S	MR	S	MR	MR
CDC Rattan	S	MS	R	-	MR	MS	I	S	I	MR	I	I
CDC Reserve*	S	I	MS	-	S	S	S	S	MS	MS	MS	R
Robust	S	I	I	-	I	S	S	S	MR	MS	MR	MS
AC Rosser	S	MR	MR	-	MS	I	S	S	MR	S	MR	MR
Seebe*	S	I	R	R	S	S	MR	S	MS	MR	S	MS
CDC Select*	S	MS	MR	-	MR	MS	S	S	I	S	MS	MR
Selkirk	S	I	R	-	MS	MS	S	S	I	S	I	I
CDC Silky	S	MR	I	-	I	S	R	I	MR	S	MR	I
CDC Sisler	I	I	MS	-	MS	S	MS	S	MR	I	MR	I
CDC Springside	S	I	I	-	MR	S	S	S	MS	S	R	I
Stander	S	I	MS	-	MS	S	S	S	MR	S	MR	MR
Stein*	S	MS	MR	I	MS	S	S	S	MR	-	S	I
Stockford*	S	MR	R	-	S	MS	MS	S	MS	MS	I	MS
CDC Stratus*	S	I	I	-	MS	I	S	S	MR	I	MS	MR
Sundre	S	MS	R	-	MS	MS	R	S	I	S	I	I
Tercel*	S	MS	I	-	MS	I	S	S	MR	I	S	S
CDC Thompson*	S	I	MR	-	MS	S	MS	S	MR	I	S	MR
CDC Tisdale	S	MS	-	-	I	I	S	S	I	I	R	R
Tradition	S	MR	MR	-	S	S	S	S	MR	S	MR	I
CDC Trey	S	MR	R	-	MS	I	MS	S	MR	I	MS	R
Trochu	S	MR	MR	-	MS	S	I	S	MR	-	I	MR
Tyto	S	I	R	-	S	S	MS	S	I	MS	I	I
CDC Unity*	S	MR	-	-	-	I	S	S	-	-	-	-
Virden	S	MR	I	R	MS	MS	S	S	MR	S	MR	MR
Vivar	S	MR	R	-	I	R	I	S	MR	S	I	MR
Westford	S	-	-	-	-	MS	MR	S	MR	S	-	MS
Xena*	S	MR	MS	-	MS	S	S	S	MR	MR	S	I
CDC Yorkton	S	MR	MR	-	MS	I	MS	S	MR	MS	MR	MR

* = Two-row barley

All cultivars are susceptible to QCC, which may occur in the prairie region.

OAT

	Covered/Loose Smut	BYD	Crown Rust	Stem Rust*
AC Assiniboia	R	I	S	I
CDC Baler	S	S	S	-
CDC Bell	-	S	S	-
AC Belmont	R	MS	S	I
SW Betania	R	S	S	S
Boudrias	R	MR	S	I
CDC Boyer	S	S	S	I
Bullion	S	S	S	S
Calibre	MS	S	S	S
Canmore	-	S	S	-
Cascade	S	S	S	S
CDC Dancer	R	S	S	I
Derby	MS	S	S	S
Dumont	R	S	S	I
SW Exactor	I	MS	S	S
Furlong	R	MR	S	I
Gehl	R	S	S	MS
AC Gwen	R	I	S	I
Hifi	MS	S	R	I
Jordan	R	S	S	I
AC Juniper	I	S	S	-
Kaufmann	R	S	S	I
Lee Williams	R	MR	S	I
Leggett	R	S	R	I
Lu	R	S	S	S
AC Medallion	R	S	S	I
CDC Minstrel	R	S	MS	I
AC Morgan	MS	S	S	I
Murphy	S	S	S	-
AC Mustang	I	S	S	S
CDC Orrin	R	S	S	S
Pinnacle	R	MS	S	I
AC Preakness	R	MS	S	I
CDC ProFi	MS	-	S	I
AC Rebel	-	MR	S	I
Riel	R	S	S	I
Robert	R	I	S	I
Ronald	R	MR	S	I
CDC Sol-Fi	R	S	S	S
Souris	R	S	S	MR
Stainless	R	S	R	MR
OT2046 (Summit)	R	S	R	I
Triactor	-	S	MR	S
Triple Crown	MR	S	S	S
Waldern	S	S	S	S
CDC Weaver	R	MS	S	I
7600M	R	S	S	I

* All oat cultivars are susceptible to race NA67, which occurs frequently in the prairie region.

RYE

	Stem Smut
Dakota	-
Gazelle (spring)	-
Hazlet	-
Musketeer	I
Prima	I
AC Remington	-
AC Rifle	R

TRITICALE

	Common Bunt	Common Root Rot	Leaf Rust	Stem Rust
AC Alta	R	I	R	R
Banjo	R	I	R	R
Bobcat	R	-	-	-
Bunker	-	-	-	-
AC Certa	R	I	R	R
Companion	-	-	-	-
AC Copia	R	I	R	R
Fridge	-	-	-	-
Pika	-	-	-	-
Pronghorn	R	I	R	I
Sandro	-	-	-	-
Tyndal	-	-	-	-
AC Ultima	R	I	R	R

WHEAT

	Barley Yellow Dwarf	Common Bunt	Common Root Rot	Leaf Rust	Loose Smut	Powdery Mildew	Stagonospora leaf blotch	Stem Rust	Stripe Rust	Wheat Streak Mosaic	Fusarium Head Blight	Tan Spot	Spot blotch
COMMON													
5500 HR	MS	R	-	R	I	-	n/a	I	n/a	-	n/a	n/a	n/a
5600 HR	MS	R	-	R	R	-	I	I	n/a	-	MS	I	n/a
5601 HR	MS	MR	-	MR	I	-	n/a	R	n/a	-	I	n/a	n/a
5602 HR	MS	MR	-	R	R	-	n/a	R	n/a	-	MR	n/a	n/a
5700 PR	MS	MR	-	MR	MS	-	n/a	R	MS	-	S	n/a	n/a
5701 PR	MS	I	-	R	I	-	n/a	R	R	-	S	n/a	n/a
5702PR	MS	I	-	MR	MS	-	n/a	I	n/a	-	MS	n/a	n/a
AC Abbey#	MS	MR	I	MR	I	-	n/a	I	n/a	-	S	n/a	n/a
CDC Abound	MS	I	-	MS	I	-	n/a	R	n/a	-	n/a	n/a	n/a
Alikat	MS	-	I	MS	MR	-	n/a	MR	n/a	-	I	n/a	n/a
CDC Alsask	MS	MR	-	R	MR	-	n/a	R	n/a	-	MS	n/a	n/a
Alvena	MS	MR	-	I	MR	-	n/a	MR	n/a	-	MS	n/a	n/a
Amazon	MS	I	R	MR	R	-	n/a	MR	n/a	-	MS	I	I
AC Barrie	MS	I	I	MS	MR	-	I	MR	MS	S*	I	I	n/a
CDC Bounty	MS	I	-	I	MR	-	I	MR	n/a	-	I	n/a	n/a
CDC Burnside	MS	I	-	R	R	-	n/a	R	n/a	-	MS	n/a	n/a
AC Cadillac	MS	R	I	MR	R	-	I	R	I	-	I	n/a	n/a
AC Cora	MS	R	I	R	MR	-	n/a	R	MS	-	I	I	I
AC Corinne	MS	I	I	MR	R	-	I	R	MR	-	MS	n/a	R
AC Crystal	MS	R	I	MS	I	-	n/a	R	MS	-	S	n/a	n/a
AC Domain	MS	MR	-	I	R	-	n/a	R	MR	-	MS	n/a	n/a
AC Eatonia#	MS	MR	I	MR	MS	-	n/a	I	n/a	-	n/a	n/a	n/a
AC Elsa	MS	I	I	MR	MR	-	I	R	MR	I**	MS	I	I
Fieldstar VB	MS	I	-	R	I	-	n/a	R	n/a	-	I	n/a	n/a
AC Foremost	MS	R	I	MS	I	-	n/a	R	MS	-	S	n/a	n/a
Glenavon	MS	-	I	MR	R	-	I	MR	n/a	-	MS	I	n/a
Glencross VB	MS	I	-	MR	R	-	n/a	R	n/a	-	S	n/a	n/a
Glenlea	MS	MS	R	I	R	-	n/a	R	MR	-	MS	n/a	I
CDC Go	MS	MR	-	I	MS	-	n/a	R	n/a	-	I	n/a	n/a
Goodeve VB	MS	MS	-	MR	MR	-	n/a	MR	n/a	-	S	n/a	n/a
Harvest	MS	I	-	MR	MR	-	n/a	R	n/a	-	S	n/a	n/a
Helios	MS	MR	-	MS	R	-	n/a	MR	n/a	-	I	n/a	n/a
CDC Imagine	MS	MR	-	I	MR	-	n/a	MR	n/a	-	S	n/a	n/a
Infinity	MS	I	-	R	MR	-	n/a	MR	n/a	-	S	n/a	n/a
AC Intrepid	MS	MR	R	MR	I	-	n/a	MR	MR	-	MS	n/a	I
Journey	MS	MR	-	I	I	-	n/a	R	n/a	-	MS	n/a	n/a

#Sawfly resistant. *Particularly susceptible to WSM. I**=Tolerant to WSM damage.

WHEAT

	Barley Yellow Dwarf	Common Bunt	Common Root Rot	Leaf Rust	Loose Smut	Powdery Mildew	Stagonospora Leaf Blotch	Stem Rust	Stripe Rust	Wheat Streak Mosaic	Fusarium Head Blight	Tan Spot	Spot Blotch
COMMON continued													
Kanata	MS	MS	-	MS	I	-	n/a	I	MS	-	I	n/a	n/a
Kane	MS	I	-	R	MS	-	n/a	MR	n/a	-	I	n/a	n/a
AC Karma	MS	R	I	MS	I	-	I	R	MR	-	MS	n/a	n/a
Katepwa	MS	MR	I	MS	MR	-	I	R	MS	-	I	n/a	n/a
Laser	MS	S	I	MS	R	-	n/a	I	n/a	-	S	n/a	n/a
Laura	MS	S	R	MR	I	-	I	R	n/a	S*	n/a	n/a	I
Lillian#	MS	MR	-	R	I	-	n/a	MR	n/a	-	S	n/a	n/a
Lovitt	MS	I	-	MR	MR	-	n/a	R	n/a	-	S	n/a	n/a
AC Majestic	MS	MR	I	MS	I	-	I	R	n/a	-	I	n/a	n/a
McKenzie	MS	R	I	R	MS	-	n/a	R	MS	-	I	n/a	n/a
AC Michael	MS	-	I	MS	MR	-	n/a	MR	n/a	-	MS	n/a	n/a
CDC Osler	MS	MR	-	R	MR	-	n/a	R	n/a	-	S	n/a	n/a
Park	MS	-	I	S	MR	-	n/a	MS	n/a	-	n/a	n/a	n/a
Peace	MS	R	-	MR	R	-	n/a	R	n/a	-	S	n/a	n/a
Prodigy	MS	MR	I	R	I	-	n/a	R	n/a	-	S	n/a	n/a
CDC Rama	MS	MR	-	MR	R	-	n/a	R	n/a	-	I	n/a	n/a
Roblin	MS	S	R	I	MR	-	n/a	R	I	-	S	n/a	n/a
AC Snowbird	MS	I	-	I	MR	-	n/a	MR	MR	-	n/a	n/a	n/a
Snowwhite 475	MS	R	-	MS	I	-	n/a	MR	n/a	-	S	n/a	n/a
Snowwhite 476	MS	R	-	I	R	-	n/a	R	n/a	-	S	n/a	n/a
Snowstar	MS	MS	-	MR	MS	-	n/a	R	n/a	-	MS	n/a	n/a
Somerset	MS	I	-	MR	R	-	n/a	R	n/a	-	MS	n/a	n/a
AC Splendor	MS	I	I	MR	I	-	I	R	I	-	MS	n/a	n/a
Stettler	-	MR	-	MS	R	-	n/a	MR	n/a	-	MS	n/a	n/a
Superb	I	MR	-	S	I	-	n/a	R	MS	I**	MS	n/a	n/a
AC Taber	MS	R	I	I	MS	-	I	R	MS	I**	S	I	n/a
CDC Teal	MS	I	I	MR	MR	-	I	MR	MR	-	S	n/a	n/a
Unity VB	MS	R	-	R	MS	-	n/a	R	n/a	-	S	n/a	n/a
AC Vista	I	R	I	MS	R	-	I	R	I	-	S	I	n/a
CDC Walrus	MS	I	-	MR	R	-	n/a	R	n/a	-	S	n/a	n/a
Waskada	I	R	-	I	MR	-	n/a	R	n/a	-	MR	n/a	n/a
DURUM													
AC Avonlea	MS	R	I	R	S	-	I	R	n/a	S	MS	n/a	I
Brigade	MS	R	-	R	S	-	n/a	R	n/a	S	MS	n/a	n/a
Commander	MS	R	-	R	I	-	S	R	n/a	S	S	n/a	n/a

#Sawfly resistant. *Particularly susceptible to WSM. I**=Tolerant to WSM damage.

WHEAT

	Barley Yellow Dwarf	Common Bunt	Common Root Rot	Leaf Rust	Loose Smut	Powdery Mildew	Stagonospora Leaf Blotch	Stem Rust	Stripe Rust	Wheat Streak Mosaic	Fusarium Head Blight	Tan Spot	Spot Blotch
DURUM continued													
Eurostar	MS	R	-	R	S	-	n/a	R	n/a	S	MS	n/a	n/a
Kyle	MS	R	I	R	S	-	I	R	n/a	S*	MS	n/a	R
AC Melita	MS	R	I	R	S	-	I	R	n/a	S	S	n/a	I
AC Morse	MS	R	I	R	S	-	I	R	n/a	S	S	n/a	n/a
AC Napoleon	MS	R	I	R	S	-	I	R	n/a	S	MS	n/a	n/a
AC Navigator	MS	R	I	R	S	-	I	R	n/a	S	S	n/a	n/a
Plenty	MS	R	I	R	S	-	I	R	n/a	S	MS	I	n/a
Sceptre	MS	R	I	R	S	-	I	R	n/a	S	S	n/a	n/a
Strongfield	MS	MR	-	R	S	-	S	R	n/a	S	S	n/a	n/a
CDC Verona	MS	R	-	R	MS	-	n/a	R	n/a	S	MS	n/a	n/a
SOFT WHITE													
AC Andrew	MS	MS	-	S	S	I	n/a	MR	R	-	n/a	n/a	n/a
Bhishaj	MS	S	-	S	S	-	n/a	S	n/a	-	n/a	n/a	n/a
AC Meena	MS	-	-	S	S	-	n/a	MS	n/a	-	n/a	n/a	n/a
AC Nanda	MS	-	I	S	S	R	n/a	S	R	-	n/a	n/a	I
AC Phil	MS	S	I	S	S	I	n/a	S	R	-	n/a	n/a	n/a
AC Reed	MS	S	I	S	S	I	n/a	S	R	-	n/a	n/a	n/a
WINTER													
Accipiter	MS	S	-	I	n/a	n/a	n/a	R	n/a	-	n/a	n/a	n/a
AC Bellatrix	MS	MR	-	S	S	-	R	S	n/a	-	MS	n/a	n/a
CDC Buteo	MS	S	-	MR	S	-	n/a	MR	n/a	-	I	n/a	n/a
CDC Clair	MS	S	I	I	S	-	n/a	I	n/a	-	MS	n/a	n/a
CDC Falcon	MS	S	-	MR	S	-	n/a	MR	n/a	-	S	n/a	n/a
CDC Harrier	MS	S	-	MS	S	-	n/a	MR	n/a	-	S	n/a	n/a
Kestrel	MS	S	-	MS	S	-	n/a	MS	n/a	-	I	n/a	n/a
McClintock	MS	S	-	MR	S	-	n/a	R	n/a	-	S	n/a	n/a
Norstar	MS	S	S	S	S	-	n/a	S	S	S	I	n/a	n/a
CDC Osprey	MS	S	I	MS	S	-	n/a	MS	n/a	-	S	n/a	n/a
Peregrine	MS	S	-	MR	S	-	n/a	I	n/a	-	-	n/a	n/a
CDC Ptarmigan	MS	S	-	S	S	-	n/a	S	n/a	-	-	n/a	n/a
Radiant	MS	MS	-	S	S	-	n/a	S	n/a	R	S	n/a	n/a
CDC Raptor	MS	S	-	MR	S	-	n/a	R	n/a	-	S	n/a	n/a
Readymade	MS	I	-	S	S	-	n/a	S	n/a	-	S	n/a	n/a
AC Tempest	MS	-	-	S	S	-	n/a	S	n/a	-	MS	n/a	n/a

#Sawfly resistant. *Particularly susceptible to WSM. I**=Tolerant to WSM damage.

APPENDIX II. Seed Treatment fungicides registered for use against diseases of barley in Canada.

Active Ingredient	Trade Name	Formulation	PCP#	Loose Smut	Covered Smut & False L. Smut	Damping-off, seed rots	Common Root Rot*	Seedling blight	Seed borne Fusarium	Scald	Leaf Stripe	Net Blotch	Septoria
carbathiin + thiram	Vitaflo 280	15.59% + 13.25% SU	11423	x	x	x	x*	x			x**	x*	
difenoconazole + metalaxyl-M	Dividend XL RTA	3.21% + 0.27% SU	25777		x	x	x*	x					x**
fludioxonil	Maxim 480FS	40.30% SN	27001					x	x				
maneb	DB-Red L	323 g/L LI	27144		x	x	x*	x					
metalaxyl	Allegiance FL	317 g/L SN	26674					x (Pythium, export only)					
	Apron FL	317 g/L SN	24262					x (Pythium, export only)					
tebuconazole	Raxil 250 FL	6 g/L SU	26138	x	x	x	x*	x	x		x**		
tebuconazole + thiram	Raxil T	6.7 g/L + 222 g/L SU	27566	x	x		x*	x					
thiamethoxam + difenoconazole + metalaxyl-M	Cruiser Maxx Cereals	2.80 + 3.36 + 0.56 SU	29127		x	x (Fusarium, Pythium)	x*	x (Fusarium, Pythium)	x				
triadimenol	Baytan 30	317 g/L SU	24677	x	x		x*			x*	x**	x*	
triticonazole	Charter	2.5% SU	26455	x	x	x	x*	x (Fusarium)	x				
triticonazole + thiram	Gemini	1.25% + 12.50% SU	27826	x	x	x (Fusarium, Pythium)	x*	x	x				

* suppression only
** seed-borne

APPENDIX III. Foliar fungicides registered for use against diseases of barley in Canada.

Active Ingredient	Trade Name	Formulation	PCP#	Powdery Mildew	Septoria	Leaf Rust	Stem Rust	Scald	Spot Blotch	Net Blotch	Fusarium Head Blight
azoxystrobin + propiconazole	Quilt	75 g/L + 125 g/L SU	28328		x	x		x		x	
propiconazole	Bumper 418 Pivot 418 Tilt 250	418 g/L EC 418 g/L 250 g/L	28017 28219 19346	x	x		x	x	x	x	
propiconazole + trifloxystrobin	Stratego 250	125 g/L + 125 g/L EC	27528	x	x	x		x	x	x	
prothioconazole	Proline 480EC	480 g/L SU	28359					x	x	x	x*
pyraclostrobin	Headline	250 g/L EC	27322					x	x	x	

* suppression only

APPENDIX IV. Fungicides registered for use against diseases of oat and rye in Canada.

Active Ingredient	Trade Name	Formulation	PCP#	Oat or Rye		Oat					Rye		
				Damping-off, seed rots	Common Root Rot*	Loose Smut	Covered Smut	Crown Rust	Septoria	Leaf Blotch	Stem Smut	Leaf Rust	Powdery Mildew
Seed Treatments:													
carbathiin + thiram	Vitaflo 280	15.59 % SU + 13.25%	11423	x	x*	x	x				x		
difenoconazole + metalaxyl-M	Dividend XL RTA	3.37 % + 0.27% SU	25777	x	x*	x	x						
fludioxonil	Maxim 480FS	40.3% SN	27001	x									
maneb	DB-Red L	323 g/L LI	27144	x	x		x						
metalaxyl	Allegiance FL	317 g/L SN	26674	x (Pythium, export only)									
	Apron FL	317 g/L SN	24262	x (Pythium, export only)									
tebuconazole	Raxil 250 FL	6 g/L SU	26138			x							
tebuconazole + thiram	Raxil T	6.7 g/L + 222 g/L SU	27566	x (oat only)	x* (oat only)	x							
triticonazole	Charter	2.5% SU	26455	x (Fusarium) (oat only)	x* (oat only)	x	x						
triticonazole + thiram	Gemini	1.25% SU 12.50%	27826			x	x						
Foliar Application:													
propiconazole	Tilt 250 Bumper 418 EC Pivot 418 EC	25% EC 418 g/L 418 g/L	19346 28017 28219					x	x	x			
propiconazole + trifloxystrobin	Stratego 250	125 g/L + 125 g/L EC	27528					x	x	x			
pyraclostrobin	Headline EC	250 g/L EC	27322					x				x	x

*suppression only

APPENDIX V. Seed treatment fungicides registered for use against diseases of wheat and triticale in Canada.

Active Ingredient	Trade Name	Formulation	PCP#	Loose Smut	Common Bunt	Seed Rot	Damping-off/Seedling blight	Seed Borne Fusarium	Common Root Rot*	Take-all	Powdery mildew	Septoria
Triticale - Seed Treatments:												
carbathiin + thiram	Vitaflo-280	13.2% + 14.9% SU	11423			x	x		x*			
difenoconazole + metalaxyl-M	Dividend XL RTA	3.37% + 0.27% SU	25777	x		x	x (Fusarium, Pythium)	x	x*	x*		x**
fludioxonil	Maxim 480FS	40.3% SN	27001			x	x					
Wheat - Seed Treatments:												
carbathiin + thiram	Vitaflo-280	13.2% + 14.9% SU	11423	x	x	x	x		x*			x**
difenoconazole + metalaxyl-M	Dividend XL RTA	3.37% + 0.27% SU	25777	x	x	x	x (Fusarium, Pythium)	x	x*	x*		x**
fludioxonil	Maxim 480FS	40.3% SN	27001			x	x	x				
maneb	DB-Red L	323 g/L LI	27144		x		x		x*			
metalaxyl	Allegiance FL	317 g/L SN	26674			x (Pythium, export only)	x (Pythium, export only)					
	Apron FL	317 g/L SN	24262			x (Pythium, export only	x (Pythium, export only)					
tebuconazole	Raxil 250 FL	6 g/L SU	26138	x	x	x	x		x*			
tebuconazole + thiram	Raxil T	6.7 g/L + 222 g/L SU	27566	x	x	x	x	x	x*			x**
thiamethoxam + difenoconazole + metalaxyl-M	Cruiser Maxx Cereals	2.80 + 3.36 + 0.56 SU	29127	x	x	x (Fusarium, Pythium)	x (Fusarium, Pythium)	x	x*	x*		
triadimenol	Baytan 30	317 g/L SU	24677	x	x					x*	x	
triticonazole	Charter	2.5% LI	26455	x	x	x (Fusarium)	x (Fusarium)	x	x*			
triticonazole + thiram	Gemini	1.25% SU + 12.50%	27826	x	x	x (Fusarium)	x (Fusarium, Pythium)	x	x*			

* suppression
** seed-borne

APPENDIX VI. Foliar fungicides registered for use against diseases of wheat Canada.

Active Ingredient	Trade Name	Formulation	PCP#	Powdery mildew	Septoria	Leaf Rust	Stripe Rust	Stem Rust	Spot Blotch	Tan Spot	Fusarium Head Blight
azoxystrobin + propiconazole	Quilt	75 g/L + 125 g/L SU	28328		x	x	x			x	
chlorothalonil	Bravo 500	500 g/L SU	15723		x					x	x*
mancozeb	Dithane DG Rainshield Manzate 200-DF Manzate Prostick Penncozeb 75	75% WG 75% WG 75% WP 75% WP	20553 21057 28217 25397		x	x				x	
propiconazole	Tilt Bumper 418 Pivot 418	250 g/L EC 418 g/L EC 418 g/L EC	19346 28017 28219	x	x	x	x	x		x	
propiconazole + trifloxystrobin	Stratego 250	125 g/L + 125 g/L EC	27528	x	x	x	x	x		x	
prothioconazole	Proline 480 SC	480 g/L SU	28359		x	x				x	x*
pyraclostrobin	Headline	250 g/L EC	27322	x	x	x	x		x	x	
tebuconazole	Folicur 432 F	432 g/L SU	25940	x	x	x	x	x		x	x*

* suppression