Direct Seeding

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Controlling Wheat Diseases in Direct Seeding Systems

Disease control in wheat requires good agronomic practices whether conventional or direct seeding systems are used. Weather conditions and crop rotations are much more important factors than the amount of tillage in determining disease occurrence and intensity.

Wheat Diseases

Yield- and quality-influencing infectious wheat diseases on the prairies can be divided into the categories shown in the table below.

Disease source	Diseases	Control
Seed-borne	loose smut	systemic seed treatment fungicides, resistant varieties
	common bunt*	seed treatment fungicides, resistant varieties, crop rotation
Residue-borne	tan spot	foliar fungicides, crop rotation, resistant varieties, tillage
	mildew (in soft white spring wheats)	foliar fungicides, resistant varieties, crop rotation
	septorias	foliar fungicides, resistant varieties, tillage, crop rotation
	ergot	increase soil copper availability, tillage
	fusarium head blight (fusarium damaged kernels)	crop rotation (avoid planting wheat after other cereal and corn crops), seed treatment fungicides
	snow moulds (in winter wheat)	crop rotation, tillage
Soil-borne	browning root rot	increase soil phosphate levels
	common root rot	seed treatment fungicides, resistant varieties, crop rotation
	take-all	crop rotation (avoid planting wheat after barley or breaking pasture)
Off-site sources	rusts**	resistant varieties, foliar fungicides
	viruses (carried by aphids or mites)	no control available for most viral diseases; for wheat streak mosaic virus, avoid overlap of volunteer spring wheat and fall wheat planting; resistant varieties being developed

* Dwarf bunt and karnal bunt of wheat do not occur on the prairies. Dwarf bunt occurs in eastern Canada and the inter-mountain valleys of southern British Columbia. Karnal bunt is widespread in the southern U.S. and severely affects the movement of cereals from the U.S. to Canada.

** Stem and leaf rusts of wheat are not normally problems in Alberta. Stripe rust occurs sporadically on winter and irrigated wheats.

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Important non-infectious wheat diseases include:

- rugby stocking (frost banding due to frost injury when the temperature drops below -3°C, or heat banding from hot, sunny weather),
- prolonged waterlogging,
- herbicide injury, and
- nutrient deficiency.

Herbicide injury can sometimes resemble infectious diseases. It can significantly harm crop growth and production and may increase disease susceptibility. Herbicide injury can result from herbicides applied to the crop or from herbicide residues. Severe herbicide injury from aerially applied herbicides in wheat crops may result from an interaction of one or more factors including high crop residue levels, high manure application rates, high soil moisture, soil-borne herbicide residues and soil copper deficiency.

A deficiency of micronutrients such as copper is a widespread problem and significantly limits yields in an estimated 10 per cent or more of Alberta cropland. About 1 acre in 3 in Alberta will show yield increases in wheat with added copper fertilizer. Many wheat diseases and disorders, including yellowing, pigtailing, melanosis (browning), apparent take-all and high ergot levels, are due to low levels of soil-available copper (see *Copper Deficiencies in Cereal Crops*, Agdex 532-2, *Micronutrient Requirements of Crops in Alberta*, Agdex 531-1 and *Minerals for Plants, Animals and Man*, Agdex 531-3).

Deficiencies in soil macronutrients (nitrogen, phosphorus, potassium and sulphur) may also affect the incidence of wheat diseases. Be sure to test soil regularly because changing to direct seeding could significantly alter nutrient availability and fertilizer needs.

Influence of Tillage Systems on Disease

Seed-borne and off-site disease sources

Tillage has no effect on the occurrence of most rusts, virus infections and loose smut. One exception is common bunt. Its spores, which are usually seed-borne, may persist up to a year on the soil surface in dry years and could infect wheat following wheat.

Residue-borne diseases

The occurrence and intensity of tan spot, mildew, septorias and fusarium head blight are very dependent on wet or humid weather, lack of rotation (wheat following wheat) or, in the case of soft white wheat, susceptible varieties. The presence of surface residues could increase levels of tan spot, septoria and possibly fusarium head blight when conditions are favourable for disease development.

The occurrence of ergots in wheat, barley and oats is an excellent indicator of soil copper deficiency (see *Copper Deficiencies in Cereal Crops*, Agdex 532-2). Fields under direct seeding or minimum tillage may have large amounts of crop residue at the soil surface which may tie up copper, increasing copper deficiency especially in wet seasons. Tillage or burial of ergots prevents them from germinating. In direct seeding systems, ergots remain at the soil surface, so they can germinate under wet conditions, including rain or heavy dew.

The occurrence of snow moulds on winter wheat may increase if winter wheat is grown after winter wheat and if the snow cover is deep and stays late into April. Direct seeding may aggravate this problem because sclerotes and other summer survival structures must be buried deeper than 7 cm (3 inches) by tillage to prevent production of infectious spores under snow cover.

Soil-borne diseases

Soil-borne diseases, such as common root rot, take-all and browning root rot, may be influenced by the amount of tillage. The degree of influence and whether it is negative or positive are still under investigation. Some preliminary data suggest that the influence of tillage on soil-borne diseases might depend on weather conditions. Researchers at Agriculture and Agri-Food Canada's Lethbridge Research Centre have linked the increased earthworm populations in direct seeded plots to reduced root rot because the earthworms feed on the disease-causing organisms.

Direct Seeding Tips for Disease Control

Crop rotation

Crop rotation is essential for the effective control of soil- and residue-borne diseases of wheat. Without crop rotation, these diseases can result in serious yield losses. For example, after three or four years of wheat-after-wheat, common root rot can reduce yields of some wheat cultivars (varieties) by up to 20 per cent, and take-all may cause yield losses exceeding 70 per cent. (However, in continuous wheat the take-all level may stabilize after these very high yield losses, at less than 5 per cent yield loss. The reason for this is not known.) A three- or four-year rotation with wheat will greatly reduce the buildup of soil- and residue-borne diseases.

Crop residue effects

- The crop residue cover on direct seeded fields conserves soil moisture and traps snow. Thus, seeding depths can be shallower in direct seeded fields. Shallow seeding results in earlier emergence and more vigorous seedlings better able to withstand disease.
- When crop residue levels are high, direct seeding can give wheat seedlings a better start. Direct seeding avoids the marked temporary nitrogen deficiency in conventional tillage fields caused by incorporating large amounts of straw into the soil.
- Early seeding of wheat into a heavily strawed field might result in more severe frost injury to the crop, but such injury is no more damaging to wheat establishment than sunscald on emerging wheat in tilled soil. Wheat may take one to three more days to emerge on direct seeded fields due to cooler soil conditions in some years (refer to *Soil Temperature and Direct Seeding*, Agdex 590-2).

Wheat Classes and Disease Control

Winter wheat

Direct seeded winter wheat benefits from snow trapped by standing stubble. The snow insulates wheat seedlings from low temperature injury. However, a heavy snow cover persisting into late March or April may favour the development of snow moulds.

Early seeding (August) of winter wheat increases the risk of wheat streak mosaic virus spreading to the winter wheat crop from unripened spring wheat or from spring and winter wheat volunteers. All volunteer wheat must be controlled both in the field to be seeded to winter wheat and in nearby fields at least two weeks before seeding. (For more information see *Direct Seeded Winter Wheat*, Agdex 112/22-1, and *Wheat Streak Mosaic in Alberta and Its Control*, Agdex 112/632-3.)

Soft white wheats

In Alberta, usually only irrigated soft white wheats are economically affected by fusarium head blight at present. Avoid planting soft white wheats into corn or cereal stubble and, if possible, plant well away from corn stubble fields since they can be a major source of fusarium head blight (see *Fusarium Head Blight of Barley and Wheat*, Agdex 110/632-1).

Hard red spring wheats

Older, lower yielding hard red wheat cultivars are more disease-tolerant than newer, higher yielding types, particularly to loose smut and bunt. However, newer cultivars appear to have more tolerance to some soil-applied herbicides than older cultivars developed in the 1970s.

Durum wheats

Durum wheats, except Sceptre, require longer growing seasons and higher heat units than other wheats. Therefore they are grown in the southern areas of the province where drier air and soil conditions are less favourable for soil-borne and residue-borne foliar diseases. In the moister areas of Alberta, the higher soil moisture under direct seeding may increase disease and grain quality problems in durum wheats.

Canadian spring wheats

Spring wheats appear to be more susceptible than hard red wheats to disease, particularly take-all. Avoid sowing spring wheat after any other wheat in the rotation, especially if take-all has been a problem.

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Factsheets in the Direct Seeding Series are also available through Alberta Agriculture's Internet site at *http://www.agric.gov.ab.ca/agdex/500/index.html*

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