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Common Root and Crown Rot Diseases of Wheat in South Dakota

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Common Root and Crown Rot Diseases of Wheat in South Dakota

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Disease Impact

Root and crown rotting diseases are among the most common and destructive diseases of wheat in South Dakota. They are present in every growing season and are estimated to cause as much as 3-4% crop losses in an average year. Losses may be greater in years with environmental conditions favoring specific root or crown diseases.

Pathogens and Diseases

There are three common diseases of the roots and crowns of the wheat plant in South Dakota:

- Take-all.
- Common root rot.
- Fusarium foot and crown rot.

Several different fungi cause these diseases, but each fungus is associated with crop residue in the soil. The fungi do not survive and grow directly in the soil, rather, they are closely associated with the crop debris.

Take-all is caused by *Gaumanomyces graminis* var. *tritici*. It is the least common of these diseases, but may be the most damaging, "taking all" of the yield. Take–all is typically a greater problem on winter wheat growing in wet soils.

Common root rot is caused by *Cochliobolus sativus*, and foot and crown rot is caused by several species of *Fusarium*. Often, common root rot will occur more obviously on hillsides, and foot and crown rot will be worst on hillsides or low areas. Common root rot and foot and crown rot are favored by dry conditions and may occur on either winter or spring wheat.

Successive years of cropping wheat in the same fields may increase populations of these fungi in the soil and the potential for causing damage. Reduced tillage practices, especially no-till, can increase the population of root and crown rotting fungi by maintaining the residue that they survive on.

The take-all fungus infects the plant by growing from infected residue to healthy roots in a close proximity in the soil. The fungus then grows onto and into the root tissue. Similarly, common root rot infections occur when the pathogen contacts the sub-crown internode and moves upward into the crown and basal stems of the plant.

A complex of several species of Fusarium fungi attack wheat plants causing foot and crown rot by growing from crop residue into

Figure 1. Glassy-black symptoms of take-all.

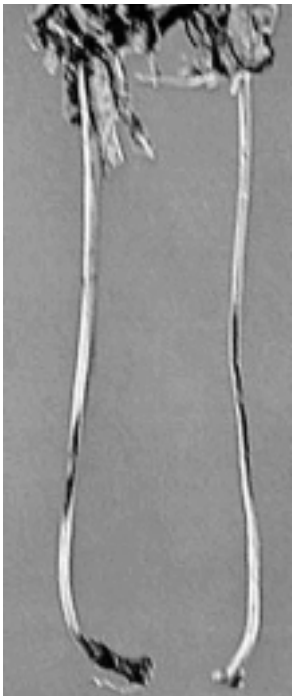

Figure 2. Sub-crown internode discoloration characteristic of common root rot.

Figure 3. Stunting and uneven tillers from a root rot disease.

the crown roots of the plant. The fungus continues to grow into the crown tissue, rotting the crown and destroying the plant tissues responsible for moving water from the roots to the above ground parts of the plant. Plants must be water stressed for the disease to progress. Under adequate moisture conditions, the plants may be infected, but the disease will not manifest into the crown.

Recognizing Symptoms of Disease

Root and crown rots cause plants to mature early, causing white heads and incomplete grain fill. Whole plants or individual tillers may be stunted. The symptoms may also be minor and inconspicuous. Reduced plant growth may be minor but still result in 1-3% yield losses or reduced test weight.

Take-all is characterized by a glassy black discoloration of the basal stem (Fig. 1). The fungi grow externally on the stem. The dark discoloration is the growth of the actual fungal pathogen. Circular areas may develop in affected fields.

Common root rot is less notable. The sub-crown internode will become discolored (Fig. 2). Damage to the sub-crown internode can be fairly minor, with injury and significant yield loss resulting. Injured plants may be randomly distributed in the field or in clusters.

Foot and crown rot results in a scurfy, reddish-brown to white discoloration of the crown area. Plant tissue may take on a slightly pinkish to salmon color. The crown will become punky and dysfunctional. Affected plants may occur randomly in the field but may also appear in groups. As with other root rots, tillers may be stunted with uneven height and mature early (Fig. 3).

Other grass crops such as corn and millet may support the fungus through years when wheat is not planted in the field. Similarly, grassy weed hosts, especially the cheatgrass species (*Bromus secalinus, B. japonicus,* and *B. tectorum*) can support the pathogen during fallow years and as weeds growing with rotational crops.

Managing Root and Crown Rots

No single management strategy can eliminate root and crown rots, but crop rotation is the single most effective method of control. Other grass crops can support these pathogens, so rotation to a broadleaf crop is critical. Tillage to bury residue is also effective. The increasing use of no-till practices may have contributed to the increased incidence of root and crown diseases.

Recent observations have identified significant and repeatable differences in the response of winter wheat varieties to foot and crown rot.

Table 1 gives a full listing of the reaction of varieties with at least three years testing for foot and crown rot reaction. Evaluation of spring wheat varieties is in the early stages of testing at SDSU, but based on data provided from North Dakota State University and observations made in South Dakota, a preliminary ranking of spring wheat varieties is provided in Table 2.

Seed treatment fungicides may be partially effective against root and crown rots. Products containing difenconizole (Dividend®), imazalil (Flo-Pro IMZ®, Vitavax Extra®, Double R®), or tebuconazole (Raxil) can be effective against these fungi when applied to spring wheat but may be less effective when applied to fall-seeded wheat. When applied to winter wheat, the highest rate should be used in fields with a risk of root and crown diseases. (See Table 3.) Higher rates of the fungicide treatments are generally required for control of root diseases. Control may be erratic and is often affected by environmental conditions.

Summary

Root and crown rots are reemerging as important diseases for wheat production in South Dakota. Particularly, Fusarium foot and crown rot is becoming a factor in the central and western counties of the state.

A common root rot management strategy includes these three components:

- Crop rotation with a broadleaf crop.
- Selection of more resistant wheat varieties.
- Use of seed treatment fungicides.

Table 1. Reaction of hard red winter wheat varieties to Fusarium foot and crown rot.

Variety	Response*	Variety	Response
2137	M	Quantum 7406	M
Alliance	M	Ransom	MS
Arapahoe	MS-M	Rose	MR
Betty	MS	Roughrider	M
Crimson	MR	Scout 66	S
Culver	M	Seward	M
Elkhorn	M	Siouxland	MS
Harding	MR	TAM 107	M
Heynee	M	Tandem	MS-M
Jagger	MS-M	Vista	S
Nekota	S	Windstar	MS
Pronghorn	MS	Wesley	M-MR

*S= susceptible, MS= moderately susceptible, M= intermediate, MR= moderately resistant, R= resistant

Table 2. Reaction of hard red spring wheat varieties to common root rot.

Variety	Response**	Variety	Response
2370	S	Ingot	M
2375	M	Keene	M
2398	MS	Kulm	MS
Amidon	MR	Len	S
Argent (HWSW)	S	Nora	S
Butte 86	MS	Oxen	S
Ernest	MR	Russ	S
Forge	MS-M	Sharp	S
Grandin	M	Sharpshooter	MS
Gunner	S	Stoa	M
Gus	M	Trenton	S
HJ98	M	Verde	M

*Some information provided courtesy of North Dakota State University
**S= susceptible, MS= moderately susceptible, M= intermediate, MR= moderately resistant, R= resistant

Table 3. Seed-treatment fungicides with effectiveness against root and crown rot fungi and their treatment rates.

Fungicide trade names	Fungicide common name	Application rate (product/100 # seed)	Diseases listed on label
Dividend XL	difenconazole + mefanoxam	1-2 fl oz	Controlled: general seed rots, Common bunt, Dwarf bunt, Loose smut, Flag smut, seedborne Septoria, Fusarium seedling blight, Pythium damping-off. Suppressed*: Common root rot, Fusarium foot and crown rot, Take-all, Rhizoctonia root rot.
Vitavax Extra	carboxin + imazalil + thiabendazole	5 fl oz	Controlled: general seed rots, Rhizoctonia, Helminthosporium, and Fusarium seedling diseases, seedborne Septoria diseases, Loose smut, Common bunt. Suppressed: Seed and seedborne Common root rot diseases.
FloPro IMZ	imazalil	0.25-0.5 fl oz	Controlled: Common root rot, Barley (leaf) stripe.
Double R	imazalil	3.4 fl oz/bu seed	Controlled: general seed rots, seedborne Septoria diseases, Common root rot, Fusarium foot and crown rot.
Raxil	tebuconazole	0.1 fl oz	Controlled: Stinking smut, Flag smut, Loose smut, early season Septoria diseases, early season Rhizoctonia root rot, early season Common root rot. Suppressed: early season Powdery mildew, early season Wheat leaf rust.
Raxil Thiram	tebuconazole + thiram	3.5-4.6 fl oz	Controlled: general seed rots, Stinking smut, Flag smut, Loose smut, early season Septoria diseases, Pythium damping-off, early season Rhizoctonia root rot, early season Common root rot, Fusarium seedling blight, early season Fusarium foot rot. Suppressed: early season Powdery mildew, early season Wheat leaf rust.

* The best suppression of these diseases will occur with the highest labeled fungicide application rates.

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