IANR NebGuide
University of Nebraska–Lincoln Extension, Institute of Agriculture and Natural Resources
University of Nebraska Lincoln

G1998
(Revised June 2015)

Common Root Rot and Fusarium Foot Rot of Wheat

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Common root rot and Fusarium foot rot are fungal diseases most common in dryland winter wheat, particularly in no-till and continuous cropping systems. Cultural management and seed treatment fungicides can help to control these diseases.

Cause and Occurrence

Common root rot of winter wheat is caused by the fungus *Bipolaris sorokiniana*. Fusarium foot rot, also known as dryland foot rot, is caused by fungi in the genus *Fusarium*. These diseases are most common in dryland winter wheat, especially in no-till and continuous wheat cropping systems. Several species of *Fusarium* are usually involved in the same disease but the most common *Fusarium* species causing foot rot are *Fusarium graminearum* and *F. culmorum*.

Species of *Fusarium* may look similar but a combination of morphological and molecular tools helps to identify and distinguish them. These fungi exist abundantly in the soil, on cereals, and on other grass hosts. These two pathogens can act synergistically with other *Fusarium* species in a disease complex that causes more severe root and crown rot diseases. Infection of wheat heads results in contamination of grain. If this grain is used as seed, seedling blights may occur. The fungi also cause leaf spots and/or blotches. In winter wheat, the diseases caused by these fungi occur throughout the growing season.

Symptoms

Symptoms of common root rot include dark brown to black lesions on roots, subcrown internodes, and stem bases. Lesions may coalesce, forming large areas of dead tissue in the crown. Discoloration of the subcrown internode (*Figure 1*) is diagnostic of common root rot. Infected plants may be stunted and/or chlorotic and occur randomly or may be seen in irregular patches in the field (*Figure 2*). Primary or secondary roots may appear brown or blackened.

Figure 1. Common root rot. Note the discoloration on the subcrown internodes (arrows). Photo by Robert Harveson.

Figure 2. Scattered patches of dead and dying plants are symptom of common root rot and/or Fusarium foot rot.

Figure 3. Fusarium foot rot on a wheat stem base. Note the dark brown discoloration (arrow).

Figure 4. Yellowing caused by common root rot and/or Fusarium foot rot.

The most common symptom of Fusarium foot rot is a dark brown lesion around the node of mature plants. In dry areas, the whole stem base may become girdled by a dark brown lesion (*Figure 3*). A diagnostic symptom of Fusarium foot rot is a cottony pink mycelium that may appear on affected stem bases. If the disease is severe, plants may mature early, produce shriveled grain, have white heads which may be void of kernels and appear bronze or bleached, or die prematurely. Occasionally one or more tillers on a plant may die. Scattered pockets of chlorotic (*Figure 4*), dead and dying plants (*Figure 2*) may be seen in affected wheat fields.

Disease Cycle

Bipolaris sorokiniana overwinters mainly as mycelium in infested wheat host debris and as conidia (asexual spores) in the soil. Mycelium (pl. mycelia) consists of strands of interwoven, largely microscopic, tubular hyphae (filaments) that make up the vegetative body of a fungus. *Fusarium* spp. overwinter as perithecia (sexual fruiting structures) and chlamydospores (thick- or double-walled asexual spores) in host debris. Initial infections occur on coleoptiles, subcrown internodes, and primary and secondary roots. Only these initial infections are responsible for root and foot rotting during the growing season.

If infections caused by *B. sorokiniana* progress above the soil line, secondary conidia are produced and dispersed by wind. They land and initiate lesions on leaves and tillers, causing a disease known as spot blotch, characterized by distinct, elongate brown-black lesions that are most frequent on lower leaves and most noticeable after heading. During wet weather, *Fusarium* spp. can also cause ash-colored or brown lesions on leaves.

Favorable Environmental Conditions

Common root rot and Fusarium foot rot are favored by drought and moderate to warm temperatures. Stress caused by dry seedbeds, loose seedbeds, wind, freezing, or damage from Hessian flies predisposes wheat plants to the two diseases. Severity of both diseases is higher in no-till and continuous wheat cropping systems. In contrast to common root rot and Fusarium foot rot that are favored by dry conditions, take-all, a disease which also affects roots and is caused by the fungus *Gaeumannomyces graminis* var. *tritici*, is favored by wet and poorly drained soils.

Cultural Management

- Seed adapted cultivars for the geographic area.
- Seed into a firm, mellow seedbed (loose seedbeds promote disease).
- Maintain a balanced soil fertility (avoid excessive nitrogen fertilization, particularly by reducing the amount of fall-applied nitrogen).
- Control weeds in summer fallow land (weeds deplete soil moisture and some weeds may act as alternate hosts to pathogens, predisposing plant roots to infection in the fall).
- Use certified, fungicide-treated seed for best results (bin-run seed is at higher risk).
- Seed at the recommended date (*Figure 5*) for your geographic area (early planting or extended, warm fall weather promotes disease).
- Seed when the soil temperature at seed depth is 55-60˚F.
- Use the above cultural practices recommended for crown and root rot to also reduce the risk of winter injury.
- Rotate crops to reduce Fusarium foot rot inoculum; avoid planting wheat following corn or wheat.

Management with Seed Treatment Fungicides

Seed treatment fungicides (*Table I*) provide an early window of protection in the fall against common root rot and seedling blights caused by *Fusarium* spp. It is best to use certified seed that has been treated with fungicides and tested for germination and variety purity. When selecting a seed treatment product, pick one that has activity against common bunt and loose smut as well as common root rot and *Fusarium* spp. Uniformly coat the seed when applying the seed treatment product. Commercial seed treating equipment does the best job of uniformly coating the individual kernels. For drill box application, fill the drill box one-third full of seed, sprinkle one-third of the fungicide over the seed, and mix with a paint paddle. Repeat until the proper amount of fungicide has been added and mixed. Read and follow all label directions for mixing and application.

Table I. A partial list of wheat seed treatment fungicides[1] for control of seed and soilborne fungal diseases.

Fungicide Trade Name[2]	*Active Ingredient*	*Fungicide Class*	*Rate (per 100 lb)[3]*
Allegiance® Dry	metalaxyl	acylalanine	1.5-2.0 fl oz
Allegiance® FL	metalaxyl	acylalanine	0.10-0.375 fl oz
Allegiance® LS	metalaxyl	acylalanine	0.175-0.66 fl oz
Apron XL®	mefenoxam	acylalanine	0.042-0.085 fl oz
Captan 400	captan	phthalimide	1.5-4.0 fl oz
Captan 400-C	captan	phthalimide	1.5-4.0 fl oz
Charter®	triticonazole	triazole	3.1 fl oz
Charter® PB	triticonazole + thiram	triazole + dithiocarbamate	5.5 fl oz
Charter® F2	triticonazole + metalaxyl	triazole + acylalanine	
CruiserMaxx® Cereals	thiamethoxam + mefenoxam + difenoconazole	neonicotinoid + acylalanine + triazole	5.0 fl oz
CruiserMaxx® Vibrance Cereals	Sedaxane + difenoconazole + mefenoxam + thiamethoxam	Carboxamide + triazole + acylalanine + neonicotinoid	5.0-10.0 fl oz
Dithane® F45 Rainshield®	mancozeb	dithiocarbamate	1.6 qt/ac
Dithane® M45	mancozeb	dithiocarbamate	2.0 fl oz
Dividend® Extreme	difenoconazole + mefenoxam	triazole + acylalanine	1.0-4.0 fl oz
Dividend® XL RTA	difenoconazole + mefenoxam	triazole + acylalanine	2.5-10 fl oz
Dyna-Shield® Fludioxonil	fludioxonil	phenylpyrroles	0.08-0.16
Dyna-Shield® Foothold®	tebuconazole + metalaxyl	triazole + acylalanine	5.0-6.5 fl oz
Dyna-Shield® Foothold® Extra	imidacloprid + metalaxyl + tebuconazole	neonicotinoid + acylalanine + triazole	3.4-5.0 fl oz
Dyna-Shield® Metalaxyl	metalaxyl	acylalanine	0.1-0.375 fl oz
Dyna-Shield® Metalaxyl 318 FS	metalaxyl	acylalanine	0.1-0.375 fl oz
Dyna-Shield® Small Grains	tebuconazole + metalaxyl	triazole + acylalanine	5.0-6.5 fl oz
Dynasty®	azoxystrobin	strobilurin	0.153-0.382 fl oz
Evergol® Energy	Prothioconazole + penflufen + metalaxyl	Triazole + carboxamide + acylalanine	1.0 fl oz
Grain Guard®	mancozeb	dithiocarbamate	3.3 fl oz
Incentive™ RTA®	difeconazole + mefenoxam	triazole + acylalanine	2.5-10.0 fl oz
LSP	thiabendazole	benzimidazole	2.0-4.0 fl oz
ManKocide®	mancozeb + copper hydroxide	dithiocarbamate + inorganic	4.0 fl oz
Maxim® XL	fludioxonil + mefenoxam	phenylpyrrole + acylalanine	0.167-0.334 fl oz
Maxim® 4FS	fludioxonil	phenylpyrrole	0.08-0.16 fl oz
NipsIt™ SUITE Cereals	Clothianidin + metalaxyl + metconazole	Neonicotinoid + acylalanine + triazole	5.0-7.5 fl oz
Penncozeb® 75DF	mancozeb	dithiocarbamate	2.3-3.5 fl oz
Penncozeb® 80WP	mancozeb	dithiocarbamate	2.2-3.3 fl oz
Prevail®	carboxin + PCNB + metaxyl	carboxamide + aromatic hydrocarbon + acylalanine	1.5-3.0 fl oz
Proceed®	prothioconazole + tebuconazole + metalaxyl	triazole + triazole + acylalanine	1.0-1.5 fl oz
Raxil® MD	tebuconazole + metalaxyl	triazole + acylalanine	5.0-6.5 fl oz
Raxil® MD Extra	tebuconazole + metalaxyl + imazalil	triazole + acylalanine + azole	5.0 fl oz
Raxil® MD Extra W	imidacloprid + tebuconazole + metalaxyl + imazalil	neonicotinoid + triazole + acylalanine +azole	5.4 fl oz
Raxil® MD W	imidacloprid + tebuconazole + metalaxyl	neonicotinoid + triazole + acylalanine	5.0 fl oz
Raxil® Thiram	tebuconazole + thiram	triazole + dithiocarbamate	3.5-4.6 fl oz
Raxil® XT Wettable Powder	tebuconazole + metalaxyl	triazole + acylalanine	0.16-0.20 oz
RTU-Vitavax-Thiram	carboxin + thiram	carboxamide + dithiocarbamate	5.0-6.8 fl oz
Vibrance®	sedaxane	carboxamide	0.08-0.16 fl oz
Vibrance® Extreme	sedaxane + difenoconazole + mefenoxam	carboxamide + triazole + acylalanine	2.8-5.6 fl oz
Vitavax®-34	carboxin	carboxamide	2.0-3.0 oz
Vitavax-200	carboxin	carboxamide	3.0-4.0 fl oz

[1]Read the label to ensure the fungicide has activity against the target disease/s.
[2]Fungicides listed represent the best information available. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the University of Nebraska–Lincoln Extension is implied.
[3]Higher rates should be used with lower quality seed and/or seeding conditions that will place the new seedling under stress.

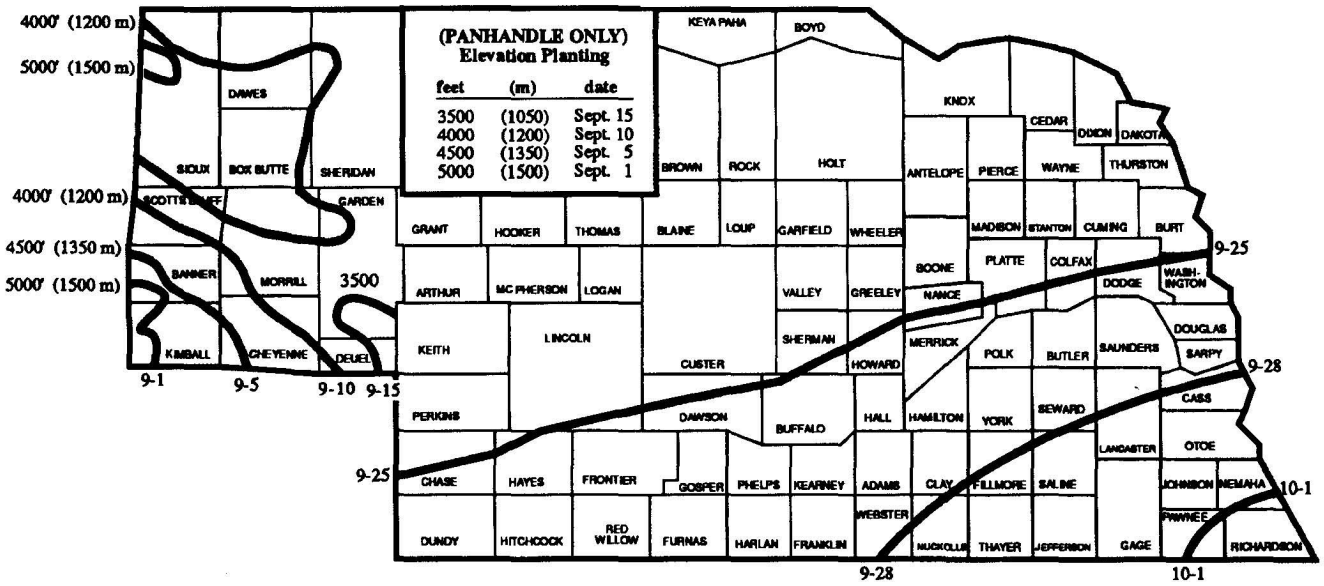

Figure 5. Suggested seeding dates for winter wheat in Nebraska.

Acknowledgments

The authors would like to recognize the contributions of John E. Watkins, the original author of the material presented in this publication.

This publication has been peer reviewed.

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