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Management of Residue-Borne Diseases of Wheat

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Recommendations for an integrated management plan to reduce the development of residue-borne diseases in no-till and reduced tillage systems.

Due to the need to prevent soil erosion and conserve soil moisture in Nebraska, emphasis has been placed on conservation tillage, a practice that leaves crop residues on the soil surface after harvest. Crop residues provide food and act as a habitat for certain plant pathogens of wheat *(Table I)*. Residue-borne wheat diseases that occur in Nebraska include tan spot (*Figures 1* and *2*), Septoria leaf blotch (*Figure 3*), Septoria leaf and glume blotch, take-all (*Figures 4* and *5*), Cephalosporium stripe (*Figure 6*), and root and crown rots and associated seedling blights caused by *Fusarium* spp. and *Bipolaris* spp. (*Figure 7*). This NebGuide discusses management strategies for residue-borne diseases of wheat. The best approach is to combine available strategies into an integrated disease management program. Proper residue management can result in healthier, vigorous plants that are able to resist pathogen attack, especially during the early stages of growth. Therefore, a discussion on crop residue management is included.

Crop Rotation

Crop rotation is one of the most effective cultural practices used to manage residue-borne diseases. Rotation to non-host crops allows time for pathogen-infested residues to degrade in the absence of new host tissue. As the residues decompose, food supply to the pathogen is depleted. This results in death of pathogen propagules (mycelia, spores, and fruiting and resting structures). When wheat is planted following a non-host crop, disease intensity will be lower due to reduced pathogen populations. If wheat is planted after wheat, pathogen populations will generally be greater and result in higher disease intensity and greater yield loss. Disease pressure will likely increase each successive season in continuous wheat cropping systems.

Resistant, Locally Adapted Cultivars

Wheat cultivars with varying levels of resistance or tolerance to some residue-borne diseases are available. Resistance, when available, is the most effective and least expensive means of managing plant diseases. Planting resistant or tolerant cultivars reduces or eliminates the costs associated with buying and applying fungicides. Hence, increased profit margins can be realized.

The cultivars selected based on disease resistance or tolerance also should be adapted to the local environment. This is important because locally adapted cultivars are less prone to environmental stresses which predispose them to disease.

Figure 1. Tan spot lesions on a wheat leaf.

Figure 2. Pseudothecia (fruiting and overwintering structures) of the tan spot fungus on wheat residue.

Figure 3. Lesion of Septoria leaf blotch on a wheat leaf. (Photo credit: John E. Watkins.)

Figure 4. White heads on wheat caused by take-all. (Photo credit: John E. Watkins.)

Figure 5. Roots and stem bases of wheat plants blackened by the take-all fungus. (Photo credit: Robert M. Harveson.)

Figure 6. Cephalosporium stripe on wheat. (Photo credit: John E. Watkins.)

Figure 7. Root and crown rot caused by *Fusarium* spp. and *Bipolaris sorokiniana*. (Photo credit: Robert M. Harveson.)

Planting Date

Planting date can have a significant effect on severity of some residue-borne diseases. Cephalosporium stripe, for example, will be more severe if wheat is planted too early because the excessive root growth provides more entry points for the pathogen when roots are subjected to winter injury. Similarly, severity of common root rot, seedling blight, and spot blotch caused by *Bipolaris* spp. and *Fusarium* spp. will be greater if wheat is planted too early because infection and disease development are favored by warm temperatures. The best planting date is the one recommended for the local area or geographical region. At North Platte, Nebraska wheat planted September 2 yielded 2 bu/acre, wheat planted September 15 yielded 27 bu/acre, and wheat planted September 25 yielded 42 bu/acre. September 25 is close to the recommended planting date.

Stand Establishment

For good stand establishment, wheat should be planted in a firm mellow soil. Healthy, vigorous seedlings can resist pathogen attack better than weak seedlings. Planting depth should be 1 to 1 1/2 inches in medium to fine textured soils and 2 inches in coarse textured soils. Soil texture should allow good soil to seed contact.

Weed Control

Some residue-borne pathogens of wheat infect certain grassy weeds. Controlling weeds and volunteer cereals can help reduce pathogen inoculum and, consequently, disease intensity during the growing season. Details on weed control are covered under *Crop Residue Management*.

Fungicides

A variety of fungicides can control residue-borne wheat diseases. Foliar fungicides *(Table II)* control diseases such as tan spot, Septoria leaf blotch, Septoria leaf and glume blotch and eyespot. Residue-borne pathogens causing root and crown

Table I. Residue-borne diseases of wheat and strategies to manage them.

Disease	*Pathogen(s)*	*Management*
Tan spot	*Pyrenophora tritici-repentis*	Crop rotation; resistant cultivars; foliar fungicides; seed treatment fungicides
Septoria leaf blotch	*Septoria tritici*	Crop rotation; resistant cultivars; foliar fungicides
Septoria leaf and glume blotch	*Stagonospora nodorum*	Crop rotation; resistant cultivars; foliar fungicides; seed treatment fungicides
Cephalosporium stripe	*Cephalosporium gramineum*	Plant at recommended date; crop rotation; resistant cultivars
Eyespot (foot rot, strawbreaker)	*Pseudocercosporella herpotrichoides*	Crop rotation; resistant cultivars; foliar fungicides
Sharp eyespot	*Rhizoctonia cerealis*	Crop rotation; resistant cultivars; avoid planting too early
Common root rot; seedling blight; spot blotch	*Cochliobolus sativus*	Plant clean, pathogen-free seed; crop rotation; resistant cultivars; plant at recommended date; plant into firm, mellow seedbed; control weeds; seed treatment fungicides; foliar fungicides
Fusarium seedling blight; foot rot; dryland foot rot	*Fusarium graminearum; F. culmorum*	Plant clean, pathogen-free seed; crop rotation; resistant cultivars; plant at recommended date; plant into firm, mellow seedbed; control weeds; seed treatment fungicides; foliar fungicides
Fusarium head blight (scab)	*Fusarium graminearum*	Crop rotation; resistant cultivars; seed treatment fungicides; foliar fungicides at heading
Take-all	*Gaeumannomyces graminis* var *graminis*; *G. graminis* var. *tritici*	Crop rotation; control grass weeds and volunteer cereals; plant seed into firm, well drained soil; balanced fertilizer program
Pink snow mold	*Microdochium nivale*	Crop rotation; resistant cultivars; weed control; plant at recommended date; seed treatment fungicides; foliar fungicides before snowfall
Speckled snow mold	*Typhula idahoensis*	Crop rotation; resistant cultivars; weed control; plant at recommended date; seed treatment fungicides; foliar fungicides before snowfall

Table II. Fungicides for control of foliar diseases of wheat.[1]

Fungicide Common Name	*Some Trade Names[2]*	*Application Timing*
azoxystrobin	Quadris	Up to Feekes 10.5 (full head emergence)
azoxystrobin + propiconazole	Quilt	Up to Feekes 10.5 (full head emergence) on wheat; up to Feekes 9 (ligule of flag leaf just visible) on barley, rye, and triticale
mancozeb	Dithane DF, Manzate 75DF, Pencozeb 80WP	Up to Feekes 10.5 (full head emergence)
propiconazole	Tilt, PropiMax EC	Up to Feekes 10.5 (full head emergence)
propiconazole + trifloxystrobin	Stratego	Up to Feekes 8 (emerging flag leaf)
pyraclostrobin	Headline	Up to Feekes 10.5 (full head emergence)

[1]This list is presented for information only and no endorsement is intended for products listed nor is criticism meant for products not listed. Consult the product label before buying and using a specific fungicide. Read and follow all label directions and restrictions.
[2]Most of the products listed recommend adding a spreader sticker and must be applied in sufficient water to ensure good coverage.

rots, seedling blights and seed-transmitted foliar diseases can be managed by applying fungicide seed treatments *(Table III)*.

Crop Residue Management

To reduce soil erosion from wind and water, crop residue needs to be maintained on the surface. The approximate amounts of crop residue for conservation compliance are listed in *Table IV.* Check with your local Natural Resources Conservation Service for the requirements for your fields.

Table IV shows the importance of maintaining residue on sandy soils and soils with slopes greater than 5 or 9 percent. Greatest susceptibility to wind erosion in Nebraska occurs during the high wind months of March, April and May. Water erosion is also important during these months because of the potential for high precipitation. Maintaining crop residue when soil is most susceptible to erosion is important and should be part of the overall residue management program.

Good fallow practices, along with good stands of adapted winter wheat varieties planted and fertilized according to recommended practices, plus effective weed control in the growing crop, usually result in a large amount of quality residue. It is very important to spread the straw and chaff at harvest to aid in the residue management program.

To control weeds in crop residue during the fallow period consider using herbicides. Appropriate control tactics depend on the weed populations present in the field. If there are few weeds at harvest, it may be advisable to delay herbicide application until late August and then use glyphosate or Gramoxone Inteon plus atrazine. The atrazine rate depends on soil type, pH, organic matter and the succeeding crops. The next herbicide application or tillage operation can then be delayed until late May or early June, if the field is fallowed the next summer.

If there are heavy populations of annual grass weeds at harvest, apply glyphosate or use a sweep tillage operation soon after harvest. This has at least two positive effects. Controlling the annual grass weeds prevents them from using moisture and producing seed. In addition, many of the annual grass weeds are hosts of the wheat curl mite which can transmit

Table III. Seed treatment fungicides for control of residue-borne, soil-borne and seed-borne diseases of wheat[1].

Fungicide Common Name	*Some Trade Names*
azoxystrobin	Dynasty
carboxin + captan	Enhance
carboxin + maneb	Enhance Plus
carboxin + PCNB	Vitavax - PCNB
carboxin + thiram	Vitavax 200
carboxin + imazalil + thiabendazole	RTU Vitavax Extra
difenoconazole + mefenoxam	Dividend XL, Dividend XL RTA, Dividend Extreme
fludioxonil	Maxim XL
mefenoxam	Apron XL
tebuconazole + metalxyl	Raxil MD, XT
tebuconazole + metalxyl + imazalil	Raxil MD Extra
tebuconazole + thiram	Raxil-Thiram
Thiamethoxam[2] + fludioxonil + mefonoxam + azoxystrobin	Cruiser Extreme
triadimenol	Baytan 30F
triadimenol + thiram	RTU-Baytan-Thiram
triticonazole	Charter

[1]This list is presented for information only and no endorsement is intended for products listed nor is criticism meant for products not listed. Consult the product label before buying and using a specific fungicide. Read and follow all label directions and restrictions.
[2]Insecticide.

Table IV. Typical crop residue required for conservation compliance in a winter wheat-fallow rotation.

	Erosion Type	
	Water	*Wind*
Soils that require residue	5% or greater slope 9% or greater slope in Panhandle	Fine sand Loamy fine sand Fine sandy loam
% Residue cover required March, April, May	50%	45%
% Residue cover required from June through after planting	30%	15%

wheat streak mosaic virus. Removing the weeds reduces the risk of transmitting the virus to the fall sown wheat crop. A second application of atrazine plus glyphosate or Gramaxone Inteon or tillage should be made in August or early September if necessary. This should control most weeds until the following spring.

By using herbicides to control weeds in the fall after wheat harvest, you can delay tillage until late May or early June and use tillage implements that maintain crop residue. Sweeps, chisel plows and rodweeders are effective at killing weeds, but should not be used in cool moist weather, which is typically early in the season.

If the field is going to be fallowed and planted to winter wheat in the coming fall, use either herbicides or tillage to control weeds in the spring. Some producers use one application of glyphosate with or without 2,4-D, depending on the weeds present, and then use tillage to control weeds and prepare a seedbed. This is a good option for those without no-till drills. For those with no-till drills weed control during the entire prewheat fallow period (spring to wheat seeding in the fall) may be achieved with herbicides such as glyphosate, 2,4-D or dicamba, depending on weeds present. Always observe the rotation restrictions and days required before seeding following herbicide applications, as advised on herbicide labels. In the early stages of no-till, penetration by a no-till drill may be a problem, especially if the late summer and early fall are dry and hot. In subsequent years, penetration by the drill is easier in the more mellow soils.

If a spring seeded crop is to be grown, maintaining the crop residue is also very important for weed control and water conservation. The success of the spring crop is often directly correlated to the efficiency of weed control after winter wheat harvest. Good weed control results in increased soil moisture and reduced weed seed production. Also, effective and timely annual grass weed control (including volunteer wheat) is important in the winter wheat disease control program. Well maintained crop residue acts as mulch and reduces the number of weeds that emerge.

There are many benefits from maintaining crop residue in addition to soil conservation. These include higher moisture retention by trapping snow, slowing water movement, increasing water infiltration, lowering soil temperature and improving habitat for wildlife. Because of these benefits, it is desirable to manage residue-borne diseases through methods that do not destroy crop residue.

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