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Managing Wheat Diseases In Conservation Tillage

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Conservation tillage is any tillage and planting system that leaves a substantial amount (at least 20-30 percent) of plant residue cover on the soil surface. Planting practices such as no-till, ridge-till, mulch-till or reduced-till result in various levels of increased plant residue with accompanying reductions in cultivations. These practices conserve our vital natural resources of water, soil, labor and energy.

Plant pathologists endorse the benefits of conservation tillage in North Dakota, where wind erosion and drought are constant problems. However, some important wheat disease organisms survive on the plant residues associated with conservation tillage. When crop residue is buried, antagonistic microorganisms in the soil decompose the residue, depriving the wheat disease organism of a food host, plus these antagonistic microorganisms directly destroy or suppress the disease microorganism. When the residue is left on the surface, the disease organisms have less competition and are freer to grow and reproduce, plus being positioned to readily infect the next crop.

Conservation tillage, with the associated reduction in cultivations, also may result in increased weeds and volunteer plants. These weeds and volunteers may be a source of viruses and insect vectors of plant disease. The producer needs to be aware of the potential for certain wheat diseases to increase with greater surface residue and fewer cultivations. Sound management practices that will keep plant disease risks at a minimum under conservation tillage should be used to control the following wheat diseases.

Tan spot

Description: Tan spot is a leaf disease of wheat caused by the fungus *Pyrenophora tritici-repentis*. The leaf symptoms are oval to elliptical tan spots which have a small, dark brown center and often have a narrow yellow border (Figure 1). Early infections are characterized by very small tan to brown spots. When infection is severe, the tan spots join together and large areas of the leaves are killed (Figure 2). Yield loss is due to destruction of

Figure 1. Young tan spot lesions on lower leaves.

Figure 2. Mature tan spot lesions on leaves.

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foliage, particularily the flag leaf, with subsequent poor grain production and filling.

Life Cycle: The tan spot fungus overwinters on wheat straw and stubble as small, raised, black fruiting bodies (Figure 3). In the spring and summer these fruiting bodies release sexual spores which are carried via wind and splashing rain to wheat leaves within the same field or several miles away (Figure 4). Wheat planted in wheat stubble under a no-till system is particularly vulnerable to early infections, since the wheat stubble often has abundant overwintering fruiting bodies. These fruiting bodies have over-wintered on the surface residue that is in close proximity to the young wheat leaves.

Early leaf spots and wheat stubble also may produce asexual spores which may further increase infection levels (Figure 4). Spore production and infection of the leaves is favored by moist weather. Six to 30 hours of leaf wetness caused by dew or rain is required for infection. The length of leaf wetness required varies among wheat varieties.

Management. Tan spot can be managed under conservation tillage by using crop rotations. Rotate away from wheat on wheat to other small grains or a broad leaf crop. This rotation reduces wheat residue and thereby reduces tan spot survival and build-up.

Chemical control of tan spot also is possible when disease levels are high and the flag leaf is threatened. Two mancozeb fungicides are currently registered for control of tan spot, Dithane M-45 and Manzate 200. Foliar application should be made at boot, to protect the flag leaf, followed by a second application 7-10 days later. Foliar fungicides are recommended only when the following conditions are met: 1) yield potential is at least 40 bushels, 2) tan spot lesions are abundant on lower leaves, 3) weather has been wet with extended periods of dew and 4) predicted weather patterns indicate continued wet weather. New fungicides may be available in the future to control tan spot and other leaf diseases. These fungicides will have a wide spectrum of action, will be systemic, and will have eradicative properties.

All wheat varieties commonly grown in North Dakota are susceptible to tan spot. Plant pathologists and wheat breeders at North Dakota State University are looking at sources of resistance and making concerted efforts to incorporate resistance to tan spot in new wheat varieties.

Wheat streak mosaic

Description: A second potentially serious disease under conservation tillage is wheat streak mosaic. This is a virus disease that causes yellowing and stunting of infected plants (Figure 5). Individual leaves show a yellow mottling or streaking (Figure 6). Wheat streak mosaic can cause sterile heads, resulting in moderate to severe yield loss, depending on the extent of infection.

Life Cycle: The virus is transmitted by the wheat curl mite, a mite so tiny it is not readily apparent to the naked eye. The mite overwinters on volunteer or planted winter wheat. Both winter and spring wheats, including durum, may be infected by the virus. Infection of winter wheat may occur in the fall if mites move from infected volunteer spring wheat to seedlings of winter wheat. Infection of spring wheat may occur if mites move from maturing infected winter wheat to the spring wheat plants.

Management: Conservation tillage results in reduced cultivations, making the control of volunteer wheat through chemical fallow herbicides of primary importance in managing wheat streak mosaic. All volunteer wheat plants should be destroyed two weeks before planting of winter wheat. A chemical fallow herbicide such as Roundup (glyphosate) may be used. These management practices are aimed at breaking the life cycle of the wheat curl mite. The mites must feed on green wheat foliage, and if volunteers are not present, the mites will die in this two-week period. The chances of infections are also reduced when winter

wheat is planted after September 1, as these mites are less active under cooler temperatures.

Varieties of spring and winter wheats vary in their resistance or tolerance to wheat streak mosaic. Spring wheats such as Waldron and Olaf are very susceptible, while Butte and Oslo show good tolerance. Durum varieties Ward and Vic showed more tolerance than Lloyd or Cando in trials at Fargo. The winter wheat variety Norstar has shown some tolerance to this disease in observations at Williston and Minot.

Take-all

Description: Take-all is the third wheat disease that is potentially more serious under conservation tillage. Take-all is a root, crown and lower stem disease. It is easily recognized at heading to maturity, when scattered plants or patches of plants die prematurely and appear as white heads among the healthy green plants (Figure 7). These prematurely whitened plants are easily pulled from the soil, and the take-all infection is differentiated by the shiny, distinctly **black** appearance of the roots, crowns and lower stems (Figure 8). Infected plants either have no seed set or have very shriveled seed.

Life Cycle: The take-all fungus, *Gaeumannomyces graminis*, survives in the soil on colonized roots and straw of wheat and other grasses. With less tillage the take-all fungus does not need to compete so vigorously with soil microorganisms to maintain its food source. This results in increased survival of the fungus in the stubble, with corresponding increased amounts of the fungus available to attack the next crop.

The disease is favored by wet soils. In North Dakota it has been most frequently found in irrigated wheat fields. However, in recent years with very wet springs, take-all has been found in non-irrigated wheat fields. The disease also is favored by alkaline soils, which are common in North Dakota.

Management: Rotation, with two to three years between wheat crops, is the best management approach for control of take-all under conservation tillage. Barley also is susceptible to this disease, and although the disease is less severe on barley than wheat, the level of the fungus may increase under barley production. Oats, rye, corn or a broad-leaf crop are suitable alternate crops.

Take-all also may be reduced by maintaining a healthy crop through balanced fertility. Ammonium forms of nitrogen fertilizer, applied over extended time periods, may reduce soil alkalinity, which, in turn, may reduce the level of take-all. No resistant varieties are currently available. A chemical seed treatment to supress take-all may be available in the near future.

SUMMARY

Three wheat diseases, tan spot, wheat streak mosaic, and take-all, have been described as potentially more serious with conservation tillage practices. Under long term use of conservation tillage for wheat production, other wheat diseases also may become problems. The risk of all of these diseases is reduced when the following management practices are used:

- Crop rotation
- Planting of resistant or tolerant varieties, when available
- Application of fungicides for fungal leaf spotting diseases
- Destruction of volunteers and weeds

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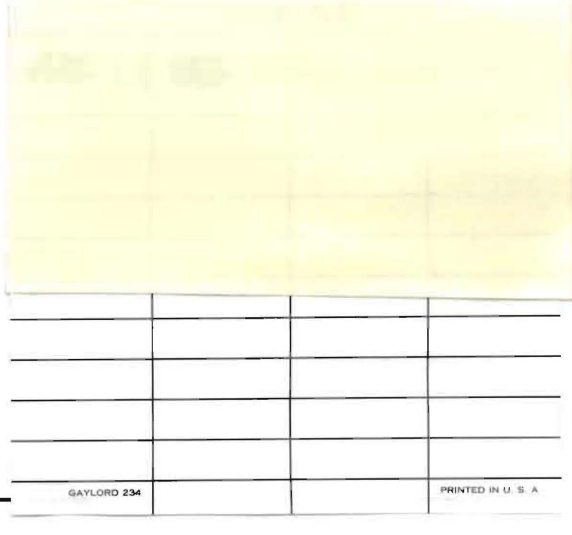

Figure 3. Tan spot on leaves and fungus fruiting on straw.

Figure 5. Wheat streak mosaic in field -center two rows inoculated with virus.

Figure 6. Wheat streak mosaic on leaves. (bottom leaf is healthy)

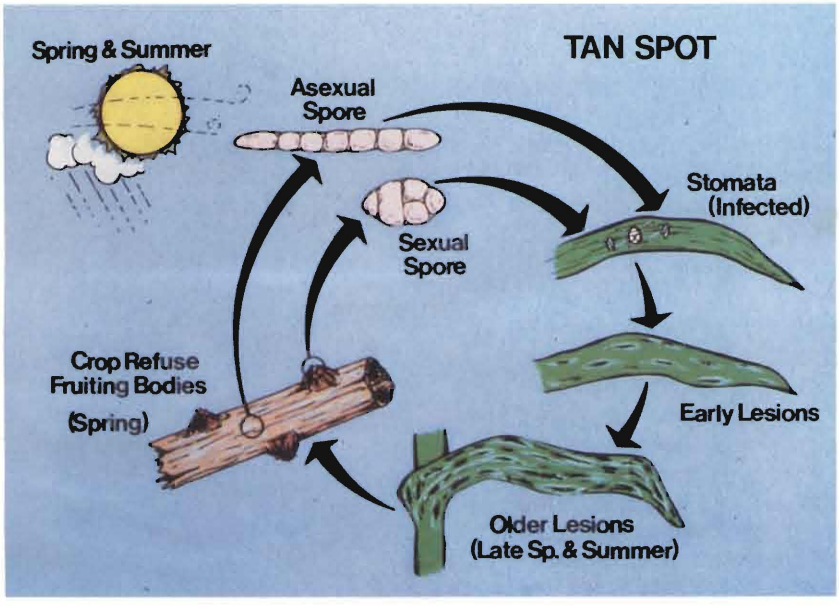

Figure 4. Tan spot - life cycle of fungus.

Figure 7. Take-all - Prematurely whitened heads.

Figure 8. Take-all - close up of blackened roots and crowns.

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