PP-766 (Revised)

TAN SPOT OF WHEAT

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Tan spot of wheat, caused by the fungus *Pyrenophora tritici-repentis*, is the major leafspot disease of spring wheat and durum in North Dakota. It also is one of the most serious leaf diseases on winter wheat. Wheat disease surveys from 1987-1992 indicated that tan spot was the most common and severe leaf disease across North Dakota in all years except the drought year of 1988. Generally speaking, years with good moisture distribution favoring crop production also favor the development of tan spot. A severe tan spot epidemic results in a disappointing harvest, when the grower finds that yields and bushel weights are much less than expected.

◆ Symptoms

Leaves

The tan spot fungus produces oval or diamond-shaped to elongate irregular lesions (spots) that are initially 1/8-1/2 inch long and 1/16-1/8 inch wide. On susceptible wheats, they enlarge and develop a tan color with a yellow border and a small dark brown spot near the center. The dark spot is best observed by holding the leaf up to the light. This pattern of a tiny dark spot in a tan lesion and a narrow to broad yellow border produces an "eye-spot" type of symptom (Figure 1). In early-season infections of tan spot, the yellow border is usually distinctive (Figure 2). As more lesions develop on the leaf, the spots tend to join together, producing large irregular areas of dead tissue (Figure 3). Destruction of large areas of leaf tissue reduces yields and lowers test weight. Tan spot can kill the leaves after heading, resulting in premature death of the plants.

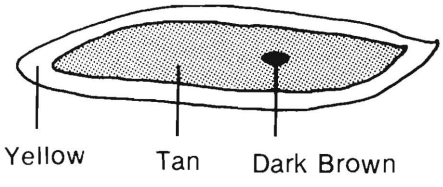

Figure 1. Illustration of a typical tan spot lesion.

Figure 2. Tan spot lesions on leaves of wheat seedlings.

Head

The tan spot fungus can infect the head and cause discoloration of the glumes and the kernels (Figure 4). Tan spot leaf infections are common in North Dakota; kernel infection is relatively uncommon in most years. Symptoms on the head are difficult to distinguish at maturity but may be characterized by bleached or brownish glumes. Infected kernels can have a reddish color on the seed coat; this kernel infection is called red smudge. Red smudge is more visible in durum kernels than in hard red spring wheat.

Figure 3. Tan spot lesions on upper leaves of headed plants.

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North Dakota State University, Fargo, ND 58105

JANUARY 1993

Healthy seed.

Infected seed showing symptoms of Red Smudge.

Figure 4.

Red smudge may resemble two other diseases which also cause pink to red kernel discoloration, **Fusarium** scab and bacterial pink seed. Of the three kernel diseases, **Fusarium** scab infection is the most common and most damaging to grain quality. Kernels infected with the **Fusarium** scab fungus are very lightweight, shriveled, often chalky in appearance ("tombstones"), and may contain mycotoxins, while red smudge kernels generally retain their vitreousness and plumpness, are not chalky, and do not contain mycotoxins. Bacterial pink seeds also remain plump and vitreous and can be distinguished from red smudge kernels by the uniform discoloration throughout the seed versus the "smudged" discoloration over the seed coat with red smudge.

The tan spot organism also is one of several fungi that cause a dark discoloration of the embryo tip of the kernel ("black point"). Black point causes dark specks in pasta products.

The red smudge and black point kernel symptoms are favored by prolonged wet periods and high humidities during kernel development. Infected seeds have lower germination and vigor than seed not infected with the tan spot fungus. Seedlings from infected seed can suffer from reinfection by the tan spot fungus under cool temperatures, but seed are not considered an important factor in disease spread in North Dakota.

◆ Survival and Spread

The tan spot fungus survives and reproduces on standing wheat stubble and on wheat stubble and straw that is on the soil surface. The fungus produces black pin-head-sized fruiting structures on the wheat residue (Figure 5). These are the sexual structures, and they release sexual spores (ascospores) in spring and early summer. Asexual spores (conidia) also are produced as the season progresses, on the stubble and on older leaf spots. Both kinds of spores are carried by air currents to developing wheat plants in the same or nearby fields. Wheat planted into fields with wheat stubble or wheat residue is more likely to develop tan spot on seedlings and jointing plants than wheat planted into stubble of a different crop or in a clean cultivated field. During wet growing seasons, which favor rapid buildup of tan spot, large numbers of asexual spores are in the air by heading time (Figure 6). With prolonged wetting of the foliage from rain or dew, this high spore concentration in the air can result in development of severe tan spot epidemics.

The fungus also causes spots and reproduces on about 50 species of native prairie and introduced forage grasses. The fungus causes only small dark spots on barley and oats, which are highly resistant.

Figure 5. Pin-head sized sexual fruiting bodies of tan spot fungus on wheat straw.

The tan spot fungus spores germinate and infect wheat over a wide range of temperatures if the leaves are wet for a long enough period. Severe spotting will occur if spores are on susceptible varieties and the leaves are wet for 12 hours, but severe spotting will not occur with wheats which are moderately resistant unless the leaves are wet for 18 to 24 or more hours. Almost all of our current wheats (hard red spring, hard red winter or durum) are severely spotted when many spores are present and extended periods (24 hours or greater) of rainy, misty, or foggy weather allow the spores to germinate and infect the plants; this occurred in 1991 when several weeks of continuous rainy weather resulted in severe tan spot in many areas of the state. Greater levels of resistance have been detected and incorporated into breeding programs for future variety releases.

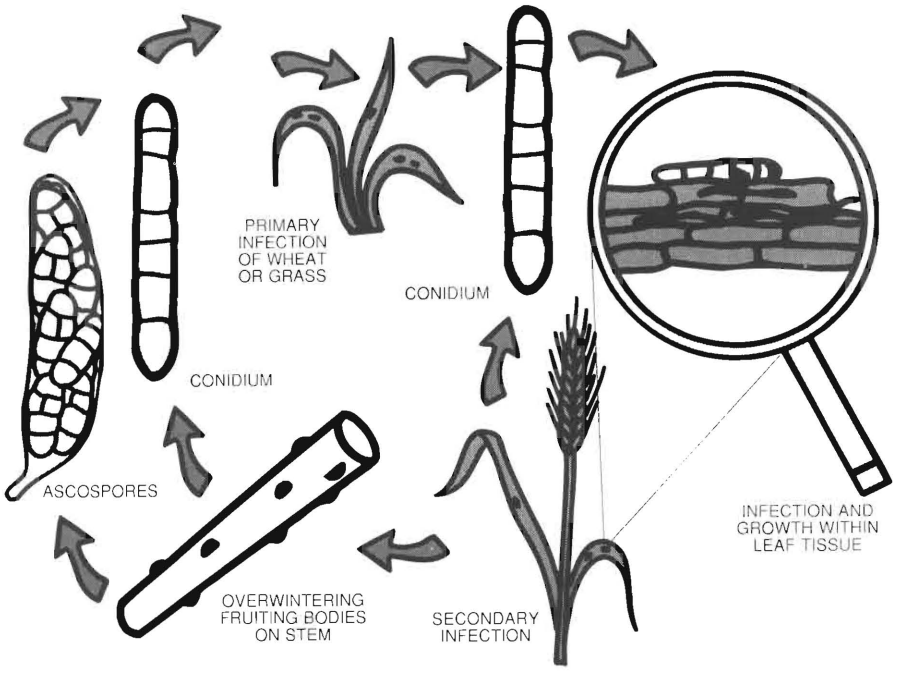

Figure 6. Disease cycle of the tan spot fungus.

◆ Management

Crop Rotations and Tillage

Crop rotations and burying wheat stubble by tillage can reduce the level of disease early in the season. Where rotation is possible, particularly in reduced tillage farming, mustard, crambe, flax, soybeans, millet or buckwheat furnish stubble free of tan spot. Sunflower stubble is satisfactory from the standpoint of leaf disease control, but planting through the old stalks may be difficult. Oat and barley stubble also are satisfactory for tan spot management. Barley can be a problem as it will carry over root rot fungi to a subsequent wheat crop. Corn is not a host of tan spot, but planting wheat into corn residue dramatically increases the risk of head scab infection. Potatoes, dry beans and sugarbeets leave little crop refuse to hold the soil but are satisfactory rotation crops for reducing wheat disease. If wheat is planted onto wheat ground, burying the stubble by tillage may reduce tan spot early in the season. However, burying may have no effect on tan spot late in the season because of the spread of spores from other areas.

Growers occasionally ask about burning the stubble. Burning will reduce the amount of the tan spot fungus in the field, but burning is not a recommended practice because it reduces organic matter. Burning and fall tillage leave the soil bare in the winter, and snow does not accumulate for soil moisture recharge. Serious wind erosion can occur on bare fields during dry, open winters. Spring tillage leaves the soil bare for a shorter time and will result in reduced tan spot inoculum. However, there is still a chance for erosion from wind or rain until the crop becomes established.

Varieties

Differences in tan spot susceptibility exist among durum and bread wheat varieties. Wheat growers are advised to consult reports of their nearest NDSU research extension centers for current information about variety response to tan spot. Disease resistance is one of many factors influencing variety choice.

Fungicides

Mancozeb fungicides (Dithane products, Manzate 200, Manex II, Penncozeb products, Clean Crop Mancozebs) can be used to help control tan spot, other fungal leaf spots and leaf rust. A mancozeb fungicide should be applied as soon as the flag leaf has fully emerged. This is when you can feel the boot swelling near the top leaf; few beards may be starting to show on bearded varieties. A second application of fungicide should be made about seven to 10 days after the first application to provide continued protection of the flag leaf. Some growers choose to delay or eliminate the second spraying if the weather is not favorable for continued leaf disease development. Spreader-stickers are recommended for use with mancozebs to increase coverage and longevity.

An early season application of one pound of mancozeb product at the five-leaf stage occasionally is applied in conjunction with herbicides without an additional spreader-sticker. This treatment has resulted in yield responses during wet springs when wheat was planted in wheat stubble.

Mancozeb is a protectant fungicide and must be applied before infection occurs. After infection, there is a three- to five-day incubation period before tan spot lesions appear. Application of fungicide during the incubation period will not "cure" the developing disease and will not prevent the tan spot lesions from appearing. It is important that the application be made to healthy, green tissue.

Tilt (active incredient propiconazole) is a systemic fungicide registered for wheat, barley, and rye leaf disease control. Other systemic fungicides also have shown good activity in reducing wheat and barley leaf spot diseases in experimental trials, and these fungicides may be registered in the near future. Tilt is applied just once, when the flag leaf first appears. This is an earlier

application time than for mancozeb. The systemic activity of Tilt provides both protection against leaf spots such as tan spot and some curative activity against some established infections.

Fungicidal control focuses on maintaining the flag leaf and head as free from disease as possible. The flag leaf, glumes and awns contribute greatly to yield and test weight. A healthy flag leaf and head are essential for high-yielding plants. The fungicides registered for tan spot control are not specifically registered to control the red smudge head infection, but they will reduce the level of infection and the amount of spores that develop on leaves.

Aerial spraying is often used to apply foliar fungicides to wheat. Further information on aerial application is contained in Circular PP-729, "Aerial Application of Fungicides for Crop Disease Control." Foliar fungicides also may be applied with ground equipment, frequently with the use of tram lines. Ground application generally requires 10-20 gallons water per acre, hollow-cone nozzles (disc-core), and spray pressures of 40-80 psi. Constant agitation of mancozeb in the spray tank is necessary.

Spray Guidelines

Spraying with a foliar fungicide seldom results in an economic return if yield potentials are less than 45-50 bushels per acre. A fungicide may be planned into the crop budget when adequate moisture is available at the beginning of the cropping season and the wheat crop is to be fertilized for at least a 45-bushel yield. The fungicide can always be cancelled later if drought or other problems lower yield expectations. When yield potentials are at least 45 bushels and tan spot is severe, the return from the use of a properly timed fungicide application may be expected to be good, sometimes more than twice the investment; years with less severe tan spot may be break-even years; in dry years with little tan spot the application will only add to production costs.

Economic return from using fungicide is dependent on the price received for the wheat, the price of the fungicide, and the bushel response to use of the fungicide. When yield potential is adequate, the following factors may help indicate the need for a fungicide: 1) when tan spot is already severe on the lower leaves at the late jointing stage, 2) when extended wet weather is forecast shortly after jointing (for mancozebs, spray early enough before the rain so that the spray deposit will dry before rain begins), 3) when wheat is planted on wheat ground under a reduced tillage situation, and 4) when winter wheat is grown in eastern North Dakota. Winter wheat grown in eastern North Dakota should be routinely sprayed if high yield potential exists because of the threat of leaf rust as well as tan spot. All of these situations, however, presume a reasonable yield potential, which is the primary consideration of whether a fungicide is likely to be profitable.

◆ Summary

Reduce the risk of tan spot by:

1) Using crop rotation;
2) Choosing moderately resistant wheat varieties;
3) Incorporation of wheat residue prior to planting, where possible;
4) Applying fungicides in a timely manner.

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