UNIVERSITY OF ILLINOIS EXTENSION
College of Agricultural, Consumer and Environmental Sciences

report on
PLANT
DISEASE

RPD No. 104
May 1995

DEPARTMENT OF CROP SCIENCES
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

FOLIAR DISEASES OF WHEAT

Foliar diseases of wheat are common throughout all wheat-producing areas. If weather conditions favor the build-up of these pathogens, losses can exceed 20% of the crop if control measures are not implemented. Fortunately, adequate control programs exist for the foliar diseases and losses rarely reach this level.

Figure 1. Wheat Powdery mildew

The most common foliar pathogens of wheat are fungal diseases. These include powdery mildew, leaf rust, Septoria leaf blight (and glume blotch), and tan spot. Each of these diseases requires high moisture levels (frequent rains, heavy and prolonged dews, or very high relative humidity) and are increased if wheat stands are thick and high rates of nitrogen have been applied. Temperature requirements and time of appearance vary for each disease. However, if one or more of these diseases is present at flag leaf emergence or during early heading, losses can be severe.

These fungal diseases may overwinter in crop debris or be blown in from southern states. Septoria diseases and tan spot survive in crop debris and are present every year. Leaf rust usually is blown in from the southern wheat-producing states and does not overwinter well in Illinois.

POWDERY MILDEW

Powdery mildew, caused by the fungus known as *Erysiphe graminis*, has a number of distinct, specialized "varieties", known as **form species** (f. sp.), that attack only certain cereals. The form species that attack wheat cannot infect barley, and the barley pathogen cannot infect wheat. Other form species attack grasses such as bluegrass, fescues, redtop, and native grasses. The wheat pathogen is *Erysiphe graminis* f. sp. *tritici*. These form species probably developed over very long associations with a single host plant and became highly specialized.

Figure 2. Septoria glume blotch

For further information contact your nearest Extension office or an Extension Specialist, Department of Crop Sciences, University of Illinois at Urbana-Champaign.

The *Erysiphe* fungus robs the wheat plant of nutrients, reduces photosynthesis, and increases respiration and transpiration (water loss) of its cereal hosts. It penetrates into the epidermal cells and withdraws nutrients by means of specialized structures called **haustoria**. Although it is not known to be an economically damaging pathogen compared to other foliar diseases, infections of powdery mildew may reduce plant vigor, can cause lodging, and may reduce yields, kernel size, and test weights.

Powdery mildew is most common in dense, thick stands where air movement is reduced and moist, cool conditions occur. It is usually the first major disease reported after spring growth resumes. Damage is most severe if heavy infections occur during periods of rapid growth: tillering, stem (culm) elongation, and head development.

Symptoms

Powdery mildew is characterized by a white-to-light gray, powdery fungal growth on the upper leaf surfaces, culms, leaf sheaths and floral bracts (Figure 1). The lower leaves are usually infected first and may be completely covered by the powdery growth (mycelial mat) and spore masses (conidia) produced throughout the infected tissues. Symptoms may occur at any time when weather conditions favor this disease, but it normally appears after spring regrowth begins. The conidia are wind-blown and produce new infections during cool (33° to 86°F) temperatures and moist conditions (relative humidity of 85% to 99%). With favorable temperatures and high moisture, a new disease cycle occurs every 7 to 10 days. In Illinois, disease development usually slows or stops at temperatures above 75°F.

As lesions mature, conidial production slows and a different fruiting structure appears within the infected tissues. These **cleistothecia** are small, round, dark brown-to-black specks embedded within the infected tissues. These fruiting structures survive in crop debris and serve as sources of overwintering inoculum. During rainy periods in early spring to autumn, cleistothecia produce **ascospores** which cause the initial infections.

LEAF RUST

Leaf rust, caused by the fungus *Puccinia recondita* f. sp. *tritici*, may be the most widely distributed wheat disease. It has been known since the earliest cultivation of wheat. As early as 700 B.C. Romans began performing ceremonies to Robigus, the god of rust, to spare their fields.

The development of rust-resistant wheat varieties has substantially reduced the yearly losses to rust. However, the appearance of new races able to infect previously resistant plants, has allowed rust to remain a substantial threat to wheat. Some leaf rust occurs every year in Illinois, but variations in weather and wind patterns plus differences in the ability of the fungus to overwinter south of Illinois, causes year-to-year variations in the level found in this state. Infections cause a reduction in the number of kernels as well as producing lower test weights. Since rust seldom kills plants or shrivels grain, estimates of losses to this pathogen may be underestimated. In susceptible varieties, losses can be severe if infections occur early and continue until the crop matures.

Orange colored spores, known as **urediospores**, are blown northward from Mexico and the southern United States to Illinois where they settle on wheat plants and, if temperatures and moisture level favor disease development, begin to infect plants within six to eight hours. A temperature range of 59° to 77°F and wet conditions (heavy dews, frequent light rains or high humidity) are required for infection. A new generation of urediospores can be produced every 7 to 14 days.

Symptoms

Symptoms of leaf rust are small, round-to-oval, raised, orange-red, dusty pustules scattered primarily on the upper leaf surface or leaf sheath. Every pustule contains thousands of orange-red urediospores that are then wind-blown to other leaves or plants. Examination of these pustules under a hand lens will reveal a small pustule, formed by the rupturing of the outer leaf cell layer (epidermis), filled with spores.

As the wheat matures, other dark gray-to-black, flattened pustules develop on the lower leaf surface, leaf sheaths, and culms. These lesions contain a different spore, called a **teliospore** or winter spore. Teliospores cause no damage in wheat and are able to infect only the alternate host of this fungus, a plant known as Meadowrue (*Thalictrum* species). Meadowrue does not grow in Illinois and is not important in any wheat-producing area of the United States. In some other rusts, the alternate host is important in maintaining the level of inoculum, but the alternate host plays no role in wheat rust.

SEPTORIA GLUME BLOTCH

Septoria glume blotch infects the chaff (or glumes) of the wheat head (Figure 2), as well as the stems, leaf sheaths, and leaves. Unlike Septoria leaf blight, favored by cool and moist conditions, glume blotch is favored by warm, moist weather.

The symptoms of glume blotch are small, irregular spots or blotches (lesions) that are grayish or brownish appearing on the chaff, usually near the top third of a glume. These symptoms appear two or three weeks after the head emerges. The lesions may enlarge and become a chocolate-brown in color. As the lesions age, pycnidia develop in the centers. Usually only scattered glumes are affected. Usually only scattered glumes are affected, however, in severe cases, the entire head turns a dark brown.

Glume blotch should not be confused with black chaff, another wet weather disease caused by a bacterium. Glume blotch lesions do not form streaks and are not as sharply defined or as dark in color as those of black chaff.

Infection of wheat plants by Septoria fungi requires six to sixteen hours of leaf wetness. A new generation of spores can be produced in 10 to 20 days, depending upon the weather. Spores are exuded in droplets from the pycnidium during wet periods. Spores are exuded in droplets from pycnidia during wet periods and are disseminated by splashing and blowing rain. Spore germination and infection are optimum between 59° and 77°F but may occur at temperatures as low as 40°F and as high as 95°F. Septoria leaf blight is most virulent between 59° and 68°F, while Septoria glume blotch is most virulent between 68° and 81°F.

Straw, seed, and overwintering and volunteer wheat are sources of primary inoculum. Undisturbed wheat stubble can support spore production as well. Seed can also harbor the Septoria glume blotch fungus. Pycnidia produce an abundance of spores (conidia) during wet periods in the early spring. The conidia are either windblown or rain-splashed to growing leaves and the infection process begins. Conidia can remain viable for months at temperatures of 36° to 50°F and infections occur with leaf wetness periods of six hours for Septoria leaf blight and sixteen hours for the glume blotch phase. A new crop of conidia can be produced every 10 to 20 days with adequate moisture and temperatures.

SEPTORIA LEAF BLIGHT

Septoria leaf blight, caused by the fungus *Septoria tritici*, (Figure 3) causes the death of leaf tissue and creates the greatest yield loss when it infects the flag leaf and the leaf directly below the flag. If these leaves are killed before the soft dough stage, the grain will be shrivelled and of light weight. When a prolonged period of cool, moist, and windy weather and/or heavy dew prevails during early and mid-spring before heading, Septoria leaf blight may reduce yields significantly.

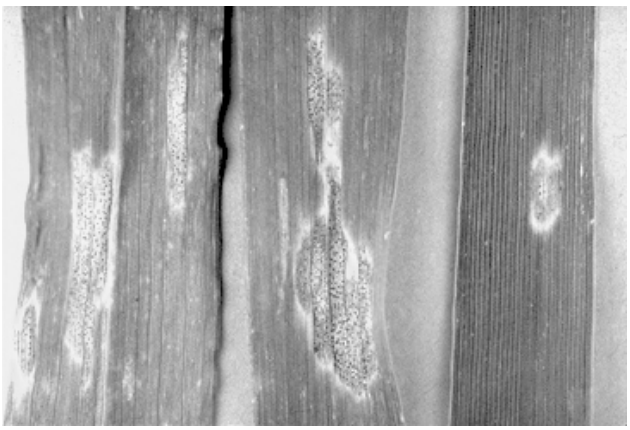

Figure 3. Wheat Septoria tritici.

The first symptom of leaf blotch is the appearance of small, light, green to yellow areas between the veins of the lowermost leaves, especially those in contact with the soil. These areas elongate rapidly in the spring to form light brown-to-reddish brown, irregular lesions. These lesions are often partly surrounded by a yellowish band. As the lesions age, small dark brown-to-black fruiting structures called **pycnidia** form in the centers of the lesions, which become light brown to whitish in color. The presence of pycnidia is the most reliable symptom for confirming Septoria leaf blight. Severely infected leaves turn yellow, wither, and die prematurely. Infections may also occur on the leaf sheaths and stems, especially at the nodes and occasionally on the tips of the glumes. Pycnidia are produced on all infected plant parts.

TAN SPOT

Tan spot (also known as yellow leaf spot), caused by the fungus *Pyrenophora tritici-repentis*, develops on both the upper and lower leaf surfaces during spring and summer. The spots initially appear as tan-brown flecks, which can expand into lens-shaped blotches up to one-half inch in length. They often have yellow borders. Large lesions coalesce and become darker brown at their centers when sporulation begins. Fruiting structures, called *pseudothecia* , develop as small random black raised specks on wheat straw but are not found in the leaf lesions as with Septoria.

Tan spot survives in crop debris. The pseudothecia mature during the fall and winter and release spores throughout the following growing season. These spores, called **ascospores**, are dispersed by wind and serve as the primary inoculum. After primary infections occur on the leaves, secondary spores (conidia) continue the disease cycle. Infections are most numerous on plant materials in close proximity to crop residues. Infections require 6 to 48 hours of wet conditions and occur throughout the growing season. Yield losses are most severe if infections damage the flag leaf.

Control of Foliar Pathogens

Disease management programs for foliar diseases of wheat should include the planting of disease-resistant varieties, high quality seed, proper fertility and fungicides when needed.

1. **Plant resistant varieties**. Varieties resistant to several of these common pathogens are available and offer the best long-term control measures. Although resistance may not be complete (i.e., some small flecking may occur from certain diseases), disease levels will be reduced and additional control measures may not be needed. However, if the same wheat variety is grown continuously over a large area, new races or shifts in pathogen virulence may occur.

2. **Where feasible, incorporate residues**. Although plowing **is not** a necessity in reducing wheat disease levels, burial of stubble and residues will help to reduce overwintering levels of most foliar pathogens.

3. **Destroy all volunteer small grains in and around wheat fields**. These plants can serve as hosts for common foliar pathogens and can serve as pathogen "reservoirs."

4. **Plant certified, disease-free seed** that has been thoroughly cleaned. This reduces the chances of introducing pathogens that may be present in small pieces of debris or may be on the seed.

5. **Use a recommended seed treatment fungicide**. Seed treatment fungicides offer protection against early season seedling blights and help promote early plant vigor.

6. **Practice balanced soil fertility** based upon results of a soil test. Excessive or deficient nutrient levels will affect diseases. Excessive nitrogen rates, for example, will promote powdery mildew development. Soils deficient in phosphorus but having high rates of nitrogen usually have more severe rust disease levels.

7. **Sow winter wheat after the fly-free date.** This will help reduce fall virus infections which are carried from grasses and other plants to the new wheat crop.

8. **Scout the crop on a regular basis**. Since foliar diseases are most damaging if the flag leaf or the leaf directly below are damaged, scouting and management should be started before flag leaf emergence. The two uppermost leaves contribute heavily to grain formation and head-fill. Thus, it is important to maintain the health of these two leaves. Scouting is normally begun at growth stage 6 (first node of stem visible) and continued at least through growth stage 9 (complete emergence of flag leaf).

FUNGICIDE APPLICATIONS

Fungicide applications are an important part of wheat disease management. However, certain conditions should be present before any fungicide applications are made. The following guidelines should be considered when:

1. **The yield potential and value of the crop are high;** the cost of fungicides is generally about $15-20 per acre, yield increases of 7 to10 bushels per acre are needed to break even;

2. **The wheat variety is susceptible to the major disease or diseases;** resistant crops usually do not respond significantly to fungicides when compared to susceptible crops. Thus, fungicide applications may not be economical if resistance (even low to moderate) is present, and

3.. **The long-range forecast is for continued cool and damp weather;** cool, cloudy, and damp weather patterns favor most foliar fungal diseases. If this type of pattern is expected to continue, fungal diseases may build rapidly.

Fungicides for use on wheat are either **protectant** or **systemic** materials. Protectant materials **must** be applied **before** infections occur, since they only prevent new infections from occurring. Systemic materials can be applied after foliar diseases are noticed. However, they cannot reduce damage from moderate to high levels of infection.

A spreader-sticker should be included when applying any wettable powder. A properly-equipped aircraft is the best means of applying fungicides to the crop. Proper application requires a minimum of 5 gallons per acre (or 20 gallons by ground application) to cover foliage uniformly. Fungicide application periods will vary, depending upon the label restrictions. Most protectant applications are made when the head is beginning to emerge from the boot in at least 25% of the plants scouted. A second spray can be made 10 to 14 days later, if needed. It is important to keep the flag leaf as disease-free as possible.