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Prospects for control of septoria

By A.G.P. Brown* and A.A. Rosielle**

Losses from septoria have been measured at up to 70 per cent of yield. Fungicides can control the disease but are too expensive for use in Western Australian crops. Resistant varieties should overcome the problem.

Two species of the fungus Septoria are responsible for the diseases of wheat generally referred to collectively as septoria. Septoria tritici Rob, ap. Desm. (commonly known as speckled leaf blotch) can attack all leafy parts of the plant, but is rarely found on the glumes. Septoria nodorum (Berk.) Berk. (commonly known as glume blotch) is usually found on all aboveground parts including the glumes.

Both species cause irregular dead spots in which pycnidia (the asexual stage) are eventually produced. Pycnidia are just visible to the naked eye and appear on leaf lesions 12 to 20 days after infection. They release vast numbers of slimy pycnidiospores. It is difficult to distinguish the two diseases in the field but generally the pycnidia of Septoria tritici are larger and darker than those of Septoria nodorum and they are produced more readily on lightly infected leaves.

Figures 1 and 2 illustrate the life cycles of the diseases. Both are characterised by a rapidly multiplying asexual stage producing pycnidia which release pycnidiospores in a slimy matrix. These spores are readily wetted and easily splashed by raindrops upwards to new growth and over short distances to neighbouring plants.

This phase of the life cycle ensures rapid spread of the disease through the crop from initial localised infections. It is greatly favoured by frequent rain and cloudy humid weather.

Rain is needed to disperse the spores from the pycnidia, and leaf surfaces need to remain wet for eight to 12 hours to allow germination of spores and infection of the wheat plant.

As the crop approaches harvest, the second stage of the life cycle appears on the straw.

At this stage, the fungal bodies are called perithecia, and they eject dry ascospores into the atmosphere. The ascospores are thus carried by the wind to nearby crops.

The perithecia develop profusely over summer on stubble and harvest residues but ascospores are not released until after autumn rains begin when new crops are available for infection. Septoria nodorum has an additional carry over mechanism. It penetrates the seed in glume blotched ears and remains dormant until the seed germinates. It then infects the seedling and begins forming pycnidia.

Alternative hosts

In Western Australia, Septoria tritici has been found very rarely on rip gut brome, Bromus gussonii. Septoria nodorum has been isolated from a number of grasses including annual ryegrass Lolium rigidum; barley grasses, Hordeum leporinum and Hordeum hystrich; brome grass, Bromus gussonii and silver grass, Vulpia bromoides. It has also been found on dead leaf tips of barley at Badgingarra.

Elsewhere in the world specialised forms of both Septoria tritici and Septoria nodorum usually not able to attack wheat have been found on oats, rye, barley and several other grasses. How important grasses and other crops are in initiating infection in the young wheat crop is unknown.

Effect on yield

Losses of up to 70 per cent of grain yield have been measured in wheat infected with Septoria nodorum at Badgingarra. Virtual failure of the crop has been associated with extremely high infection by Septoria tritici at Jerramungup. However, in experiments using fungicides to moderate disease, losses have been small and inconsistent outside particularly disease-prone areas like the West Midlands or South Coast. Septoria depends on frequent or timely rainfall followed by extended periods of wet leaf surface to allow uninhibited epidemics. Such conditions are infrequent even in

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coastal areas and very rare inland where some degree of water stress can be expected in most seasons. Moreover shortage of soil moisture during grain filling and the onset of hot weather may affect the potential of the disease to cause loss by limiting the plants' ability to photosynthesise. In other words, if leaf area is lost to water stress, the effects of loss to disease may be negated.

Distribution
Both fungi are found throughout the wheatbelt but damage to wheat crops by each species varies seasonally and geographically. Septoria tritici is usually worse in the coastal area from Mount Barker to Esperance while the West Midlands is the area most affected by Septoria nodorum.

Sowing date
Sowing early carries more risk of septoria infection and loss of yield. This is because the crop is at a more advanced stage during winter months when favourable environmental conditions are more likely. Similarly, early maturing varieties become more severely affected than late maturing varieties.

Stubble destruction
Traditionally control of septoria has included a recommendation to burn stubbles to reduce or remove sources of infective spores. However the benefit of stubble burning of adjacent paddocks returning to pasture has not been demonstrated. This may be because other unburnt stubbles are too close to the crop. The safe distance is not known, but based on dispersal of similar sized ascospores, it may be several kilometres. Effective disease control would therefore require cooperative stubble destruction by neighbouring farmers.

The effectiveness of stubble destruction will also be subject to the presence of alternative host plants which may harbour the disease over summer.

Crop rotation
Double cropping to wheat, even if accompanied by a good stubble burn, will maximise the chances of early infection. Though the probability
and degree of loss has not been defined, a wheat crop should not follow wheat in areas prone to septoria.

Delaying sowing

Delayed sowing will certainly reduce the chance of losses to septoria but usually this is not desirable, as it also reduces yield potential. Reduced infection is usually more than offset by a shortened growing season. However, Department of Agriculture experiments indicate that if the susceptible mid-season variety Gamena is sown before June, yields are often less than June sown crops in the high and medium rainfall zones but not in the low rainfall zone (325 mm or less). The causes of the lower yields have not been determined but increased septoria is a possible explanation.

Seed treatment

Only Septoria nodorum is seed-borne. It survives just beneath the seed coat as a small fungal colony made dormant by low moisture. At germination, the fungus becomes active and colonises the soft tissue of the seedling, causing a brown discolouration. Some seedlings may be weakened and even killed by infection at this early age but the main damage is that many plants throughout the crop are carrying the disease. Spores are quickly produced and splashed to neighbouring plants. Current seed pickles do not control septoria. Even if an efficient fungicide were available, stubble and perhaps other hosts appear to provide plenty of spores to spread the disease. An extra seed treatment to control Septoria nodorum appears to be unwarranted.

Fungicides

Recently the use of fungicides* for septoria control has received publicity, particularly in Europe. However, no fungicide is outstandingly effective against septoria and the use of fungicides to control the Septoria diseases alone has seldom been profitable.

In Western Australia, experiments at Katanning in 1977 showed that one spray either just before heading or one just after, increased yield by about 10 per cent; both sprays
increased yield by 18 per cent. However, similar experiments in 1978 and 1979 showed no increase in yield. It is clear that the value of spraying depends on disease potential, and the potential yield that the fungicide spray is intended to protect. High yielding crops will warrant greater “insurance” costs. Fungicides cannot be recommended on present evidence.

Resistant varieties
The best answer to septoria appears to be in the development of resistant varieties, and the Department of Agriculture has begun a breeding programme to incorporate resistance into local wheats.

Good resistance to Septoria tritici is available in exotic varieties though they tend to be unsuitable for Western Australian conditions. Often they are very tall, red-grained and low-yielding. Fortunately, resistance is simply inherited and has been easily recovered in progeny from crosses between three highly resistant South American varieties and local wheats.

Progeny from crosses are tested for resistance in the field by spraying them with pycnidiospores in a very dilute gelatin solution just before the passage of a rain-bearing front. This is done several times through the season to ensure high disease levels. Plants are assessed just after flowering and resistance is based on the number and size of pycnidia on the leaves.

Resistance to Septoria nodorum will be more difficult to obtain. High resistance has not been found in bread wheats but lower levels of resistance are available. Progeny from crosses with resistant American wheats are undergoing testing and selection, both in the glasshouse and in the field.

At the Department of Agriculture in South Perth, seedlings are screened for resistance by observing the reaction of leaf segments. A carefully measured droplet transfers a set number of spores to each sample which is then incubated under controlled conditions and rated for resistance after seven or eight days.

In the field, mostly at the Badgingarra Research Station, the disease is spread by spraying plants with a spore suspension and assessment of resistance is based on the proportion of damaged tissue on the flag leaves. But since this is influenced by other characters like height and heading date, kernel weight is also measured and compared with the weight from unsprayed rows protected by fungicides. Lines which produce large grain and show small losses in the presence of the disease are regarded as resistant.

Resistance is already available in some varieties. Egret has good resistance to Septoria tritici but is susceptible to Septoria nodorum in Western Australia. In New South Wales, Egret is not regarded as resistant and this may be due to the evolution of a different race or some unknown environmental effect. Current investigations should soon resolve this question.

Darkan appears to be tolerant to Septoria nodorum (susceptible but able to yield well).

Ideally, resistance to both species of Septoria will eventually be incorporated in a single variety.

*Effective materials include protective fungicides from the dithiocarbamate group (maneb, zineb, mancozeb and mezineb) captan and chlorothalonil, and some therapeutic fungicides such as benomyl, thiabendazole, carbendazim and triadimefon.

Technical notes
The perfect state of Septoria tritici is Mycosphaerella graminicola (Fuckel) Shroter.
The perfect state of Septoria nodorum is Leptosphaeria nodorum Muller.