Yellow spot of wheat:
a conservation cropping dilemma

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Plate 1. Severe yellow spot debilitates plants, substantially reducing grain yield. The heads to the left are from healthy plants, those on the right are from infected plots.

Plate 2. Severe yellow spot can defoliate crops, leaving green heads and stems.

Introduction

Soil erosion is probably the greatest problem facing stable agricultural production in Queensland with virtually all our crop land vulnerable. Retaining crop residues on the soil surface (conservation cropping) is a very effective means of increasing water infiltration into soil and so reducing erosion. Unfortunately, some crop diseases survive in crop residues and increased levels of residues on the soil surface may aggravate disease problems. It is, however, possible to minimise diseases in conservation cropping systems.

In the past, it was accepted practice to burn stubble shortly after harvest. This disposed of the large bulk of stubble and any pathogens it contained. Under these conditions yellow spot was not a problem but our wheat lands were frequently exposed to severe erosion. The trend to surface retention of crop residues has resulted in yellow spot becoming the most conspicuous disease of wheat in Queensland.

Does this suggest that we should return to the 'bad old ways' of burning crop residues soon after harvest? No! Quite the opposite! Conservation cropping has proven its worth and is vigorously encouraged. However, stubble-borne diseases can be a problem under these systems and control measures are required. Since yellow spot is typical of several diseases that survive in stubble, an understanding of the pathogen and how it may be controlled can be applied to other crop/disease complexes.

The disease

Yellow spot is caused by the fungus *Pyrenophora tritici-repentis*. It was first recorded in New South Wales and Queensland in 1950 and is now a major problem in these areas as well as parts of Western Australia. It has also become a serious problem in other countries where conservation cropping has been adopted.

The disease initially appears as brown flecks on leaves and these soon expand into lens-shaped, light brown areas of diseased tissue (lesions), often with yellow surrounds. The lesions can be up to 10 to 15 mm long and may coalesce to kill the leaf blades and sheaths. The fungus can infect all above-ground parts of the plant. However, lesions on the stem and head are usually confined and remain dark brown to black. Infection of the grain can result in a 'pink grain' symptom and will lead to downgrading at receival depots.

Survival and development

The yellow spot fungus survives in wheat stubble or, at times, stubble of triticale. In very rare cases the fungus may survive in barley stubble, but it is not generally an effective source of initial (primary) inoculum. Wet spores (ascospores)

develop in spore producing structures (ascocarps) on wheat stubble. Ascospores are spread under wet conditions and when deposited on living wheat tissues under wet conditions, infection may occur. Ascospores are generally not spread far and so there is usually a strong association between yellow spot and wheat stubble.

As the crop develops, masses of a second type of spore (conidia) are produced on old lesions and dead tissues. Wet conditions promote the development of conidia and are necessary for infection to occur. Unlike ascospores, conidia may be distributed widely by the wind. Conidia result in rapid development of the epidemic within a crop and spread the disease to other crops and areas. Figure 1 illustrates the disease cycle for yellow spot.

Plate 3. Typical yellow spot lesions showing light brown areas of dead tissue with yellow surrounds.

Since the two important requirements for severe yellow spot are infected wheat stubble and a wet growing season, it is seldom a problem in dry years.

Effects of the disease

In severely diseased crops, most of the leaves present at any given time will be dead. This results in short, spindly plants with reduced tillering and root development. Where conditions favour continued development of the disease, plants may lose all their leaves soon after flowering.

Grain yield can be substantially reduced and losses of more than 50% may occur in extreme situations. Where wheat crop follows wheat crop and some stubble remains on the soil surface, losses would commonly be around 10 to 15% and nearer 30% in wet growing seasons.

Managing the problem

Crop rotation

Crop rotation is the best means currently available to reduce the impact of yellow spot. This is because other crops, except for some triticales, are resistant to the disease. In addition, ascospores are generally not dispersed far from wheat stubble and management practices in a field have a strong influence on the level of yellow spot in wheat planted in that field.

Stubble incorporation

Once buried below the soil surface, stubble plays no further role in the development of yellow spot. Hence a useful procedure is to retain stubble on the soil surface through most of the summer before incorporating it into the soil. The degree of yellow spot control achieved largely depends on the amount of stubble remaining on the soil surface. The more stubble remaining, the greater the chance of severe yellow spot developing.

Stubble grazing

Removing wheat stubble by grazing will also reduce the severity of yellow spot.

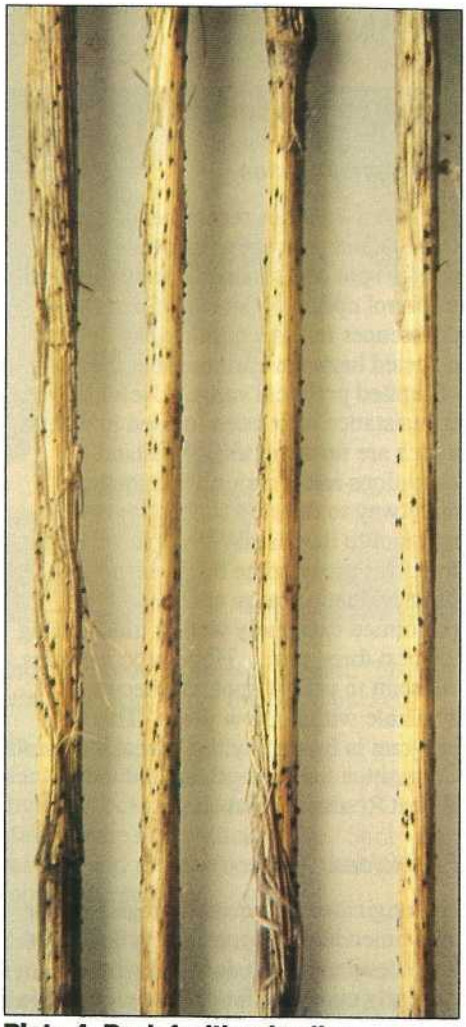

Plate 4. Dark fruiting bodies (ascocarps) on wheat stubble produce spores (ascospores) under wet conditions, initiating yellow spot in wheat planted through the stubble.

Stubble burning

Burning wheat stubble will generally give good control of yellow spot. However, because retention of stubble on the soil surface is an excellent means of improving water storage and reducing soil erosion, early burning is undesirable. A compromise solution to this dilemma is to delay burning as long as practicable. While there may be practical problems in achieving a good burn in autumn, burning stubble before planting can be beneficial in terms of yellow spot control. In trials, this practice has resulted in considerable yield increases under conditions suited to severe yellow spot.

Future control options

Resistant varieties

All wheat varieties recommended in Queensland are very susceptible to yellow spot and resistant varieties are not a control option at present. Small differences in susceptibility can be detected between varieties, but these are of limited practical value. Useful sources of resistance have been located in wheats which are unsuited to Queensland conditions and a major programme is underway to develop adapted varieties resistant to the disease. Advanced lines from this programme have reached the field evaluation stage and some have performed extremely well in trials during the past three years. Hopefully, varieties resistant to yellow spot will become available within a few years. This program is funded by the Wheat Research Committee for Queensland and the Wheat Research Council.

Fungicides

No fungicides are currently registered or recommended for control of yellow spot in Queensland. It is doubtful whether any currently available fungicides would give economic control of the disease.

Summary

Yellow spot can be a major disease problem in wheat crops where wheat stubble has been retained on the soil surface. The impact of the disease can be reduced by avoiding planting wheat through wheat stubble. This can best be achieved by crop rotation. Effective control is also obtained by incorporating stubble into the soil or grazing or burning stubble after the erosion risks from high intensity summer storms have lessened. Yellow spot will be a problem only in wet years. Resistant varieties will greatly improve our ability to control yellow spot.

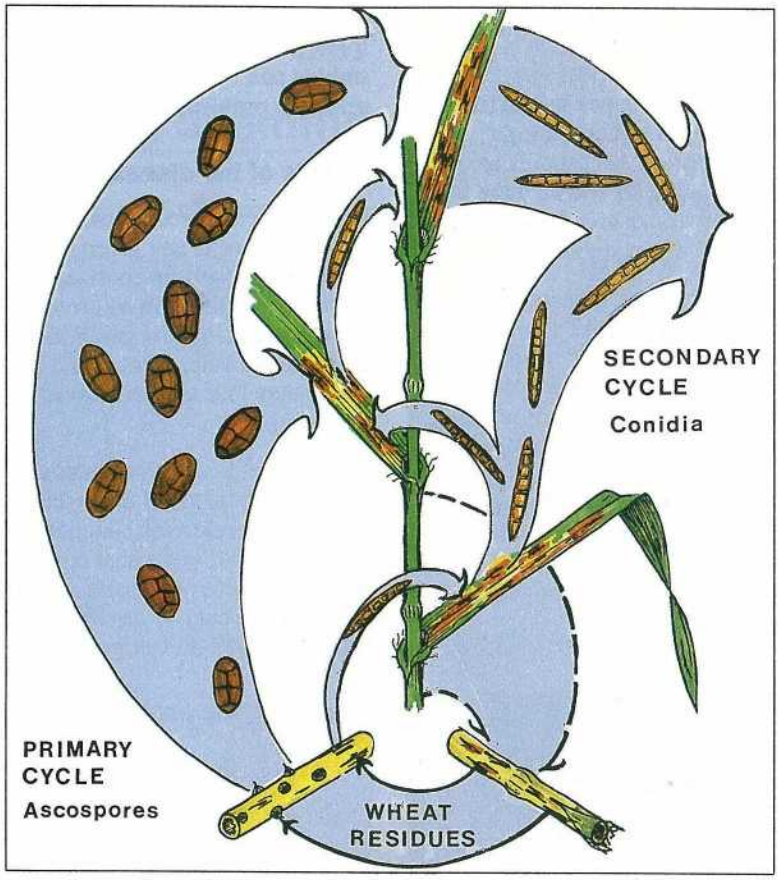

Figure 1. Yellow spot disease cycle. Ascospores of the fungus produced on wheat residues start the epidemic while conidia produced on diseased plant tissues promote its rapid development and spread to other crops.