Managing soybean leaf rust

Leaf rust can spread rapidly in cool wet conditions devastating soybean crops. Regular monitoring and early identification are important.

**KEY POINTS**

- Check undersides of the lower leaves to identify leaf rust outbreaks early.

- When deciding whether to treat the crop with a fungicide spray, consider:
  - crop stage: how many weeks of growth are needed to fill the pods?
  - level of infection: how much green leaf is left on the plants to fill the pods?
  - prevailing weather conditions: soybean leaf rust can develop quickly if leaves are wet and daytime temperatures are less than 27°C.

- Seek advice on spraying from an agronomist. A fungicide with some curative as well as protective effects should be selected.

- Crop checking is essential after spraying as re-infection can occur particularly if high risk conditions prevail, for example rainfall, heavy dews, overhead irrigation, cooler than normal summer temperatures, and the presence of leaf rust on other crops in the district.

**What is soybean rust?**

Soybean leaf rust is a disease caused by a fungus, *Phakopsora pachyrhizi*. Like rusts affecting other crops, the symptoms appear as slightly raised, dull grey/brown pustules on the underside of the leaf (Figure 1). Lower leaves are usually affected first.

The disease can spread rapidly in a crop when cool and wet conditions prevail. As the rust disease develops it destroys the green leaf tissue and reduces the plant's capacity to fill the grain in the pods.

Significant yield losses can occur when high rust levels cause premature defoliation of the crop. Depending on the time of infection, yield reduction can be due to fewer seeds per pod and fewer filled pods and/or smaller seed size. While seed size is reduced, protein levels and germinability of the soybean seed appear to be unaffected.

The soybean rust fungus is not internally seed-borne but spread by wind and needs a live host to survive.

In cool moist conditions soybean rust can rapidly spread through a crop destroying green leaf and yield potential.
Identification

Figure 1: Pustules of soybean leaf rust are dull, grey/brown in colour and develop on the underside of the leaf (A). Symptoms usually appear on the lower leaves first. Advanced leaf rust infection destroys the green leaf (B) and the plant’s capacity to fill developing pods.

Soybean leaf rust

Figure 2: Downy mildew symptoms should not be confused with leaf rust. These can develop anywhere on the plant and are visible as uneven blotches on the upper side of the leaf (A). The underside of a soybean leaf infected with downy mildew can sometimes show fungal growth with a fluffy or downy appearance (B) and an uneven margin.

Downy mildew

Infection

Spores of the soybean rust pathogen can spread many kilometres by wind but need to infect living host plants to survive. This fungus infects soybean and some other legumes in Australia, for example sprawling glycines and desmodium. It does not infect sugar cane, grasses, or winter cereals such as barley, triticale or oats and is not able to survive during winter unless living host plants are present (for example volunteer soybean or other Glycine species).

Cool wet conditions promote rust development

The two requirements for soybean rust are suitable temperatures and prolonged periods of leaf wetness. Work conducted in Queensland in the 1970s indicated that the combination of a night-time temperature of 17°C and a daytime temperature of 27°C resulted in the fastest appearance of rust. Leaves need to be wet for greater than six hours for the rust spores to germinate and infect the leaf. Leaf wetness can be due to rainfall, overhead irrigation, dew or fog. The more frequent and longer the wet events, the greater the chance of a significant rust outbreak occurring.

Symptoms

Unlike some cereals rusts that have bright orange or yellow pustules, soybean leaf rust pustules are dull, grey/brown in colour. This makes them more easily confused with other soybean diseases such as downy mildew (Figure 2). Soybean rust pustules are generally smaller, only occur on the underside of the leaf and have a more clearly defined margin than downy mildew.

When checking for symptoms of soybean leaf rust:
- check the undersides of the leaves, especially older leaves toward the base of the plant. Walk into several sections of the crop as leaf rust can start in one or two small areas within the crop. Take care not to transfer infection between crops on clothes and vehicles;
- look for slightly raised pustules that are a dull grey/brown colour (see Figure 1);
- compare pustules with images of leaf rust and downy mildew (Figure 2). Rust pustules are generally smaller with a more clearly defined margin than downy mildew.
- Downy mildew infection can occur anywhere on the plant and develops a blotchy or uneven spot that does not have a raised area on the underside of the leaf;
- check to see how far up the plant the infection has spread, that is determine how many green, uninfected leaves the plant has left; and
- check the stage of maturity of the pods. Determine how many more weeks of growth are needed to fill the pods.
Management options

In-crop

Fungicide

In response to severe outbreaks in 2007-08, a permit for the Bayer product Folicur 430 SC (active ingredient tebuconazole) was obtained for treating soybean leaf rust in Australia. Only two treatments of Folicur 430 SC are currently permitted per crop per season. The Permit (No PER11180) is valid until June 2011 and for the most up-to-date information check the APVMA website.

Experience to date suggests that this tebuconazole fungicide achieves better results than mancozeb-based products in protecting green leaves, particularly if applied early in the disease cycle. Tebuconazole provides some curative as well as protective effect, whereas mancozeb can only be used as a protectant on leaves that have not yet been infected by rust spores.

Important points about the permit include:
- only the Bayer form of tebuconazole is specified on the permit as Bayer provided the data to satisfy permit conditions;
- only two sprays per crop are permitted each season; and
- check with your local agronomist or the APVMA website to obtain up-to-date information about this permit and recommended rates.

Prior to sowing

Crop density

Planting to achieve the recommended plant density is particularly important in coastal regions. Over-crowded crops are more likely to produce humid conditions that prevent aeration and drying out of leaves after rainfall, dew or fog. Row cropping is also preferred to combine-sowing to improve aeration in the crop.

Weed control/green bridge

Good weed management is important, including the removal of volunteer soybean plants from headlands and roadsides. Control of other hosts, for example sprawling glycines and desmodium, is important. Soybean leaf rust is not able to survive during winter unless living host plants are present so control of the green bridge is essential.

Variety susceptibility

All current commercially available soybean varieties in Australia are susceptible to soybean leaf rust, except the variety Stuart®, which has good levels of tolerance to the disease. Stuart® is suitable only for growing in tropical Queensland and is not suited to northern New South Wales or southern Queensland environments.

A soybean crop that was treated with tebuconazole to retard the development of soybean leaf rust. The section of crop at the right was sprayed and shows the protection of green leaf. The area of crop at the left was unsprayed and shows the development of the leaf rust causing premature defoliation and unfilled pods.
Frequently asked questions

Can soybean rust be introduced on seed?

No. Although rust spores might adhere to seed during harvesting, there is no evidence that these spores are capable of surviving until the next season if the seed is used for planting. In addition, soybean rust does not grow inside seed. Soybean rust survives only on living plants of soybean and other hosts including sprawling glycines and desmodium, and its spores are capable of long-distance spread in the wind.

What type of nozzles are best for applying fungicides using ground rigs to control soybean rust?

Either medium or large spray nozzles which deliver a coarse droplet size of 200-350 microns at the desired ground speed, pressure and volume are preferred for fungicide application to control rust in soybean. As rust pustules are usually found first on the lower leaves the fungicide droplets must be able to penetrate the soybean canopy, and droplets of this size are ideal. Consult your local agronomist or spray specialist for advice on selection of appropriate nozzles.

Is water volume a consideration when applying fungicides to control soybean rust?

Yes. Achieving good coverage of leaf surfaces with fungicides is just as important as obtaining good penetration of the canopy, so water volume is critical. For ground application a minimum of 100 litres of water per hectare is needed, while for aerial application the minimum rate should be 50L water per hectare.

Useful resources:

- Dr Natalie Moore, Research Agronomist, Industry and Investment NSW 02 6640 1637 Email natalie.moore@industry.nsw.gov.au
- Dr Malcolm Ryley, Principal Plant Pathologist, Queensland Department of Employment, Economic Development and Innovation 07 4688 1316 Email malcolm.ryley@deedi.qld.gov.au
- Australian Pesticides and Veterinary Medicines Authority www.apvma.gov.au
- Stuart variety guide www.csiro.au/resources/StuartSoybean.html

Row cropping improves aeration in the crop. This can help to reduce the development of soybean leaf rust by allowing the leaf surface to dry out more rapidly following rain, dew, fog or overhead irrigation.

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