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Soil-borne diseases of beans

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Introduction

Soil-borne diseases can be devastating in bean production areas, especially if they are grown repeatedly in the same ground. Some diseases develop under differing conditions; for example, some are worse when the soil is wet whereas others prefer a dry environment.

Management of most of the diseases described below is difficult and although using fungicides or fumigants are options (if available and registered) they may not be economic for the value of the crop. Avoidance of infected fields and rotation are the only viable options for most of the diseases described below.

Beans prefer a growing environment where temperatures are between 15°C and 30°C. Germination is reduced when soil temperatures are below 15°C. Optimum vigour at germination is desirable to reduce the effects of soil-borne diseases which may infect slowly germinating plants. Beans are sensitive to frost.

Sclerotinia rot

Sclerotinia rot is common on many vegetables, ornamentals and weeds. It occurs later in the crop as the canopy increases and high moisture levels are maintained. Foggy conditions especially favour Sclerotinia rot.

Cause: the fungus *Sclerotinia sclerotiorum*.

Symptoms: a watery, soft rot with white, fluffy fungal growth on above-ground plant parts. Small, solid, irregular black bodies called sclerotia form in the white growth and inside the rotting tissue (Fig.1). The fungus often attacks the stem at ground level, and the whole plant dies.

During transit, the pods of plants affected by this fungus may develop a rapid rot called nesting.

Source of infection: the sclerotia can survive for several years in soil. They germinate under damp conditions to form small saucer-shaped structures called apothecia, which produce spores (Fig. 2).

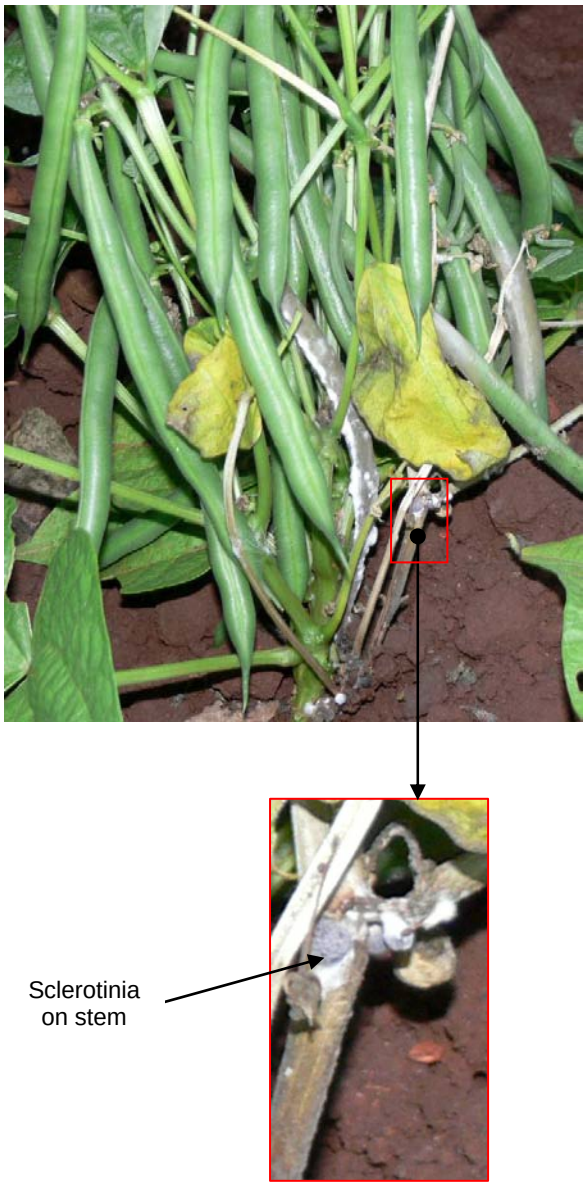

Figure 1. Typical symptoms of Sclerotinia with the white thread-like hyphae on a dead bean pod.

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The spores are ejected into the air and infect plant parts. They require a nutrient source such as rotting flower petals to infect. They also produce mycelium, which grows through the soil. Overhead irrigation may increase infection potential.

Figure 2. Apothecia on soil surface. These produce spores that are ejected and land on necrotic areas on the plant especially senescent flowers.

Spread: the spores are spread by wind and air currents.

Favoured by: cool, damp weather. Infection often starts through injured or dead plant parts coming in contact with the plant. The habit of the bean crop also plays a part in infection. Crops producing a dense canopy provide ideal conditions for infection and can reduce the efficacy of fungicide sprays.

Control: use a rotation with crops in which sclerotinia rot is not a host. Crops rarely affected by sclerotinia include cereals and grasses, onions, potatoes, and many summer crops. Spray with currently registered fungicides at the correct time, i.e. flowering.

Sclerotium stem rot

Sclerotium stem rot can affect many plant species but is uncommon on beans. Often a few plants near each other will be affected.

Cause: the fungus Sclerotium rolfsii.

Symptoms: a dry rot of the stem and root. Under dry conditions, slight, white, threadlike, sometimes fan-shaped fungal growth is conspicuous; small, brown, spherical sclerotia, 2–3 mm in size, develop (see Fig. 3, opposite).

Source of infection: the fungus is widely distributed in soil. Sclerotia can survive for several years.

Favoured by: high soil temperatures, fluctuating soil moisture and an abundance of undecayed organic matter.

Control: avoid land with a lot of undecayed crop trash, or deep plough to bury the trash.

Pythium stem rot

Cause: fungi of the genus Pythium.

Symptoms: a soft rot of the stem, with white, fluffy fungal growth at or above ground level (Fig. 4).

This does not form black sclerotia. Pod infection can occur and cause a rapidly developing transit rot.

Source of infection: common and widespread in soil.

Figure 3. Sclerotium rot showing white fungal growth and white (immature) to brown (mature) fruiting bodies. (Photo courtesy of Joe Wessels, QDPI)

Favoured by: hot weather, wet conditions, plant injury.

Control: avoid growing beans on poorly drained land. Do not over-water or injure plants, or throw up soil on the stem during cultivation. Discard diseased pods.

Figure 4. Typical symptoms of beans infected by Pythium. Symptoms may be confused with Sclerotinia. (Photo courtesy of Dennis Persley, QDPI)

Ashy stem blight (charcoal rot)

This fungus has a wide host range.

Cause: the fungus Macrophomina phaseolina.

Symptoms: a pale, ash-coloured, dry rot of the stem (Fig. 5). Small black dots develop in the dead areas. Death soon follows.

Source of infection: from previous crops or weed hosts.

Favoured by: hot weather and dry conditions.

Control: difficult, as the fungus infects many plants, many of which are weeds. Maintaining optimal moisture during hot conditions is critical.

Figure 5. Bean stem showing brown/black lesion due to Ashy stem blight up one side of the stem (top). The lesion eventually turns grey, in which black fruiting bodies would be observed (below).

Rhizoctonia root rot

Common in crops grown after potatoes, otherwise sporadic.

Cause: the fungus Rhizoctonia solani.

Symptoms: sunken, brick-red cankers on the root and lower stem (Fig. 6). When the fungus attacks seedlings, some are usually killed, some remain stunted, and others produce new roots above the diseased area and grow satisfactorily. When it attacks older plants with woody stems some cankers may develop, but little yield loss occurs.

The fungus may attack pods in contact with the soil; a rapid transit rot with off-white fungal growth can develop in these pods.

Source of infection: the fungus is common and widespread in soil.

Favoured by: previous cropping with susceptible crops.

Control: avoid growing beans in land that has been cropped with potatoes, cabbages, cauliflowers or broccoli in the previous six months. If the crop is to be picked by hand, or harvested as dry seed, hill up the soil around the base to encourage new root growth above the diseased area.

Figure 6. Bean stem showing typical Rhizoctonia lesion. These lesions can girdle the stem causing plant death, especially in young plants.

Aphanomyces root rot

Cause: Aphanomyces euteiches p.v. phaseoli

Host range: This fungus has been found specific to beans. A similar fungus Aphanomyces euteiches p.v. pisi infects peas.

Symptoms: lower stem and roots become discoloured. The lower stem may initially be light brown to grey, progressing to black or dark brown over time. Infected roots turn from a healthy white colour to brown (Fig. 7). Plants may die if infected when young or survive until harvest with reduced yield.

Figure 7. Typical symptoms of Aphanomyces root rot showing the brown lesion on the lower hypocotyl and tap root and brown finer roots.

Source of infection: Aphanomyces produces long lived structures that survive in bean trash. Bean trash, as it is left in the ground, provides a source of infection for future crops.

Favoured by: excessive soil moisture; however, heavily infected soils do not require much excess moisture. Aphanomyces root rot has been found in northern NSW. The fungus can infect the roots of a wide range of plants but seem to infect beans severely.

Control: There are no disease control measures, avoiding soils with the fungus for six to ten years is the only option. A soil test can be carried out to determine disease levels before planting. Careful irrigation management is important because excess will increase infection.

Fusarium root rot

Cause: Fusarium root rot is caused by a fungus, Fusarium solani.

Symptoms: reddening (Fig. 8) and drying out of the taproot; the lower root may be completely destroyed and secondary roots may form above the diseased area; stunting and yellowing.

Source of infection: land in which the disease has occurred; seed.

Favoured by: low soil temperatures, especially at planting; compacted soil.

Control: avoid planting in ground where this disease has occurred until the soil is warm. Loosen the soil by subsoiling (deep tillage) under the drill row before planting or after plant emergence.

Subsoiling must be carried out after ploughing to be effective. Hill the soil around the base of each plant to encourage new root growth above diseased areas, providing the crop is not to be harvested mechanically.

Figure 8. Brown lesions on hypocotyls.

Figure 9. Bean plants have the ability to regrow roots above areas that have died out because of root disease. This may keep plants growing till harvest.

Long crop rotations avoiding beans for five to six years may reduce losses. Clean cultivation equipment, such as rotary hoes, before working new areas.

Black root rot

Found in most Australian states on many different crops. Found on beans in most states of Australia.

Cause: the fungus Thielaviopsis basicola.

Host range: wide host range including beans, peas, cotton, lettuce, lucerne, lupin and soybean.

Symptoms: blackening of hypocotyl, tap root and fibrous roots (Fig. 10). The end result is stunting and possibly plant death.

Source of infection: old plant residue or long-lived spores in the soil.

Figure 10. Typical symptoms of black root rot showing the black lesion on the lower stem.

Favoured by: low temperatures, around 15º–20ºC and high soil moisture.

Control: this disease is sporadic and may not require treatment. No fungicides are registered for this disease on beans.

Root rot complex

Cause: species of Fusarium, Pythium, Rhizoctonia and Aphanomyces have been implicated in a root rot complex found in bean growing areas such as Gympie. The disease has been called ‘red root’. It is usually seen in early plantings such as the late winter plantings.

One of these fungi, or a combination of them, can cause stem symptoms as described earlier.

Symptoms: red colour associated with the lower hypocotyl/tap root.

Source of infection: old bean plant material.

Control: as this disease appears to occur in the cooler period plantings, especially in the Gympie area of Queensland, shallower sowing has been shown to reduce disease levels.

Summer death

Summer death is not a soil-borne disease but symptoms of the disease may be confused with other soil-borne diseases. The disease causes severe losses on susceptible varieties, particularly in beans grown in inland districts. Many suitable resistant cultivars are now available.

Cause: bean summer death virus.

Host range: not known, may be wide.

Symptoms: yellowing and death of the plant. Death is rapid during hot weather. During cool weather death is slower, and the plant is often stunted and wilted, with young leaves curling downwards. Root symptoms are distinctive: in early stages the vascular system in the root and lower stem discolour; in advanced stages it may blacken, and the roots rot.

Source of infection: weeds and pasture plants.

Figure 11. Early symptoms of summer death in the susceptible variety on the left.

Figure 12. Typical symptom of summer death on a severely infected bean (right) and early symptoms (left).

Spread by: the common brown leaf-hopper (*Orosius argentatus*), a small, lively, brown, speckled insect about 3 mm long. These leaf-hoppers move from

drying weeds to beans and other crops, particularly after hot weather, but are not often seen on beans. The virus is not transmitted by seed.

Favoured by: hot weather.

Control: use a resistant cultivar. All borlotti beans are susceptible. Avoid susceptible cultivars except for crops grown in northern coastal districts (NSW) during late autumn, winter, and early spring.

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