Sclerotinia in soya beans: Know your enemy

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Sclerotinia, a disease found in crops across the globe, can cause a 0,25t/ha loss for every 10% of plants infected. It occurs in 64 different plant families and in over 400 plant species, including some well-known weeds. It can infect almost all annual broadleaf crops.

It is essential that anyone wishing to minimise damage, knows and understands the disease. As there is no single management regime that can control it, an integrated management plan is the only way to limit the impact of the disease.

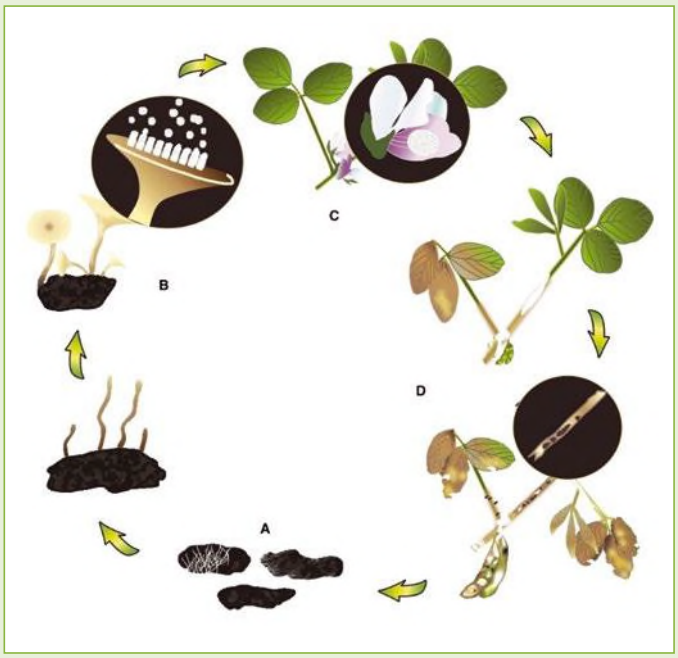
Life cycle of sclerotinia in soya beans

A: Sclerotinia can survive as undefined black structures, known as sclerotia, in the soil for seven to ten years. The inside is cream- to salmon-coloured.

B: When weather conditions are favourable, the sclerotia germinate and small mushroom-like structures, known as apothecia, start to grow upwards. In order for them to develop, these apothecia need wet soil, humidity higher than 75% and relatively cool soil temperatures of 12 to 24°C. Sclerotia buried as deep as 5cm can still produce apothecia, but most are formed on sclerotia present just below the soil surface. Conditions must remain favourable for several days in order for apothecia to reach maturity.

Apothecia are small, funnel-shaped mushrooms that are light- to salmon-coloured with a diameter of 2 to 5mm. Once conditions are ideal and apothecia have matured, thousands of spores are released up to 16cm high into the air, where air currents spread it over larger distances.

Figure 1: The life cycle of sclerotinia.



C: Sclerotinia spores germinate on the flowers of soya beans at air temperatures below 28°C. The flowers must be wet, either from heavy dew, mist or rain, for at least three consecutive mornings for spores to germinate (keep in mind that spores can germinate on any dead plant material). The soft petals are energy-rich and the ideal medium for the spores to germinate on.

D: Sclerotinia that is growing, releases oxalic acid which kills the flower; the sclerotinia then penetrates even deeper into the flower. This process is repeated until the leaf axil is reached via the flower stalk. Infection spreads from the leaf axil to the stems, which then start to die in an upward manner. Leaves that die and wither are the first symptom, which is usually only observed two to three weeks after the spores have infected the flowers.

The sclerotinia grows actively in the maturing soya bean plant and forms new sclerotia, which resemble mouse droppings. During the harvesting process the sclerotia are distributed by the combine harvester, allowing a new generation to spread. Infection can only spread from one plant to the next when leaf stalks or stems touch and sclerotinia then grow from plant to plant.

The best way to control the disease is by preventing the sclerotia from germinating and forming apothecia, or by protecting the flowers and preventing spores from germinating on the flower. Nothing can be done about plants that are already infected as corrective spraying cannot be applied.

Sclerotinia control

Unfortunately, all yield-enhancing practices contribute to the occurrence of sclerotinia. The more leaves a soya bean field can produce, the better the yield. There are two options for managing sclerotinia:

- Option 1 is to open up the leaf canopy to allow the soil to dry out faster and to keep the plants as dry as possible. This can be achieved by using wider rows (1,1 to 1,5m). Wider rows mean lower yields if sclerotinia does not occur. The prevalence of sclerotinia in wider rows is normally lower and yield losses are limited. This practice

is recommended in areas in which sclerotinia is common.
- Option 2 is to plant upright-growing cultivars later in the season to keep rows from closing. This practice can restrict yields and lead to low pod height that, in turn, can greatly complicate the harvesting process.

Chemical control

Here the goal is to prevent the spores from germinating on the flowers. For control to be successful, the flowers must be sprayed. This process is made more difficult in a soya bean field of which the canopy has already closed.

Timing is therefore critical; spraying must be done when the climate is optimal for spore release and while the soya bean plants are flowering. Large volumes of water must be used to wash the chemical into each leaf axil carrying flowers. The money put towards a preventative spray programme will be wasted if the timing is off.

It is very difficult to predict climate conditions accurately and forecast models are not really helpful. The main disadvantage of chemical control is that only the sprayed flowers are protected; those opening a week later are not protected and can be infected, thus negating the entire process.

Crop rotation

Using soya bean in rotation with another non-host crop reduces the incidence of sclerotinia. Non-host crops include grasses such as maize, sorghum and forage grasses. In areas where sclerotinia is commonly found, it is recommended to plant soya bean only every third or fourth season; this allows sclerotia to germinate in the soil and produce spores while no host is present.

Sclerotia in soya bean seed.

If cover crops are part of your crop rotation, do not include broadleaf crops in the mix as it can serve as a host and help sclerotinia to take hold. Radishes, turnips and cabbage-type crops are particularly sensitive to sclerotinia and in such instances it is best to use only grasses as a cover crop.

Biological control

Biological control of the disease is still in its infancy, but the future looks very promising. The primary action is to attack the sclerotia on or in the surface layer of the soil and prevent apothecia from forming. A few products are available on the market for this and preliminary trials show that this is one of the solutions that will have a greater foothold in future. The main challenge is to increase the stability of the products, especially during seasons with challenging climatic conditions.

Tillage

Thinking that a deep cultivation will bury the sclerotia deep in the soil, is probably the first solution that comes to mind. Unfortunately sclerotia can survive underground for long periods and any subsequent cultivation will only bring the sclerotia back to the surface – the problem will simply repeat itself.

No-till, on the other hand, has been shown to be more successful and actually reduces sclerotinia outbreaks. Using a no-till system, sclerotia are left on the soil surface where, when a good crop rotation system is used, most will germinate the following season and release many spores. If no host is present, it will have no effect and disease pressure will therefore be reduced.

Weed management

There are several broadleaf weeds that act as hosts for sclerotinia. Fields should therefore be kept as clean as possible, especially during crop rotation. It is also vital to keep headlands, contours and fences free of broadleaf weeds. These weeds can act as hosts for sclerotinia, thereby maintaining the disease and increasing the source of spores in the field.

Plant date

This is one of the easiest ways to limit sclerotinia damage, but success is not guaranteed. The flowering date of the entire farm can be extended over a longer period if quick-growing cultivars are planted first and longer growers later. Certain fields can therefore escape the disease if ideal climatic conditions that can promote an outbreak do occur.

Small, light-coloured apothecia.

Cultivar choice

There is a very small difference between different cultivars' sensitivity to sclerotinia. Under ideal climate conditions and when a specific cultivar is in bloom, airborne spores can infect and damage all cultivars.

However, cultivars have different growth habits. The more upright-growing and less-branched cultivars are usually less affected by sclerotinia, as the field has greater air flow and is usually drier. Unfortunately, these cultivars have a lower yield potential than lush cultivars with more branches.

Clean seed

Seeds that have not been adequately cleaned can serve as a source of sclerotia when planted in the field. Only use seeds purchased from a reliable source.

An integrated management practice that includes all the above management actions will greatly reduce the negative impact of sclerotinia. Regrettably, the disease will never be entirely preventable.

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