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Taifun Soy Info

Specialist information for soybean producers and processors

Sclerotinia stem rot

Summary

Sclerotinia is a fungal disease common in all soybean growing regions. It is caused by the fungus *Sclerotinia sclerotiorum*. Clear symptoms are sclerotia similar to mouse feces and a white, fluffy mycelium on infected stems. The incidence and intensity of infestation fluctuates from year to year and is strongly dependent on the weather conditions. The disease can lead to considerable yield reductions. Besides adapting cultivation techniques to the location (sowing time, plant density, choice of varieties, fertilization), control strategies include above all the observance of a sufficient crop rotation with non-host plants.

Introduction

Sclerotinia stem rot is a disease that is widespread in soybean cultivation worldwide. It is caused by the fungus *Sclerotinia sclerotiorum*, which is also known in rape cultivation for causing great damage. The frequency and intensity of infestation depends largely on the climatic conditions within the soybean stand. Favorable weather conditions are maximum daily temperatures below 29°C and high humidity in the stand due to rain, fog, dew or irrigation. A dense stand during flowering (growth stages R1 to R3) offers ideal conditions for the development of Sclerotinia stem rot. Stand density is mainly promoted by narrow rows, large numbers of plants and available nitrogen in the soil. In addition, Sclerotinia is increasingly found in fields that were already affected prior to the soy stand and where other susceptible crops have been included in the crop rotation.

Life cycle of the pathogen

S. sclerotiorum survives in the soil in the form of so-called sclerotia, which resemble mouse droppings in structure and color (Fig.1). If the soil is shaded, moist and cool (4-15°C), the sclerotia can germinate in the upper 5 cm of the soil profile and produce apothecia (fruiting bodies). Apothecia are small (approx. 0.3 to 0.6 cm), light-brown, cup-shaped mushrooms. They produce millions of spores, so-called ascospores, which typically infest the soy plant via the flowers. The infection spreads and new sclerotia form inside and outside of the infected stems. During harvest the sclerotia fall to the ground or remain on the field with the harvest residues. In spring the sclerotia can germinate again and the cycle starts anew.

Figure 1: Sclerotia from crop. Taifun, 2014

Symptoms

Typical symptoms of Sclerotinia stem rot are lesions on the stem, which spread rapidly above and below affected nodes and finally enclose the stem. Over time, the infested stems become light colored and fibrous and lesions may also appear on other stems, pods, petioles and rarely on leaves. Very heavy infestations interrupt the transport of water and nutrients, leading to wilting, lodging and death of the plants (Fig. 2). Sclerotinia often does not occur on the whole field, but in nests. The white fluffy mycelium and the sclerotia on infected plant tissues (Fig. 2) are suitable for a clear diagnosis. Sclerotia can be produced inside and outside stems and pods.

Figure 2: Symptoms of Sclerotinia: wilting, lodging and dying of the plant. Taifun, 2012.

Figure 3: Clear symptoms of Sclerotinia stem rot: fluffy white mycelium and mouse feces-like sclerotia. Taifun, 2014.

Yield and quality losses

Sclerotinia stem rot causes crop losses by reducing the number of beans and the bean weight. Apart from crop loss, Sclerotinia can also have an influence on bean quality. Sclerotia in the harvested material are regarded as foreign material (dockage) when recorded. *Sclerotinia sclerotiorum* can also directly infest the beans and thus, when resown, be transferred to fields previously free of Sclerotinia. Infestation can reduce the germination capacity and sometimes also the oil and protein concentrations of the beans.

Control strategies

Crop rotation:

By cultivating non-host plants such as maize or cereals in a period of at least two to three years, the number of sclerotia in the soil can be reduced. Fodder legumes such as alfalfa and clover, are less susceptible to *S. sclerotiorum* than soy, but can still be infested. In fields already affected by Sclerotinia, a sufficient cultivation distance should be maintained from other susceptible crops such as rape, cabbage, other legumes (peas, chickpeas and lentils), sunflowers and potatoes.

Tillage:

The influence of tillage on the development of Sclerotinia is discussed controversial in the literature. Some studies have shown less infestation in fields with no-tillage systems. Deep tillage can initially reduce the infestation by removing sclerotia from the topsoil and thus fewer apothecia. However, sclerotia can survive for more than three years at a depth of 20-25 cm and return to the soil surface with a subsequent soil cultivation. In no-tillage systems, more sclerotia are found in the topsoil, yet they are decomposed more quickly than in other systems.

Stand structure:

Early sowing, narrow rows, high plant numbers and abundant nitrogen in the soil accelerate the canopy closure and favor the development of Sclerotinia.

Row spacing: narrow rows lead to fast and dense canopy closure. Wider row spacing (≥ 50 cm) can have a preventive effect against Sclerotinia.

Time of sowing and relative ripeness: Early sowing and the use of late ripening, bushy or lodging-prone varieties can also contribute to the development of denser stands. However, the direct influence of these factors on the occurrence of Sclerotinia stem rod and yields fluctuates, as the development of the disease is strongly dependent on the weather conditions during generative growth.

Weed control:

Many weeds found in soybean fields are also infested by *S. sclerotiorum*. Some of them are listed below. High percentages of weeds of any kind can also contribute to the formation of denser stands and thus promote the development of the disease.

Weeds that can serve as hosts for *Sclerotinia sclerotiorum*:

- Field thistle (*Cirsium arvense*)
- Fodder vetch (*Vicia sativa*)
- Recurved amaranth (*Amaranthus retroflexus*)
- Burdock bedstraw (*Galium aparine*)
- Curly sorrel (*Rumex crispus*)
- Ordinary shepherd's purse (*Capsella bursa-pastoris*)
- Small Burdock (*Arctium minus*)
- Dandelion (*Taraxacum*)
- Goose Thistle (*Sonchus*)
- Common chickweed (*Stellaria media*)
- Field stinkweed (*Thlaspi arvense*)
- Common burdock (*Xanthium strumarium*)
- Stem-enclosing deadnettle (*Lamium amplexicaule*)
- Lime leafed beautiful mallow (*Abutilon theophrasti*)
- White goosefoot (*Chenopodium album*)
- Jerusalem artichoke (*Helianthus tuberosus*)
- Hourflower (*Hibiscus trionum*)
- Purslane (*Portulaca oleracea*)
- Jimson weed (*Datura stramonium*)
- Wild carrot (*Daucus carota subsp. carota*)
- Mugwort (*Ambrosia artemisiifolia*)
- Field mustard (*Sinapis arvensis*)
- Sunflower (*Helianthus annuus*)
- Prickly lattich (*Lactuca serriola*)
- Meadow parsnip (*Pastinaca sativa var. pratensis*)

Irrigation:

Excessive irrigation during flowering should be avoided. Low moisture in soy stands is crucial to reduce the risk of Sclerotinia outbreaks. Rare, intensive irrigation is often better than frequent, low intensive irrigation.

Variety choice:

Although there are no soy varieties that are completely resistant to Sclerotinia, some are more tolerant than others. The frequency of infestation is significantly lower for these varieties than for susceptible varieties. Under conditions favorable to the fungus, the plant nevertheless is infested to a certain extent. However, in German-speaking countries information on tolerance against Sclerotinia is usually missing in variety descriptions.

Breeding resistant varieties is difficult because resistance is likely determined by several genes. In addition, the identification of resistant plants is often not easy as the disease can develop very differently on different experimental plots. Differences in maturity and plant morphology can also influence infestation and disease development.

Chemical control:

In Germany, no synthetic fungicides against Sclerotinia are registered for soybean cultivation. In other cultures, especially in special cultures and in the cultivation of ornamental plants, the following active substances are used against Sclerotinia: Azoxystrobin, Prothioconazole or Tebuconazole.

Biological control:

Direct control of Sclerotinia is not possible. Yet, prophylactic control with the fungus *Coniothyrium minitans* is. *C. minitans* is the best studied fungus for biological control of Sclerotinia. It is commercially available under the name Contans® WG. *C. minitans* should be applied at least three months before Sclerotinia typically breaks out. Hence the fungus has enough time to colonize and decompose the sclerotia. Destroyed sclerotia do not produce apothecia and subsequently no ascospores, which initiate the infestation of the soy plants.

To date there is little data on the effectiveness of *C. minitans* in controlling Sclerotinia in soybean stands. Most recent studies investigating the effect of *C. minitans* have been focused on other crops.

In the few studies focusing on soy, the amount of sclerotia could be reduced by up to 95% and the incidence of Sclerotinia could be reduced by 10% to almost 70%.

Summary

- Documentation of infestation intensity and frequency of Sclerotinia for risk assessment and crop rotation planning
- Use of healthy seeds (free from Sclerotinia)
- Verification of stand density
- Maintaining crop rotation with non-host plants
- Adaptation of irrigation during flowering

Source

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