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Managing soybean sudden death syndrome and white mold

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2009 season review

The cool 2009 growing season resulted in a challenging disease management year for soybean growers. The long wet planting season followed by a record cool July was ideal for disease occurrence. It was the first time that two soybean diseases, sudden death syndrome (SDS) and soybean white mold, were wide spread in the same season in Iowa, as well other states. In August, SDS showed up almost in every area in Iowa with some regions having high intensity. Large patches of soybean with SDS symptom were obvious from south to north. Into late August, white mold gained attention as producers knew from their previous harvest experience that this disease affects yield. This year white mold was so wide spread that agronomists in southern Iowa reported the observations of this disease in many soybean fields. In northern Iowa, patches of soybean killed by this disease were so obvious that I found them in nearly every soybean field while attending a field day. Prior to 2009, the highest loss from white mold in my memory was about $32,000 for a farm. This year, a farmer told me he estimated a loss of $40,000 by this disease from his farm.

SDS management update

Variety selection, tillage, and delayed planting are effective means to manage the risk of SDS. Variety selection and tillage are most commonly used means to manage the disease risk. Not much new information is available on these two methods except that there are a lot more resistant/tolerant varieties available on the market, except for the early maturity groups.

Planting date

Planting soybeans in cool soil increases disease risk. The longer the seedling in contact with cool and wet soil, the higher the risk. The earlier you plant in cool soil, the more exposure of geminating seed to the pathogen. We have previously reported that SDS fungus can infect soybean plants as early as seed germination. Fungus spores survive in the soil, germinate in cool temperatures, and penetrate through cortex tissues of the soybean root. The fungus then colonizes in xylem tissues of infected taproot plants. Since the xylem is the soybean plant's pathway for upward movement of material such as water and nutrients, colonization in the xylem system is critical for the fungal toxin to move from the tap root to the leaves. When toxins produced in the infected plant are pumped to foliar parts, initial symptoms are produced as scattered yellow or white spots between leaf veins.

The younger the soybean plants are, the more likely the pathogen will penetrate into xylems of tap roots. If the fungus fails to penetrate the xylem during the infection, no foliar symptoms would occur. Since the fungus attacks soybean effectively in cool soil temperatures and warm soil reduces the fungal activities, early-planted soybeans in cool soils are more likely to be colonized by the SDS fungus inside its tap root.

Rotation effects

Management of SDS risk for the following year's soybean crop should start when harvesting corn. Our studies, both in greenhouse and field, show that corn harbors the SDS pathogen, especially corn kernels. We compared the survival of SDS fungus in different crop residues (corn or soybean) and in different parts of the plant (root, seed, straw). We found the treatment of corn kernels at an average harvest loss density consistently had the highest SDS fungus population. Our finding is consistent with producers' observations that severe outbreaks of SDS occurred after a few years of continued corn production. Our results suggest that reducing harvest losses should help reduce the risk of SDS, while a high amount of harvest loss increases SDS risk when soybean is planted the following year.

Fungicides

Currently, no fungicides are available for SDS control. Research is ongoing to study seed treatments for SDS control. So far studies are limited to greenhouse trials and plots, and no compounds have demonstrated consistent effects. As for foliar spread, no chemicals are effective to control this disease. Cobra has been studied in greenhouse and field for SDS control and there have been no reports showing consistent control.

White mold management

Soybean white mold is a fungal disease caused by ***Sclerotinia sclerotirum***. The fungus occurs during flowering stages and it starts to enter soybean from flowers. Wet and cool conditions during blooming are necessary for its spread. The 1992 and 1994 weather conditions were wet and cool. If the weather conditions are dry and hot during the soybean flowering season, the disease risk would decrease significantly. That is why one cannot predict the disease. Cultural practices also affect the disease. Often, we see more white mold in drill planted soybean than 30" soybean because the canopy has higher moisture in narrow row soybeans than wide row soybeans.

Cultural practice

There are a few things we can do to minimize the disease risk. If your fields have high levels of white mold, avoid using susceptible varieties and consider using white mold-tolerant varieties for the next soybean crop. High yielding, white mold tolerant varieties are available. One thing to keep in mind is that the tolerance sometimes may not work due to lack of consistence in disease pressure in breeding. Also, avoid planting soybean with narrow row (15 inch or less) in fields which have a history of white mold.

If severe white mold is found in your soybean fields, consider the use of no-tillage if corn is a rotation crop. Tillage can affect white mold in several ways. Although sclerotia can survive in deep soil up to 7 years, only sclerotia within 2 inches from soil surface germinate and produce spores to infect soybean. Therefore, burying infested residues by deep plowing can prevent the germination of the sclerotia. However, subsequent cultivation and tillage could bring sclerotia up to the surface. Under no-till, or shallow till, a large portion of the sclerotia germinate under corn or other non-host crops, which reduces the amount of pathogen in the soil. Therefore, no-till results in a smaller white mold risk compared with conventional tillage, which has been proven from large scale sampling (Figure 1). When corn is used to reduce sclerotia in a field, seed corn fields will not be effective because of the open canopy from detasseling. Sclerotia will not germinate in field with an open canopy.

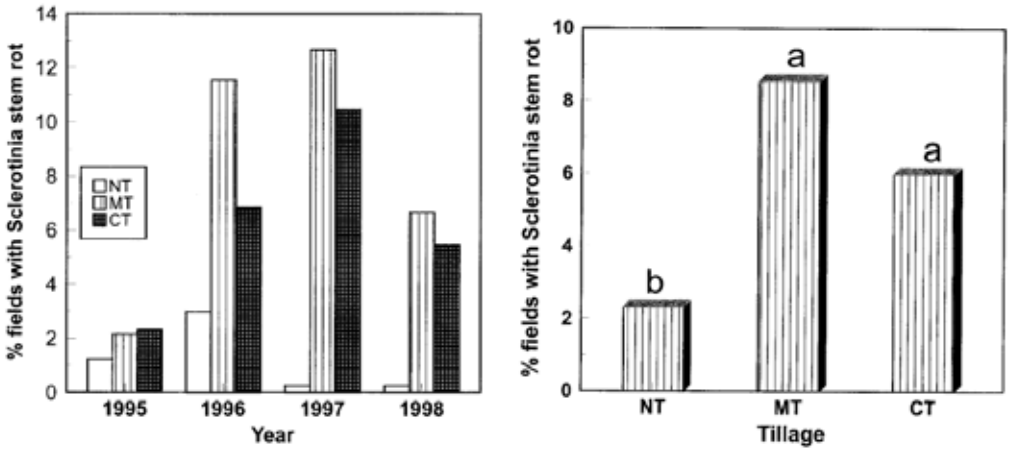

Figure 1. Tillage effects on soybean white mold occurrence from survey data collected in 1,500 fields in North Central Region.

Other cultural practices to reduce the disease can be applied at harvest. First, if you observe some sclerotia, or mouse dropping-type structures, in harvested soybean, it is a sign of significant risk for next soybean crop. You should take action to reduce white mold risk. The second measure at harvest is to limit white mold during harvest. In Iowa, the disease often is more severe in even years because of rotation effect. This year was different and was the first occasion of wide occurrence in an odd year. For most of the fields where white mold was found, the disease was scattered in small patches. To prevent the disease to leading to a problem of every year, we should minimize the spread of this disease in a field. When combining a soybean field infested with while molds, we should harvest the disease patches the last so that the combine will not spread infested plant materials to non-infested area. This should be applicable to any field where white mold is found with minimum yield damage .

Chemical control

Unlike many years ago when there were two fungicides available for white mold control, now, there are several fungicides on the market. It is very important to use the right fungicides to control white mold. Some fungicides are good to control foliar diseases but they are not necessarily effective to all fungal diseases. Read the label before selecting a fungicide. In this season, there were instances of growers using incorrect fungicides, which were not labeled for white mold, to control white mold. Also, there were growers who incorrectly used fungicides at R3 growth stage to control white mold.

Timing of application

White mold outbreaks require specific environmental conditions. Knowing the risk of white mold infection in July is a key to provide you economical return for white mold control.

Production of white mold mushroom from sclerotia is a sign of risk. The sclerotia dropped into soils becomes the source of inoculums for next year's soybeans. Although scouting for these white mold mushrooms has not been recommended before, detection of these structures can be an early warning for the occurrence the disease. If a large number of apothecia (mushroom) are present in a soybean field, there is a good chance white mold will be present. Unfortunately, there is no threshold available as what number of apothecia per square foot require a fungicide treatment. Further, because one white mold mushroom (apothecium) can produce millions of ascospores and one ascospore would be effective to kill soybean plant, a small number of white mold mushrooms may be sufficient to cause significant damage when weather is conducive.

If soybean has passed the flowering stage, it is too late to reduce disease damage. It is recommended that fungicides should be applied no later than 50% of blooming. To apply fungicides at later growth stages is not economical. There was a question; would it be effective if a chemical is applied as soon as white mold infestation in the field is observed?. The short answer to that is --it is too late to apply any fungicides for white mold control once the disease occurs and by that time the fungus has completed its infection process. From pathological point of view, the disease will not spread although one may observe continuous increase in dead plants. What you observed were plants that were infected a few weeks prior to seeing dead plants. So, the increase of dead plants seen in the field is an effect of infection/spread occurred a few weeks prior..

Although the mold grows from leaf to leaf, less than 7% of dead plants are results of this type of spread. Some white mold was reported from irrigated soybean fields. Irrigation will not increase the spread but may promote growth of the fungus on infected plants.

Other control measures

Contans

You can also consider applying Contans after harvest of soybean, to break the disease cycle of white mold fungus in the following season. Contans is a product from a biological control agent proven to be effective in white mold control in many crops. It has been used to control white mold in many crops of high value and Contans is labeled for soybean. The active ingredient in Contans® is fungal spores of ***Coniothyrium minitans***, a parasite that attacks the resting spores called sclerotia of white mold fungus. Unfortunately, little research data from public sector are available on using Contans to control soybean white mold. However, ten years ago a similar biological control agent was tested at ISU to control soybean white mold and the results were excellent. Contans has been used by some Iowa soybean growers.

Cobra

Cobra is an herbicide that is also labeled for white mold control. Cobra has been used to control white mold for a number of years by Iowa growers. Cobra effects in white mold control are two fold: it increases plant resistance and reduces the density of canopy. When used for white mold suppression, yield response to Cobra can be variable, especially if the disease incidence is low or absent. This is especially true when white mold is absent. If you have white mold, Cobra may offer protection. If you do not, Cobra can be a problem for soybean of early maturity group. For most effective control, application should be done at R1 or right before flowering. If application is done too early, the suppression of the disease may not be sufficient. If applied at full blooming, the incorrect application may reduce flowering. Cobra can cause leaf burn and may reduce yield with late applications. Generally, if beans are under stress at application time (flowering, pod fill) any further stress will have a negative impact on yield.

Manage risk of two diseases in one season

Manage the risk of white mold and SDS in one season would become a future challenge. In 2009 growing season, soybean sudden death syndrome and soybean white mold were in epidemic proportion not only in Iowa, but also in other states in the north central region. This is the first year that the two diseases were wide spread in the same season although the two diseases are not new to some growers in east-central Iowa who have been trying to manage the damage of two diseases in their farms. It is likely that more growers will face both SDS and WM in their farms in future as the expansion of SDS into soybean production region where white mold is historically prevalent. Producers in these regions should try to minimize the possibility of facing the two diseases in one farm/field because when both diseases become a threat in one soybean field, we will not be able to use conventional management options in the way we have been doing. Few varieties are resistant to both diseases and to manage the risk of two diseases could be complicated and expensive.