# Sclerotinia Head Rot of Sunflower

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## Biology of Sclerotinia

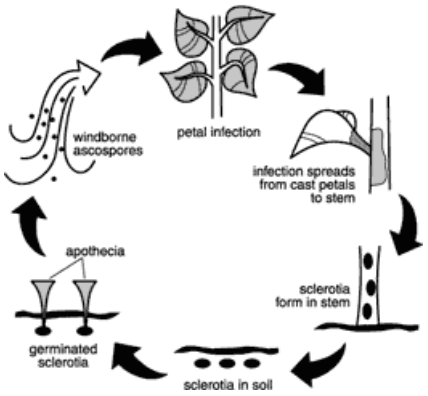
### Sunflower Wilt

*Sclerotinia* overwinters as sclerotia (the hard black bodies formed in stalks and heads) in the soil and in plant debris. In summer when the growing sunflower roots come in contact with sclerotia, the sclerotia germinate and infect the roots. The fungus grows upward in the infected root, into the tap root, and forms a canker at the base of the plant. The plant wilts and dies. This is called Sclerotinia wilt or stalk rot. Adjacent plants in the row may be infected through root-to-root contact. Sclerotinia wilt can occur any time that sunflower is planted into an infested field. Its development is independent of weather conditions, with infection occurring at almost any soil moisture capable of supporting sunflower growth.

### Sunflower Head Rot

When excessive rainfall saturates the soil, the sclerotia germinate to produce tiny mushroom-like bodies the size and shape of golf tees. These bodies, called *apothecia*, liberate millions of airborne spores (Figure 1). The spores infect sunflower during wet weather at flowering time producing middle stalk rot and head rot. The spores do not infect healthy plant tissue, but need dead plant matter as a food source in order to begin growth. Dead flower parts are the preferred food source. Once growth is established, the fungus produces oxalic acid, which kills plant tissues. It also produces extracellular enzymes, which dissolve and digest plant tissues. By this means the Sclerotinia fungus attacks the healthy green plant tissues. There has been much debate about whether hail or other wounds favor Sclerotinia infection. The consensus is that hail wounds may favor infection. These wounds may not produce much dead tissue, but wounds on the back of the head are sites for the collection of water and flower parts, favoring infection.

**Figure 1. Sclerotinia disease cycle.**




### Where do the spores come from?

Recent NDSU research indicates that the half life of these spores under normal atmospheric conditions is about 12 hours. Spores may be blown from infested fields to non infested fields. In some cases, spores may be blown many miles down wind, causing infection in areas previously free of Sclerotinia. This also explains why growers who have had good crop rotations and have not had problems with Sclerotinia may suddenly have a serious problem with Sclerotinia head rot,

although they have done nothing wrong

## Sclerotinia Management in Infested Fields

Outbreaks of head rot may result in infestation of many fields in an area that previously was free or had only low levels of Sclerotinia. These infestations pose a threat to other susceptible crops grown in subsequent years if wet weather occurs at flowering. They also pose a threat to sunflower any time sunflower is planted in an infested field, since Sclerotinia wilt may occur any year, regardless of weather conditions. This necessitates special precautions with sunflower, and this crop should not be planted in highly infested fields for at least five years. Broad leaf crops that can be grown in rotation with crops highly susceptible to Sclerotinia include flax and semi-leafless peas.

If sclerotia are buried more than 2 inches by tillage, they cannot produce apothecia in future years. Preferably, burial should be deep enough that shallower tillage in future years will not return the sclerotia to the soil surface. However, deep tillage will bring sclerotinia back to the surface and increase potential for white mold problems. Future root infection of sunflower is not controlled by deep tillage and burial.

## Managing Sclerotinia Head Rot in Sunflower

### Hybrid Selection

Research data on Sclerotinia stalk rot and head rot is gathered at various research sites in North Dakota. Significant head rot and data is not available for all years. Circular A-652, North Dakota Hybrid Sunflower Performance Testing includes available data on hybrid performance and tolerance ratings for stalk and head rot. The mechanism of tolerance for sclerotinia stalk rot is different than for tolerance to head rot. A hybrid may be tolerant to stalk rot but not be tolerant to head rot. Using the most tolerant available hybrids for head rot may help reduce the amount of sclerotinia produced in the crop. No hybrid is resistant, and hybrid tolerance to rot may change in different environments. Hybrid tolerance is currently being studied and is not understood well enough to accurately predict a hybrid reaction to sclerotinia. Use available data as a guide.

### Rotation

Always plant sunflower with a minimal interval of three or four years from highly susceptible crops such as Crambe, Canola, dry beans and sunflower. Rotation is not as big a factor for reducing head rot as for reducing stalk rot. Spores that blow in from some distance can cause head rot on sunflower, even though it may be planted in a field with no broadleaf crop history at all. Rotation will not prevent head rot in sunflower but will be beneficial for other reasons.

### Desiccation of Mature Sunflower

Desiccants are available for confection sunflowers to kill and speed dry down of the sunflower plant and seed. Use of desiccants is not common but can be useful when the crop is physiologically mature and when earlier than normal harvest would be advantageous to the grower. When head rot of sunflower is present, early dry down of the plants may slow or stop the development of head rot and reduce total sclerotia and destruction of seeds. This is somewhat dependent on weather following desiccation. Wet weather following desiccation may increase the problem in desiccated sunflowers as compared to sunflowers that are still green. White mold does attack dead tissue, and while little data is available, grower experiences indicate an enhancement of head rot when wet weather follows desiccation as compared to green fields left undesiccated. Growers need to weigh the weather probabilities and the advantage of early harvest compared to the risks of wet weather following desiccation.

## Delaying Harvest

Development of head rot in sunflower causes the head to lose structure and be subject to breakup due to wind, rain and other natural causes which cause the seed and head contents to fall to the ground. (Figure 2) This, of course, removes damaged seed and sclerotia from the combine. Disadvantages of waiting for head rot to cause disintegration of the head is additional loss of good seed by natural weather conditions and bird depredation.

**Figure 2. A disintegrated sunflower head.**

Delay in harvest is an option mostly considered by confection sunflower growers, because confection seed processors have very low tolerance for sclerotinia and sclerotinia damaged seeds. Sclerotinia damaged seeds when roasted turn dark in color and taste rancid or bitter to the consumer. Tolerances for dark roast are generally less than 1% of seeds. A grower can estimate the number of dark roast seeds by examining samples for off colored or bleached seeds. Typically, dark roast seeds would be one-half to two-thirds the number of bleached seeds in the sample. A grower can get a quick estimate of dark roast seeds by selecting 100 seeds and counting off colored or bleached kernels and multiplying that number by .5 to .67. If the number of dark roast seeds exceeds one, the sample may not be accepted for human consumption. The grower needs to consult with processors concerning their specifications and would be advised to take a harvest sample and submit it prior to combining the whole field to make sure that harvested seed is acceptable to the processor. For oil seed sunflower growers, harvest delay offers no advantage as generally sclerotinia would be treated as foreign material. There is an expense involved in trucking and handling foreign material.

Bird seed specifications are generally less stringent than those for human consumption. Dark roast seed is not a factor in bird seed markets, but the amount of sclerotia is a factor. Generally, sclerotia levels above 3% are expensive and difficult for processors to condition, and levels higher than that may be rejected even for bird food markets.

## Combine Settings

Combine adjustment offers a minimal opportunity to reduce sclerotia in harvested seed A study of diseased confection sunflower seed completed in the fall of 1999 found significant and widely variable foreign material (FM) in samples collected from a combine with various settings. The settings included cylinder speed, concave spacing, beater grate setting, fan speed and variable chaffer, chaffer extension and sieve spacing. Twelve combine settings were tested with seed samples taken from the tank. Foreign material in the 12 samples varied from 8.0 to 14.7% with the majority (70 to 80%) of the FM being sclerotinia sclerotia (white mold).

A double screen cleaning was done to remove the large and small pieces of sclerotia. The top screen was a 14�/64" X �" slotted screen and the bottom screen was a 17/64" round hole screen. The FM for the 12 samples was reduced to a low of 1.2% up to a high of 4.1%.

Confection sunflower seed buyers will usually accept FM in the seed of 0.8 to 1.0%. All screen cleaned seed samples exceeded this level. A secondary cleaning was done on a gravity table. This reduced the FM down to 0.6 to 0.8%. This would be satisfactory for confection sunflower except for the individual white mold infected seed. The sunflower seed

industry refers to these as dark roast seeds. These can often be identified as discolored confection seeds. The dark roast term comes from dehulling a sample of seed and roasting them. After roasting, the infected seeds turn a dark color. The maximum allowed by processors is 1%. All 12 samples contained 3.0% or more dark roast seeds after screen cleaning and separation on a gravity table.

Mechanical cleaning (screen and gravity) can remove the sclerotinia sclerotia but will not remove the infected seeds. Leaving the plants standing in the field allowing the wind and other environmental affects to shake or dislodge the infected seed from the head may help.

Another trial was done using a "head shattering bar." This involved mounting a double V-shaped bar to the front and extending forward of the sunflower catch pans. This V-shaped bar was designed to shake the sunflower heads so the diseased heads and seeds may fall to the ground. A drawing of the attachment is shown in Figure 3. Four tests using the bar were done at a moisture content of 12 to 13%. The total amount of FM was not determined, but after screen cleaning with a single 20/64" round hole screen, the FM was 3.5% without the shatter bar and 3.0% with the shatter bar installed. The shatter bar did reduce the FM but not enough to get the FM down to the 0.8 to 1.0% level. Cleaning the seed on a gravity table could do that. But, the dark roast disqualified the seed from the confection market. All seed samples contained dark roast seed of 3.0 to 3.5%. This is well above the accepted market level.

**Figure 3. Head shattering attachment for sunflower catch pans.**

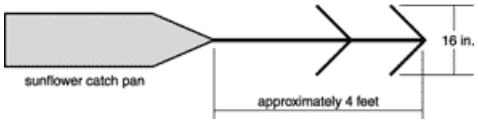



**Figure 4. Off-color or bleached sunflower seed.**

**Figure 5. Sclerotinia Sclerotia.**

## Fungicide Use

No fungicides are currently labeled for use in sunflower to reduce sclerotinia head rot. Sclerotinia may infect the sunflower

head over a long period of time, so timing and residual control with any product becomes a concern. White mold controlling fungicides are expensive and would need to control the problem to be economically feasible. Timing, amounts to be used and effectiveness have not been researched to date and there are no options available for fungicides.

## Storage

Confection seeds that are rejected at harvest may be eligible for Farm Service Agency loan. Storage allows the market to sort out needs and quality needs. Storage is an option that may result in market opportunities later in the year. It is risky in that market needs may not change over time. Quality factors involved in obtaining a loan need to be understood as they may be a factor when closing out the loan.

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