White Mold

White mold, also known as stem rot and southern blight, is a common and often destructive disease of peanut in Alabama. Annual losses due to this disease reduce farm income in Alabama by nearly $40 million. In selected fields, disease-related losses have exceeded 40 to 50 percent of anticipated pod yields. In Alabama, common hosts of the causal fungus of white mold, *Sclerotium rolfsii*, include tomato, pepper, watermelon, soybean, and beggarweed.

White mold severity is closely tied to the frequency peanuts are grown in a field. In a recent survey of Alabama peanut fields, the worst yield losses caused by white mold occurred when peanuts were cropped every year or after 1 year of corn or clean fallow. When peanuts were planted once every 3 years behind cotton or corn, the incidence of white mold was much lower, and yields were much higher. The incidence of white mold in peanuts grown behind 5 or more years of bahiagrass was extremely low.

Symptoms

White mold usually appears in peanuts after vine growth has begun to slow and numerous pods are being set. Sudden wilting or flagging of the terminal or one or more lateral limbs on randomly scattered plants, starting mid to late July, is usually the first symptom of white mold in peanut (figure 1). Leaves on the wilted limbs quickly yellow and then brown. Elongated brown lesions, which often girdle the limb, are usually found on the vertical terminal stem just above the soil line and at the base of the lateral limbs. Generally, the remaining limbs on diseased peanuts will then wilt and die (figure 2).

The white mold fungus also attacks the roots, pods, and pegs of peanut. Pods on damaged pegs are usually shed before harvest. Diseased pods turn dark brown and often disintegrate in the soil. At times, a severe pod rot may occur just before harvest without any apparent damage to the rest of the peanut plant. Scattered areas or “hot spots” of dead or dying plants may be seen in those fields where disease activity is light to moderate. In heavily fungus-infected fields, nearly all the plants on long sections of each row succumb to white mold.

During wet, hot weather, a dense white mat of mycelia of the white mold fungus will grow under the peanut canopy on the soil surface, in crop debris around the base of the plant, or...
on peanut stems and vines at or just above the soil line (see figure 3). Occasionally under very wet conditions, the lower leaves may be blighted. As the fungus grows along the soil surface down the row middle, it often attacks adjacent healthy plants (see figure 4). As the soil surface dries, the white fungal mat often colonizes the roots and pods as it grows through the top 2 to 3 inches of soil.

Round, light tan to brown clusters of seedlike bodies no more than $\frac{1}{16}$ of an inch in diameter called sclerotia form on the mat of fungal growth on the soil surface, decaying stems, and other crop debris. As the soil surface dries or weather cools, the white fungal mat will disappear but the sclerotia remain. Only sclerotia of *S. rolfsii* in the upper inch or 2 of soil survive between host crops, while those buried by deep turning die. Fallen leaves and other undecomposed plant tissues on the soil surface, which stimulate sclerotial germination, are quickly colonized and then used as a food base by the fungus to attack nearby healthy peanuts.

Typically, white mold appears during steamy, hot weather in July and August anytime from pod set through harvest. Disease development is favored by several days of hot, dry weather followed by a day or two of showers. Often, two or more separate white mold outbreaks may occur in disease-prone fields before cooler temperatures in September slow the pathogen's activity. Lengthy periods of cloudy, mild, very wet weather along with constant heavy irrigation or extreme drought appear to suppress white mold, while high nematode populations may increase disease.

**Control**

Control measures for white mold on peanut include crop rotation, deep tillage, resistant cultivars, and preventative fungicide treatments.

**Crop rotation** remains the most effective though often underutilized weapon against white mold on peanut. As is the case with peanut root-knot nematode, cropping peanut behind 4 or more years of bahiagrass and coastal bermudagrass pasture will virtually eliminate white mold (see table 1). Since neither pasturegrass is a host of *S. rolfsii*, the causal fungus often dies out before the next peanut crop is planted. However, broadleaf weed control in grass pastures is critical because colonization of weed hosts may allow the white mold fungus to survive between peanut crops. Also, white mold and peanut rootknot nematode may be introduced into grass pastures where peanut hay bales have been stored or are fed to cattle. A second peanut crop can often be grown the year after turning under a grass pasture with few problems from root-knot or white mold.

Cropping 1 year of peanut after 2 to 3 years of corn, cotton, grain sorghum, sudangrass, or another nonhost crop of *S. rolfsii* is also an effective way of minimizing white mold damage and maximizing peanut yield (see table 1). The heaviest white mold damage consistently occurs where peanuts follow 1 year of any of the above crops or in fields in continuous peanut production (see table 1). Summer-fallowed fields should be disked or planted to a cover crop, such as sudangrass or a forage sorghum to eliminate volunteer peanuts and weed hosts of *S. rolfsii*. Crops that are good hosts for *S. rolfsii*, such as soybean, tomato, watermelon, and pepper, should not be rotated with peanut.

In fields with a history of severe white mold, 2 years of corn, cotton, or clean summer fallow will not make this disease disappear. Over time, however, the use of the above cropping pattern will reduce yield loss to the point that fungicide treatments are unnecessary. Cropping peanut behind 3 or more years of a nonhost crop or clean summer fallow, which would greatly reduce the carry-over of *S. rolfsii* in the soil, will also eliminate the need for costly fungicide treatments.

Tillage practices may have a significant impact on white mold pressure in peanut. Using a moldboard plow to bury debris and sclerotia of *S. rolfsii* from the previous peanut crop may reduce the severity of white mold on peanut. However, sclerotial numbers in many Alabama peanut fields may be so high that deep tillage has little or no impact on disease severity. Preliminary trials indicate that an increase in white mold severity and yield loss may be seen with reduced or strip tillage production systems. In fields where white mold pressure is high, fungicides are required on reduced-till peanuts to maintain acceptable yields.

Burying or "dirting" peanut vines with soil when cultivating for weed control will greatly increase white mold damage as well as reduce pod set around the taproot. If cultivation for weed control is done, use flat sweeps to avoid pushing soil over the vines.

### Table 1. Influence of Cropping Sequence on Occurrence of White Mold and Yield of Peanuts

<table>
<thead>
<tr>
<th>Sequence</th>
<th>1991</th>
<th></th>
<th>1992</th>
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<th>1993</th>
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<tbody>
<tr>
<td></td>
<td>Hits</td>
<td>Yield</td>
<td>Hits</td>
<td>Yield</td>
<td>Hits</td>
<td>Yield</td>
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<tr>
<td>Peanut after bahia</td>
<td>0.3</td>
<td>3859</td>
<td>0.8</td>
<td>3932</td>
<td>0</td>
<td>2714</td>
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<tr>
<td>Peanut every 3 yr.</td>
<td>5.5</td>
<td>3692</td>
<td>4.6</td>
<td>4035</td>
<td>379</td>
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<tr>
<td>Peanut every 2 yr.</td>
<td>14.5</td>
<td>3608</td>
<td>15.0</td>
<td>3645</td>
<td>11.2</td>
<td>2481</td>
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<tr>
<td>Continuous peanuts</td>
<td>5.8</td>
<td>3222</td>
<td>11.9</td>
<td>3229</td>
<td>10.8</td>
<td>2350</td>
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*Number in table indicates average number of hits per 100 feet of row. One hit equals 1 foot of row with one or more diseased plants.
Planting disease-resistant cultivars can also reduce the incidence of white mold in peanut (see table 2). Currently, 'Georgia-02C', 'Georgia-07W', and 'Tifguard' have partial resistance to white mold as well as to several other damaging diseases. Generally, these cultivars, which usually suffer about 50 percent less white mold damage and yield higher than 'Georgia-06G,' are good choices for disease-prone fields.

Fungicides such as Abound, 2SC, Artisan, Convoy SC, Headline, Provost, Quash, and Moncut usually give 75 percent control of white mold and are also effective in controlling limb rot. In Alabama peanut fields, yield gains of up to 2,500 pounds per acre have been obtained with fungicides in white-mold-prone fields. Normally, yield increases following treatment with one of the above fungicides is usually in the range of 700 to 1,000 pounds per acre.

Fungicide use is recommended in fields where white mold has consistently damaged previous peanut crops or where cropping patterns favor disease. When possible, consult scouting reports and other farm records for each field for information concerning white mold damage in previous peanut crops. If records are not available, treat fields that have been cropped to peanut every year or every other year. Also apply a fungicide for white mold in those fields where peanut follows 2 years of cotton or corn and where disease-related yield losses in the previous peanut crop were severe. Yield gains from white mold fungicides usually will not be seen in peanuts planted behind 3 or more years of grass pasture.

For effective control and maximum yield response, apply white mold fungicides before symptoms are seen. Most years, white mold does not appear in peanut before the second or third week of July. Application scheduling, rate, and number for each white mold fungicide is unique, so refer to the fungicide label for this information as well as for instructions concerning surfactant use, tank-mix combinations, and recrop restrictions. Rainfall patterns have a significant impact on fungicide effectiveness. To ensure effective disease control, particularly on dryland peanuts, apply the recommended rate at the interval specified on the label. In addition, better white mold control can be obtained with most fungicides when applications are made just before and after dawn when compared with mid-afternoon applications of the same product. Fungicide recommendations for peanut are revised annually and are listed in Extension publication IPM-0360, “IPM for Peanuts,” and Extension publication ANR-0500-A Alabama Pest Management Handbook, Volume 1.

Resistance management has become critical to extending the life of the triazole fungicides propiconazole (Tilt 3.6E, Bumper 3.6F, and Propimax) and tebuconazole (various generic products) on peanut. Both fungicides have the same mode of action in fungal cells. Control failures due to tolerance or resistance are much more likely to occur particularly in leaf spot fungi for fungicides that act at a single site than for those such as chlorothalonil (Bravo Weather Stik 6F and Echo 720) that poison cells at multiple sites. Similar issues with resistance management may also arise with the repeated use of strobilurin fungicides such as Abound SC and Headline.

A catastrophic control failure of triazole fungicide, such as the sudden resistance of leaf spot fungi to Benlate in the mid-70s, has not occurred. However, overuse of either or both triazole fungicides has resulted in the slow erosion in the control of early and late leaf spot due to a loss of sensitivity in the target population.

Growers must avoid the overuse of triazole and strobilurin fungicides for the control of both foliar and soilborne diseases on peanut. Limiting the number of applications and/or including chlorothalonil as a tank-mix partner should reduce the risk of selecting for triazole- or strobilurin-insensitive fungal strains. Also, the risk of a control failure can be further limited by applying triazole fungicides at the rate and spray interval specified on the label.

Limb Rot

Limb rot, caused by Rhiogtonia solani, is recognized across the Southeast as a common and sometimes damaging disease of peanut. Although irrigated peanuts are usually considered more susceptible to this disease, sizable limb-rot-related yield losses have been seen in dryland peanuts. Overwatering, frequent heavy showers, dense vine growth, overfertilization, and tractor traffic often increase the severity of this disease in peanuts. Limb rot may be equally damaging regardless of whether the preceding crop was peanuts or bahiagrass pasture. Studies in Georgia indicate that for each 10 percent of limb area damaged, yields may be reduced 7 percent.

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<td>2803</td>
<td>7.3</td>
<td>3185</td>
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<tr>
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<tr>
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<td>3057</td>
<td>4.8</td>
<td>3651</td>
<td>2.5</td>
<td>4081</td>
</tr>
</tbody>
</table>

*Number indicates average number of hits per 100 feet of row.
One hit equals 1 foot of row with one or more diseased plants.
**Symptoms**

The limb rot fungus usually attacks peanut vines lying on the soil’s surface during hot, humid summer weather. A dense canopy of leaves and vines creates an environment that favors rapid and continued growth of this fungus. Vines crushed by tractor tires are especially susceptible to attack. Circular to oval, brown, sunken spots with a distinct zonate or “target-spot” pattern develop on the underside of the vines (see figure 5). As these spots elongate, the damaged vines may be girdled, and the foliage dies.

Under ideal conditions for disease development, many of the vines are killed and the pods on those limbs lost (see figure 6). At times, the fungus may also grow up into the peanut canopy and blight the leaves. Lesions on the leaves are light to dark brown with a distinct zonate pattern. The roots, pegs, and pods, independent of limb rot, may also be colonized by *R. soltani*. Damage on mature pods usually is characterized by one or more dry, brown, circular to irregular spots (see figure 7). Seed found in these damaged pods is often discolored and shriveled. The reddish brown hyphae of this fungus often can be seen with a hand lens on the surface of the spots on damaged pods and vine.

**Control**

Nitrogen carryover from the previous crop may be partially responsible for the excessive vine growth often associated with severe limb rot outbreaks on peanut. To minimize nitrogen carryover, fertilize corn or cotton according to soil-test recommendations. Also, limb and pod rot may be tied to a deficiency of calcium or an imbalance between several minerals. Applying high calcium lime or gypsum, particularly on Virginia-type peanuts, should help suppress limb and pod rot.

Peanut cultivars that have dense vines are most sensitive to limb rot.

**Irrigate** peanuts as needed. Several expert systems that are specifically designed to improve irrigation efficiency may also help reduce the risk of limb rot outbreaks in peanut.

Damage caused by tractors and other spray equipment running over the vines is closely tied with severe limb rot outbreaks in peanut. When the vines begin to lap, apply leaf spot and white mold fungicides, labels permitting, by air or through the line, using a center-pivot or side-roll irrigation system. Other management practices such as crop rotation and deep plowing have not given much control of limb rot.

**Chemical control** is now a viable option for controlling limb rot in peanut. The fungicides currently recommended for the control of white mold will also provide good protection from limb rot. Control of limb rot alone should result in yield gains of 300 to 500 pounds per acre. Fungicides are recommended only in those fields with a history of damaging limb rot outbreaks or those with rank vines. Fungicide recommendations for limb rot control in peanut are revised annually and are listed in Extension publication IPM-0360, “IPM for Peanuts,” and Extension publication ANR-0500-A, *Alabama Pest Management Handbook, Volume 1*.

**Cylindrocladium Black Root Rot**

**Cylindrocladium** black rot or CBR, which is caused by the fungus *Cylindrocladium crotalariae*, occurs sporadically on peanuts in Alabama. This disease is most likely to occur in Alabama where Virginia-type peanuts have previously been grown. High soil moisture levels and reduced soil temperatures for extended time periods favor disease development. In contrast, extended periods of dry and hot weather will suppress CBR. Nematode-damaged peanuts are often more susceptible to CBR.

**Symptoms**

From a distance, CBR symptoms can easily be confused with white mold or peanut root-knot. Yellowing of the foliage, a marginal leaf burn, and wilting of the main stem are usually the first symptoms of CBR (see figure 8). As is the case with nematode-damaged peanuts, diseased plants are usually found in one or more clusters, which may range in size from a foot to several acres. The roots and pods attacked by the CBR fungus turn dark brown to black. Shredding or disintegration of the taproot just below the soil line is a diagnostic symptom for CBR on peanut (see figure 9).

Clusters of brick red fruiting bodies of the causal fungus, *C. crotalariae*, often appear on rotted tissues along the main stem, taproot, pegs, or pods (see figure 10). These fruiting bodies are diagnostic signs of CBR and are usually found at or just below the soil line after periods of mild, wet weather just before harvest.

**Control**

At-plant in-furrow applications of selected fungicides coupled with a series of midseason soil fungicide treatment programs can give a high level of CBR control in peanut. Vapam soil fumigant, which is registered for the suppression of CBR, is widely used in Virginia and North Carolina but is not a viable treatment for Alabama peanut producers.

Rotating peanut with nonhost crops of the CBR fungus, such as corn, grain sorghum, cotton, or permanent pasture, may reduce CBR-related yield losses. In fields where severe losses have occurred, rotating to bahiagrass or coastal bermudagrass for at least 5 years may be required before peanut may again be planted.
Cultivar selection may influence the severity of CBR. Several runner- and Virginia-type peanut cultivars are partially resistant to this disease. The combination of resistant cultivars along with soil fungicide program should prevent significant yield loss due to CBR. Fungicide recommendations for CBR control in peanut are revised annually and are listed in Extension publication IPM-0360, “IPM for Peanuts,” and Extension publication ANR-0500-A, *Alabama Pest Management Handbook, Volume 1*.

**Figure 5.** Zonate or target-spot lesions are usually seen where the underside of the peanut vine touches the ground.

**Figure 6.** Typical limb rot damage on peanut. Note the good taproot crop and absence of a limb crop.

**Figure 7.** Pod rot caused by *R. solani* on a Virginia-type peanut.

**Figure 8.** A cluster of CBR-damaged peanuts.

**Figure 9.** The roots and pods attacked by the CBR fungus typically turn dark brown to black.

**Figure 10.** The brick red fruiting bodies of the CBR fungus on the pegs and pods of peanuts.

Austin Hagan, *Extension Plant Pathologist*, Professor, Entomology and Plant Pathology, Auburn University

Use pesticides only according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label.

The pesticide rates in this publication are recommended only if they are registered with the Environmental Protection Agency and the Alabama Department of Agriculture and Industries. If a registration is changed or canceled, the rate listed here is no longer recommended. Before you apply any pesticide, check with your county Extension agent for the latest information.

Trade names are used only to give specific information. The Alabama Cooperative Extension System does not endorse or guarantee any product and does not recommend one product instead of another that might be similar.

For more information, call your county Extension office. Look in your telephone directory under your county’s name to find the number.

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