Wise management of diseases is an essential part of profitable peanut production. Long rotations, use of resistant cultivars, early disease detection, weather-based disease prediction, scouting, and proper pesticide selection comprise the basic elements of a disease management strategy.

The best way to manage plant diseases is to avoid them by using long rotations. Reductions in peanut acreage in North Carolina have given the opportunity to grow rotational crops that do not host peanut pathogens (organisms that cause disease). Fields with a history of disease should be planted with cultivars resistant to those diseases.

Early detection is critical in developing effective and low cost approaches to disease management. Accurate identification of diseases is critical for selection of the most appropriate management tactics and thorough scouting is necessary for the most effective use of crop protection products. Information to help identify disease problems can be found at:

http://www.ces.ncsu.edu/depts/pp/notes/Peanut/peanut_contents.html

Contact your county agent for help with disease diagnosis or to submit samples to the North Carolina State University Plant Disease and Insect Clinic.

In most cases, fungicides must be applied soon after diseases appear if they are to be effective. Anticipate disease outbreaks by using weather-based predictive models, which will minimize unnecessary pesticide use and add precision to those applications that are necessary. For many diseases (CBR, Sclerotinia blight, pod rot, nematodes), management decisions must be made before the next crop of peanuts is planted. Prepare maps showing where these diseases were located in the current crop. These maps will serve as guides for future rotations and use of resistant cultivars.

Cultural and chemical controls are usually used in combination for maximum benefit. Cultural control methods, such as rotation and resistant cultivars, generally reduce the number of pathogens. Pesticides are only useful when cultural practices have not sufficiently reduced pathogen levels below economic thresholds.

This chapter covers disease identification and management. Important tables list best rotational crops (Table 6-1), disease resistant cultivars (Table 6-2), effect of tillage practices (Table 6-3), a comparison of CBR and Tomato Spotted Wilt Virus (TSWV) symptoms (Table 6-4), and chemical controls for peanut diseases (Table 6-5). A disease management calendar (Table 6-6) organizes disease management issues to be considered from the start to the end of the season. Table 6-7 describes characteristics of fungicides
used to control peanut leaf spots. The following information describes each major disease of peanut, its cause, and management considerations unique to each disease.

**Foliar Diseases**

**Peanut leaf spot** is caused by two different fungi: *Cercospora arachidicola* (early leaf spot pathogen) and *Cercosporidium personatum* (late leaf spot pathogen). There are other important leaf diseases that cause spots, but are not referred to as "leaf spot" (see other diseases listed below). It is often difficult to distinguish between early and late leaf spot, particularly since symptoms depend on the cultivars grown and the fact that lesions can change in appearance as the season progresses. Early leaf spot usually causes brown lesions that are generally surrounded by a yellow halo. Early leaf spot can be found as early as June 1. Late leaf spot causes darker spots, usually without a halo, that appear later in the season. The best way to tell these two diseases apart is by using a good magnifying glass to see where spores are being produced. Spots of early leaf spot produce spores on the top of the leaf. The spores have a slivery, hair like appearance. Spots of late leaf spot produce spores most frequently on the underside of the leaf. These spores are dark brown and have a velvety appearance. It is important to determine if late leaf spot becomes predominant since some fungicides are not very effective against this disease.

Because the leaf spot fungi attack only peanuts, rotations (Table 6-1) with any other crop help to reduce disease. Peanut cultivars vary in their resistance to disease (Table 6-2) and highly susceptible cultivars should be avoided. Conservation tillage appears to reduce leaf spot slightly (Table 6-3).

In addition to cultural practices, fungicide application usually is required for leaf spot control (Table 6-5). Fungicides can be applied in one of two ways: 1) a set calendar 14-day schedule, or 2) a weather-based leaf spot advisory schedule. The advisory is a safe method of minimizing the unnecessary use of fungicides by spraying only when weather conditions favorable for disease have occurred. Eliminating unnecessary fungicide sprays also helps to prevent spider mite flare-ups (Chapter 5). For more information on weather-based advisories, contact your county agent.

**Fungicide resistance management**

Recently, several new fungicides have been registered for use on peanut. These fungicides tend to be highly effective at low rates and, when used properly, will be important disease management tools for many years to come. Unlike many older fungicides, however, some of the newer compounds have very specific modes of action. This specificity makes it likely that unless certain precautions are taken, fungicide resistant strains of the target pathogen may build up to damaging levels with continued fungicide use, resulting in a loss of efficacy. To reduce the likelihood of developing fungicide resistant populations, the following strategies should be used: mix or alternate sprays of fungicides with different modes of action; use fungicides at the recommended rates; do not exceed the total number of recommended sprays; and use broad spectrum
fungicides for the first and last spray of the season. Since pathogens resistant to a particular fungicide usually will be resistant to all fungicides with similar modes of action, it is important use fungicides with different modes of action as partners when mixing or alternating sprays. Table 6-7 provides a summary of suitable fungicides for mixing or alternating. Fungicide labels also provide resistance management information and recommendations.

**Web blotch** (caused by the fungus *Phoma arachidicola*) is a sporadic problem that has been very serious in the past few growing seasons. A large (1/2 inch), circular, dark area forms on the upper surface of the leaf, which can dry and crack as it ages. Severe defoliation often occurs in portions of a field, but can spread over the entire field in a short time. Web blotch is controlled by leaf spot fungicides. If using an advisory schedule, you may need to switch to more frequent sprays if web blotch is present.

Use long rotations (Table 6-1) with any crop other than peanut, and cultivars with resistance to this disease (Table 6-2). Avoid highly susceptible cultivars. Fungicides (Table 6-5) such as chlorothalonil (various formulations), tebuconazole (Folicur), propiconazole + chlorothalonil (various formulations), propiconazole + trifloxystrolin (Stratego), and azoxystrobin (Abound) control early and late leaf spot and web blotch. Frequent applications of chlorothalonil are the most effective means of controlling this disease.

**Pepper spot** (cause by the fungus *Leptosphaerulina crassiasca*) is present every year in all fields as very small dark lesions that "pepper" a leaf. Occasionally, lesions will kill large areas, resulting in a scorch symptom. Pepper spot has been associated with severe vine decline, which sometimes occurs after a heavy late-season rain. Control is the same as for leaf spot.

**Botrytis blight** (caused by the fungus *Botrytis cinerea*) is most commonly seen at the end of the season when conditions are moist. Symptoms appear first on vines or leaves that have been injured (i.e. by tractor tires or freezing temperatures). Massive numbers of gray to brown spores can be produced on leaves and stems and black sclerotia can be found on the pods of peanuts. While this disease does not usually cause serious losses, it can be alarming. Symptoms are sometimes seen on the leaves without occurring on any other part of the plant. Numerous lesions can appear on the top of the leaf. Spots are about the same size as early leaf spot lesions, but they are irregular in shape, light tan in color, and have no obvious spores. Harvesting in a timely fashion and avoiding plant injury will reduce symptom incidence and severity.

**Phytotoxicity** (chemical toxicity) caused by systemic insecticides applied at planting is often confused with leaf spot. These symptoms will usually be around the margins of the leaflets on the lower most leaves. In general, spots found before mid-June are caused by phytotoxicity. Herbicide toxicity can also cause leaf spots by burning areas associated with the spray droplets. Symptoms associated with phytotoxicity will not spread or form spores. Learn to identify symptoms associated with chemical damage to keep from
mistaking symptoms for a contagious problem such as leaf spot. Avoid practices that lead to plant injury (see Chapter 4).

**Tomato spotted wilt virus** (TSWV) is found in all peanut counties in North Carolina. Spread is accomplished through feeding of thrips, which obtain the virus by feeding on infected weed or crop hosts. Symptoms vary but usually include one or more of the following: stunting, dead terminal buds, pale yellow or white ring patterns on leaves; purple blotches on the underside of leaves; stunted, small, and malformed growth; undersized pods; and red seed coats. On some occasions, the whole plant may turn light green, resembling CBR disease. CBR and TSWV symptoms are compared in Table 6-4. Diagnosis can be confirmed by having your county agent submit a sample to the North Carolina State University Plant Disease and Insect Clinic.

Use preventative measures to reduce the risk of TSWV. Severity can be reduced by avoiding susceptible cultivars (Table 6-2). Since low plant stands (less than 4 plants per foot of row) tend to be more severely affected by this disease, it is critical to plant quality seed under conditions that favor fast and uniform emergence. In a like manner, twin rows have less spotted wilt than single row planting patterns: thick plantings and twin rows tend to have less disease. Minimum tillage appears to reduce the incidence of TSWV (Table 6-3). In-furrow use of phorate (Thimet) may reduce disease incidence more than aldicarb (Temik), but phorate will not control any nematode problems that may be present. TSWV is most severe when no in-furrow insecticide is used. Planting date also can influence severity of TSWV, with mid-season planting appearing optimal for disease suppression. Since populations of thrips carrying the virus can live on many cultivated and wild plant species, rotation is not very effective in managing TSWV. Use the Tomato Spotted Wilt Risk Index (Chapter 5) to assess how choice of cultivars and the cultural practices discussed above affect the overall risk of tomato spotted wilt in a given field.

Thus far, research conducted on seed transmission has shown no evidence that this occurs. Occasionally, TSWV appears to be worse where certain batches of seeds have been planted. This most likely is caused by different rates of emergence rather than seed transmission. The potential for TSWV and other peanut viruses to be seed transmitted is currently under investigation.

**Diseases Caused by Soil-borne Pathogens**

Initially, soil-borne nematodes and fungi attack parts of the plant that grow in or near the soil. As disease progresses, the entire plant may show symptoms or die. While most soil-borne pathogens can survive for years in the soil, their numbers decrease when there are no plants to infect. Using at least a 3 year rotation to non-host crops prevents the build-up of disease problems; however, once heavy infestations occur, very long rotations may be necessary before numbers of pathogens are reduced enough to result in little or no plant disease. Since soil borne pathogens have limited mobility, mapping the location and intensity of the diseases they cause is a useful tool for deciding where certain cultural practices and/or chemical treatments will be applied next time peanuts are grown. At the same time, it is important to avoid introducing soil borne pathogens into uninfested areas.
Use high quality seed and wash equipment frequently. Loose soil and debris should be cleaned from combines used to harvest heavily infested fields.

**Nematodes** attacking peanuts include the Northern root knot (*Meloidogyne hapla*), peanut root knot (*Meloidogyne arenaria*), lesion (*Pratylenchus brachyurus*), ring (*Criconemella ornata*), and sting (*Belonolaimus longicaudatus*) nematodes.

Nematodes cause stunting, wilting, and yellowing of above-ground portions of the plant. Depending on the nematode species, root systems may be stunted and pods and roots may have small lesions. Root knot nematodes cause galling on roots, pegs, and pods. The Northern root knot nematode (*Meloidogyne hapla*) is the species most commonly found in North Carolina. The galls caused by this nematode are similar in size to root nodules. These galls appear as irregular thickenings in the the root and can be distinguished from nodules, which are round and found attached to the sides of the root. The root system may have a bushy appearance and pods may have small round lesions about the size of the head of a pin. The peanut root knot nematode (*Meloidogyne arenaria*) causes large swellings or galls on roots, pegs, and pods. Checking pods or roots for galls after digging may indicate where root knot problems are found. Nematode damage can increase susceptibility to black root rot (CBR). Fields to be planted to peanuts should be sampled for nematode populations in the previous fall (September through November). Twenty probes (1 inch in diameter to an 8-inch depth in the row) should be taken for each sample, with one sample to each 4 or 5 acres. Samples will be more representative of the field if the soil is mixed by disking before samples are collected.

Samples should be taken in a zigzag pattern across the field. Divide fields requiring more than one sample according to the row direction so only infested areas receive nematicide treatment. To prevent decomposition, nematode samples should remain cool (50-60 degrees) and be given to the county Extension agent or sent to the North Carolina Department of Agriculture Nematode Advisory Service as soon as possible after collection. See the NCDA & CS web site for further information:

[http://www.ncagr.com/agronomi/nemhome.htm](http://www.ncagr.com/agronomi/nemhome.htm)

Fields that are below threshold levels (A category) need no control procedures. Fields that are B category are borderline cases; treatment may give a return on control investment, but probably will not. C category fields are above threshold levels and should receive an appropriate control.

Nematodes are often found in spots or small areas of fields. For the best use of nematicide dollars, treat for nematodes on a field-by-field or part of a field basis rather than treating the entire crop. Apply nematicides only according to label directions for injection, banding, and/or incorporation. Fumigating with metam sodium for CBR control or applying aldicarb (Temik) in the furrow at planting for foliar insect control may help reduce nematode populations, but these practices do not replace banded or injected nematicide treatments when C category nematodes are found. Never leave granular
nematicides/insecticides on the soil surface. Always incorporate, particularly at the row ends, to avoid bird kills.

Planting crops that do not support the growth and reproduction of nematodes reduces their numbers (Table 6-1). Long rotations are the most effective method of controlling nematodes and can be used instead of nematicides. Conservation tillage appears to reduce nematode numbers slightly (Table 6-3).

**Seed and seedling rots** can be caused by many fungi. Seeds either will not germinate (seed rot), germinate but not emerge from the soil (pre-emergence damping off), or die shortly after emergence (post-emergence damping off). The result is a poor stand with skips, which can lead to more TSWV. Rots often develop after seeds and seedlings are weakened or killed by environmental problems (poor seedbed conditions) or due to poor seed quality.

Plant in warm soil (65 degrees at a 4-inch depth for 3 consecutive days), since cold soils retard germination and increase the chance for rots. Bedding generally aids soil warming and drainage. Poor drainage can cause water logging, a major factor in seed and seedling rots. Seed and seedling diseases can usually be prevented by using high-quality seed coated with a good chemical seed treatment fungicide.

**Aspergillus crown rot** (caused by *Aspergillus niger*) causes pre- and post-emergence damping off and at times may kill older plants. Seedlings with crown rot infections rapidly collapse and die. Dark brown discoloration is common on decayed roots and hypocotyls. Later, these areas often are covered with masses of black spores. Aspergillus crown rot generally is of minor importance in well rotated fields and rotation is an effective control for this disease. Seed treatments also inhibit crown rot development. Azoxystrobin (Abound) can be applied preventatively at planting if crown rot is a concern.

**Southern stem rot** or white mold (caused by *Sclerotium rolfsii*) is found in all peanut counties of North Carolina. Symptoms include wilting of individual stems, brown stem lesions, shredded stems and pegs, and plant death. Southern stem rot is characterized by white, stringy fungus growth and tan to brown birdshot-sized balls (sclerotia) on the lower stems and leaf litter. These sclerotia distinguish southern stem rot from other diseases caused by soil-borne pathogens, but underground damage can occur with few signs of the fungus being visible above ground. Fields with heavy vine growth and excess moisture are most prone to stem rot. This disease is most active during the hottest part of the season, especially following rain. Irrigated fields are most severely attacked. In drier seasons, the fungus may be most active underground and damage may not be apparent until digging. Southern stem rot often is found along with CBR.

*Sclerotium rolfsii* has an extremely broad host range, but does not attack small grains, corn, and other grass species (Table 6-1). Rotations with tobacco and vegetables should be avoided. Although most cultivars are susceptible to this disease, NC 10C is
moderately resistant (Table 6-2). Contrary to popular belief, conservation tillage may actually reduce disease incidence (Table 6-3).

Some of the fungicides used to control leaf spots, such as azoxystrobin (Abound), tebuconazole (Folicur), and propiconazole + flutolanil (Artisan), also control stem rot (Table 6-5). Flutolanil (Moncut) will control stem rot, but not leaf spots. Most soil fungicides work best when applied just prior to disease onset. Treat fields with a history of problems according to the leaf spot advisory between July 15 and the end of August.

**Rhizoctonia limb and pod rot** (caused by *Rhizoctonia spp.*) is sometimes confused with southern stem rot. While both affect the stems, Rhizoctonia limb rot does not produce white stringy growth or tan sclerotia. Lesions are usually found on the bottom (touching the soil) of stems. Dead areas have a purple border around the diseased area and may have a target-like appearance. Rhizoctonia pod rot is the most destructive phase of the disease. Rhizoctonia limb and pod rot is most common in moist fields or where vines growth is thick. Irrigated fields are most severely attacked. Management practices and fungicides are the same as for southern stem rot (see above).

**Sclerotinia blight** (caused by *Sclerotinia minor*) is found throughout North Carolina, but is most severe in the most northerly counties. This disease starts by killing individual limbs rather than causing an overall wilt. Careful scouting is required to see this disease when symptoms first appear. Vines must be pulled back to expose lower stems and early infection. The end portion of infected limbs will remain green and look healthy for some time. Only after the disease has been present for many days will limbs be visibly wilted. Sclerotinia blight exhibits cottony mold growth (seen on humid mornings) on straw-colored stems. Small black sclerotia (irregular in shape) can be seen both on and in infected tissues.

To prevent build-up of damaging levels of Sclerotinia blight, rotate as long as possible with cotton or corn (Table 6-1). A number of winter annual weeds have been shown to be hosts of *Sclerotinia minor*, the fungus that causes Sclerotinia blight. Once infected, they allow reproduction of the fungus, potentially resulting in more disease on peanut. Weed hosts include yellow nutsedge, henbit, small flowered bittercress, common chickweed, mouse-ear chickweed, swinecress, cutleaf evening primrose, horseweed, wild mustard, and mouse-ear cress. Fields with a history of Sclerotinia blight should be kept clean of these weeds.

Avoid vine injury by cultivating early (before June 15) or not at all, using small tires, and spraying for leaf spot on the advisory program to minimize trips across the field. Frequent application of the leaf spot fungicide chlorothalonil (various brands) can make this disease more difficult to control. Several cultivars have some resistance (Table 6-2) and susceptible cultivars should be avoided. Conservation tillage may be somewhat beneficial at low levels of disease, but not at higher levels (Table 6-3). Fields planted early (by May 1) tend to have less Sclerotinia blight. This also allows earlier harvest, which minimizes late-season damage.
Fluazinam (Omega) is effective against Sclerotinia blight when applied preventatively (Table 6-5). Fields with a history of serious problems should be treated when vines are close to touching and Sclerotinia blight is first observed, or according to the weather-based Sclerotinia blight advisory. First spray applications are usually made after mid-July and sometimes as late as September. Apply more fungicide if the disease is continuing to spread 3 to 4 weeks after the last application.

**CBR** (Cylindrocladium black rot or black root rot, caused by *Cylindrocladium parasiticum*) is found in all peanut counties in North Carolina. Whole plants become light green, wilt, and die, although some limbs may die before others. A blackened, rotting root system is characteristic of this disease. Numerous brick red fungus structures (as large as the head of a pin) may be found on dead tissue near the ground following moist weather. CBR can be confused with tomato spotted wilt virus (TSWV) late in the season when both cause root rots (Table 6-4). Typically, plants infected with CBR can be pulled up or broken off easily due to extensive rotting of the root system.

Long rotations help to reduce the amount of fungus in the soil (Table 6-1). Non-hosts, such as cotton, corn, sorghum, and small grains, are excellent rotations and will help reduce Cylindrocladium populations in the soil. Peanut following peanut or soybean is a formula for disaster and will quickly lead to heavy infestations once disease gets started. An important key in CBR management is the use of resistant cultivars (Table 6-2). Tillage practices don’t significantly affect CBR (Table 6-3) except that small grain mulches appear to reduce disease. Also, no-till appears to reduce the soil-borne inoculum of this disease that could ultimately lead to less disease. CBR can be seed transmitted; however, new procedures being used by the seed industry should reduce this already low transmission rate to an insignificant level.

Fields with a history of CBR should be planted on a bed around mid-May to maximize soil warmth. CBR infects during cool, wet periods in the spring and in the fall. Fall infections cause less damage than spring infections. Symptoms seen in mid-summer are usually the result of spring infections.

If CBR has been identified in a field, submit a nematode sample the fall before peanuts are to be planted. Root knot nematode makes the disease worse on all peanuts. Ring nematode affects all but resistant cultivars in the same way. It is not clear what effect the other nematodes may have. Use the nematode assay information to aid in determining which chemical treatment is most suitable.

Soil fumigation with metam sodium (Table 6-5) and planting a resistant cultivar usually controls CBR. Both fumigation and a resistant cultivar are needed when peanut fields have a history of 10 percent or more disease incidence in prior peanut crops. Fields with a history of 1 to 10 percent disease should be planted to a resistant cultivar. Fumigants must be injected 12 inches deep (below the top of the bed) at least 2 weeks prior to planting to prevent damage to young peanut plants. If cool and/or wet conditions are prevalent following fumigation, growers may want to use a lettuce seed bioassay to assure that it is safe to plant. Incorporation of herbicides prior to bedding and injecting
gives adequate weed control. Some fungicides applied in furrow or to foliage may suppress CBR. Check the label for details.

**CBR Seed Transmission**

Another concern associated with the spread of CBR is seed transmission. To develop a better understanding of the significance of seed transmission of CBR, it is first important to emphasize that under most circumstances, there is little or no seed transmission. That is true if: 1) the seed are produced in clean fields, 2) infested seed are sorted out at the shelling plant, 3) the fungus dies during drying, storage, or following seed treatment, or 4) disease is not transmitted due to unfavorable field conditions.

Seed transmission of CBR has become an issue because at times it does occur. A survey of 62 commercial seed lots sampled after conditioning, but before the application of seed treatment, showed that an average of 1.3 percent (range of 0 to 5.6 percent) of the seed had evidence that *Cylindrocladium parasiticum* was present (i.e. cinnamon colored speckles about the size of a pencil dot). The speckles are the resting structures (sclerotia) of the fungus. Speckled seed were found in at least one subsample of every seed lot. While all speckled seed had living *C. parasiticum* at harvest, by planting time only 4 to 45 percent of speckled seed had living fungus. This means that most sclerotia had died during the winter storage. When the fungus remains alive, these seed can serve as a source of infection to plants emerging from the speckled seed and nearby uninfected plants.

To avoid seed transmission of peanut diseases, peanuts produced for seed should be grown in fields with little or no CBR or Sclerotinia blight (which is also suspected of being seed transmitted). Fields should be on long rotations, fumigated prior to planting, and scouted late in the season to identify these diseases. Portions of fields heavily infested with either of these diseases should be harvested separately and used as edible peanuts.

**Methods to Reduce/Eliminate CBR in seed**

North Carolina Crop Improvement Association supports the following recommendations that will reduce/eliminate seed transmission of *Cylindrocladium parasiticum* (CBR).

Plants grown in soils infested with the fungus that causes CBR can produce seed colonized with this fungus. Seed have visible fungus on the seed coat seen as cinnamon colored speckles. Planting speckled seed can result in infesting soils with the CBR fungus.

Recommendations for Certified Seed Production:

- Maintain accurate records of field history and maps of CBR incidence.
- Adopt a minimum of 3-year rotations of peanut with non-hosts of *Cylindrocladium parasiticum* (cotton, corn, etc.).
- Select fields with low levels of CBR.
- Fumigate fields with metam after soil temperatures are greater than 65° F at 4 in. depth as reported by weather stations, www.ipm.vt.edu/infonet/, or by contacting your Cooperative Extension center.

- Consult weather forecasts (www.wunderground.com or www.weather.com) and delay fumigation when heavy rainfall saturates soil or cold weather is likely to reduce soil temperature below 65° F.

- Inspect fields at the end of the season.

- Selectively harvest infested fields to avoid heavily infested areas.

- Avoid harvesting seed peanuts where disease exceeds 5 percent disease incidence.

**Determining Percent Disease.** In most cases, CBR will be clearly above or below the threshold. General observations made across the field will be sufficient. When in doubt, divide the field into one acre blocks, select the worst block, and determine the percent disease by stepping off three 100-foot sections of row, and counting the number of feet within each that were diseased. Five feet of diseased row out of 100 is 5 percent disease. Average the percentages from the three samples. In this manner, you can determine which acres should not be harvested for seed. Field scouts should be careful not to confuse symptoms of CBR with Tomato Spotted Wilt Virus late in the season (see http://www.ces.ncsu.edu/depts/pp/notes/Peanut/gallery/index.html).

**Pod rot** can be difficult to control because the causes are so diverse. Symptoms include spotting, darkening, and/or rotting of the pods. Rhizoctonia pod rot causes distinct brown spots on the pod and dark brown fungal growth can be seen on the seed or the inner pod surface. Pod rot caused by *Pythium spp* can turn the entire pod black and soft in severe cases. In addition, pod rot can be caused by all of the soil-borne pathogens listed above. Brown, shredded pods and pegs are typical of southern stem rot. Pod rot caused by CBR and Sclerotinia blight generally is found in association with other symptoms and the brick red (CBR) or black (Sclerotinia) fungal structures described above. Some pod rot symptoms can be the result of poor calcium nutrition or excessive magnesium or potash levels, which weaken the hull and allow various soil fungi to grow into and rot the pod. Plants grown in soils with proper fertility can also have severe pod rot if pathogen numbers are present in high numbers or insect damage is severe. High pathogen numbers are usually the result of very short rotations or poor choice of rotational or cover crops.

Long rotations with cotton or corn usually have the very positive effect of reducing the numbers of pod rotting organisms in soil (Table 6-1). However, rye is a host of *Pythium* and should be avoided as a rotation or cover crop. Addition of landplaster has also been shown to reduce the likelihood of some pod rots.

All diseases caused by soil-borne pathogens (i.e., stem rot, Rhizoctonia, Sclerotinia, CBR, etc.) can also have a pod rot phase. Therefore, management of soil borne pathogens is also beneficial in reducing pod rot. The most economical plan for pod rot control is to rotate as long as possible and use a fungicide if necessary. The fungicides tebuconazole (Folicur), flutolanil alone (Moncut) or as a component ingredient (Artisan), and azoxystrobin (Abound) reduce damage caused by the pod rot phases of southern stem rot.
and Rhizoctonia limb rot. Mefanoxam plus PCNB (Ridomil PC) has broad spectrum activity against *Pythium* species (Table 6-5).

**General information**

**Zinc toxicity**

Chicken litter has the potential to add toxic levels of zinc to peanut soils and may also make Tomato Spotted Wilt Virus (TSWV) worse. Although zinc toxicity and TSWV appear to be unrelated issues, both problems may be worse after repeated use of chicken litter.

Peanuts are very susceptible to zinc toxicity. Typically, patches of poor growth are found in areas of peanut fields where tin-roofed sheds stood for years. This is due to the cumulative release of zinc from the tin. Since zinc is added to feed as a nutritional supplement for chickens, it is found in abundance in chicken litter. Once spread in soil, this non-mobile metal is toxic to peanuts. If zinc accumulates to toxic levels (i.e., index of 200 to 400), it is likely to damage peanuts for years to come. Stunting and characteristic split stems are indicators of this problem. Since zinc toxicity increases in acid soils, it is important to maintain soil pH in a range favorable for peanut production (See Chapter 3).

**Digging Dates**

Growers often use early digging as a disease management tool for Sclerotinia blight, southern stem rot, TSWV, and CBR. In general, early digging as a method of minimizing disease losses is a mistake. Healthy peanuts gain in weight and marketability more rapidly than diseased ones are lost. As a rule of thumb, harvesting early is a losing proposition until there is at least 50 percent disease. If more than 50 percent of the plants are diseased, early digging may be advisable. Most diseases caused by soil borne pathogens are not evenly distributed across the field. Therefore, if a grower decides to dig early it is advisable to dig the most diseased portion of a field early and the remainder at the "normal" harvest time. Clean equipment before moving it to healthy fields.

**Adjuvants.**

Adjuvants are sold as a means to enhance the effectiveness of a pesticide and many claims are made for them. Fungicides for peanut disease control do not normally need adjuvants and certain combinations of adjuvants and fungicides should not be used. Check the fungicide label before adding any adjuvant. Consumers can check out some of the claims by asking for the California registration number and label. Data on efficacy is available for products registered in California.