

# Tomato Spotted Wilt Virus on Peanuts

In the last decade, tomato spotted wilt virus (TSWV) has become widely distributed across Alabama on many field, vegetable, and floral crops. About 300 plant species, mainly broadleaves, are hosts of TSWV. In addition to peanut, other important crops grown in the Southeast that are susceptible to this virus include tomato, pepper, potato, cucurbits, lettuce, eggplant, and tobacco. Chrysanthemum, glloxinia, gladiolus, impatiens, and begonia are among the floral hosts of TSWV. So far, the only weed host of this virus found in Alabama peanut fields is Florida beggarweed.

TSWV is spread from plant to plant by seven thrips species, two of which are found in peanut in Alabama. Severe disease-related losses have occurred when early-season vegetable crops or tobacco are established prior to planting peanuts and in areas with an extended peanut planting season, like that found in south Texas.

## Distribution

TSWV was first found on peanut in the United States in 1971 in southern Texas, but the disease did not cause extensive damage until the 1984 growing season. Peanut growers in one Texas county suffered an estimated \$3-million income loss in 1986 due to TSWV.

This disease was first found in peanut in the Southeast in 1986. In that year, expected yields in Coahoma County, Mississippi, dropped from 2,500 to 500 pounds per acre because of a combination of TSWV and verticillium wilt. In Alabama and Florida, a few isolated peanut fields were significantly damaged that year by the virus. In Georgia, the occurrence of TSWV was confirmed in a single peanut

plant collected at the Coastal Plain Experiment Station.

Field surveys in Alabama and Florida in the late 80s showed that TSWV was common in most production fields but at levels so low that losses in grade and yield were minimal. By 1988, symptomatic plants were quite common in peanut in Alabama, Florida, and Georgia. However, the numbers of TSWV-infected plants in most fields remained extremely low.

In recent years, severe outbreaks of TSWV in peanuts have occurred in south-central Georgia. In some fields, an estimated 40 to nearly 100 percent of peanut plants were infected with the virus. Sharp increases in the incidence of TSWV have been seen in Alabama, particularly the southeastern-most counties. The virus has been particularly damaging in mid-April planted peanut. In 1997, TSWV reduced the value of Georgia's peanut crop by 5 percent.

TSWV is now well established throughout the southeastern peanut belt and has spread into North Carolina and Virginia. Recent epidemics in Texas, Mississippi, and Georgia show that the virus is a serious threat to peanut production in Alabama. Effective control measures for TSWV must be adopted in order to prevent serious losses in yield and grade.

## Symptoms

Initial symptoms may appear on TSWV-infected peanut as early as 21 days after the seedlings emerge. Earliest symptoms of the disease are brown speckles on the underside of the first leaf below one or more terminal buds along with chlorotic (yellow) ring-spotting and mottling on the upperside

of the leaf. This first symptomatic leaf may also be wilted or flaccid (Figures 1 and 2).

Brown, necrotic spots or streaks may also be seen on the leaf petiole and stem and at times on the terminal bud. These spots may develop into a shoot dieback which may ultimately kill the plant. Any new leaves are about half their normal size, crinkled, and display a range of symptoms including chlorosis, concentric chlorotic ring-spots, ring-spots with green centers, chlorotic line patterns, and general



Figure 1. The leaf below the terminal bud, showing typical yellowing and mottling, appears wilted while the rest of the plant looks healthy.



Figure 2. Brown to maroon speckles or streaks are usually seen on the lower surface of the leaves.

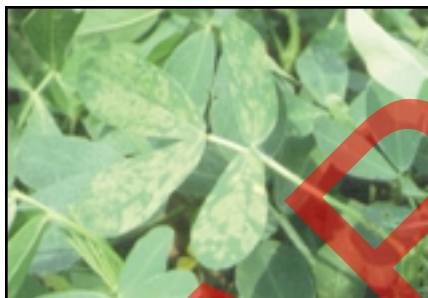
mottling (Figures 3, 4, 5, and 6). A downward twisting of leaf petioles and some terminals, a characteristic symptom of this disease, can also be seen at this stage.



**Figure 3.** Immature leaves on infected plants are crinkled, yellow to mottled, have an upright growth habit, and are less than half their normal size.



**Figure 4.** TSWV symptoms on mature leaves may appear as chlorotic leaf spots.



**Figure 5.** Mature leaves of infected plants may show numerous ring-spots with necrotic centers.



**Figure 6.** Elaborate line patterns may also appear on mature leaves.

Late-season TSWV infections on peanut are characterized by a decline in plant vigor, yellowing of the foliage, collapse of the vines, and often plant death (Figure 7). At times, faint ring-spot or line patterns may be seen on the youngest leaves. The root systems of these plants are often discolored and partially rotted. Late infections may have little impact on yield because the pods are not easily shed by the TSWV-infected peanuts.



**Figure 7.** A yellowing of the foliage, followed by a sudden collapse of the vines, may also be seen in late summer.

Stunting, which is most severe on plants infected by TSWV in the seedling stage, becomes less noticeable in the older peanuts that are infected. Severely stunted peanuts often have a bushy appearance due to the upright growth habit of the runners (Figure 8). Few pods are usually set on plants infected with TSWV at the seedling stage (Figure 9). Seed produced by



**Figure 8.** Stunting of the vines and upright growth habit associated with TSWV.



**Figure 9.** Comparison of pod set on healthy (left) and virus-infected (right) peanuts.

TSWV-infected plants are smaller than normal, have mottled red to brown seed coats that are often cracked (rather than the normal, healthy light pink coats), and show poor germination. TSWV infections occurring after pod set may have little effect on yield, but seed-coat mottling, though unusual, may still occur.

TSWV-infected peanuts first appear at random throughout a field. With time, clusters of diseased plants may be seen. The virus usually spreads within a field down the row from plants infected at the start of the growing season. Plants in 5 or more consecutive feet of row can show symptoms ranging from ring-spotting on only a few young leaves to severe stunting or plant death.

## Vector

Worldwide, seven species of thrips are known to be vectors of TSWV. Two of these thrips vectors occur in Alabama. The tobacco thrips *Frankiniella fusca* (Hinds), is by far the most abundant, according to surveys conducted from 1986 to 1989 (Table 1). The western flower thrips, *F. occidentalis* (Pergande), which was only recently found on peanuts in Alabama, is an efficient vector of TSWV in vegetable and ornamental crops. The western flower thrips is only a minor component of the total thrips population on peanuts (Table 1). The flower thrips *F. tritici* (Fitch) and *F. bispinosa* (Morgan) occur at low levels on peanuts but are not reported to be vectors of TSWV.

**Table 1.** Thrips On Peanuts In Alabama In 1989.

Date	Total No. Adults	Percentage Of Species			
		1	2	3	4
5/15	7.0	69	28	1	0.5
5/23	3.6	86	13	1	0
5/30	5.0	80	18.5	1	0.5
6/6 blooms	34.0	69	25	5	1
6/13	9.0	62	27	7	4
6/20	7.7	65	14	6	15
6/27	14.5	64	6	20	10
7/6	10.7	50	9	31	10
7/12	15.3	71	7	12	10
7/19	30.0	88	4	4	5
7/26	21.0	93	3	1	3

Key: 1=*F. fusca*                      3=*F. tritici*  
       2=*F. occidentalis*            4=*F. bispinosa*

In early spring, tobacco thrips emerge from the soil or crop residue and move into various hosts such as clovers, vetch, small grains, henbit, and other weeds. They then migrate to the emerging peanut seedlings. Western flower thrips are active throughout the winter on annual winter weeds. They migrate to spring weeds and begin to reproduce before moving into peanuts in late April to early May.

In Alabama, thrips populations on peanuts peak about 2 to 4 weeks after seedling emergence and decline sharply after 6 weeks (Figure 10). Feeding damage on peanut seedlings is more obvious at this stage because their growth is slow. Once peanuts begin rapid growth and start to bloom (about 40 days after planting on Florunner peanuts), they usually outgrow most thrips damage.

The larval populations at this point in the growing season remain low, showing that there is little thrips reproduction on fast-growing

peanuts. Rapid leaf and shoot growth, coupled with short retention time of blooms (1 day), may not allow enough time for larval numbers to increase thrips populations.

Newly emerged peanut seedlings are infested by adult thrips migrating into the field. Adult female thrips usually lay eggs between the young, folded leaflets. After 3 to 5 days, the first-stage larvae emerge and feed for about 2 days before changing into larger, second-stage larvae.

These larvae feed for 3 to 5 days before changing into a non-feeding, inactive prepupal stage. Adult thrips then emerge 3 days later. The average time required to complete the cycle from egg to adult is about 13 days for tobacco thrips.

Thrips damage to peanut is characterized by scarring and deformation of new leaves, which often results in a stunted, slow-growing seedling. Adult female tobacco thrips are small (1.3 mm) and dark

brown. Male tobacco thrips are smaller (1 mm) and pale yellow. Tobacco thrips of both sexes occur in winged or wingless forms. During the growing season, the ratio of females to males may be 6:1 or greater.

Female western flower thrips are also small (1.5 mm), with a yellow to blotchy brown abdomen. Males are smaller (1 mm), with a pale yellow body. Larvae of both species range from pale to bright yellow and have bright red eyes.

Thrips larvae acquire TSWV by feeding on virus-infected plants. However, the thrips are capable of transmitting the virus only as adults, and they can do so throughout the remainder of their lives. The average life span of an adult female tobacco thrips is about 33 days.

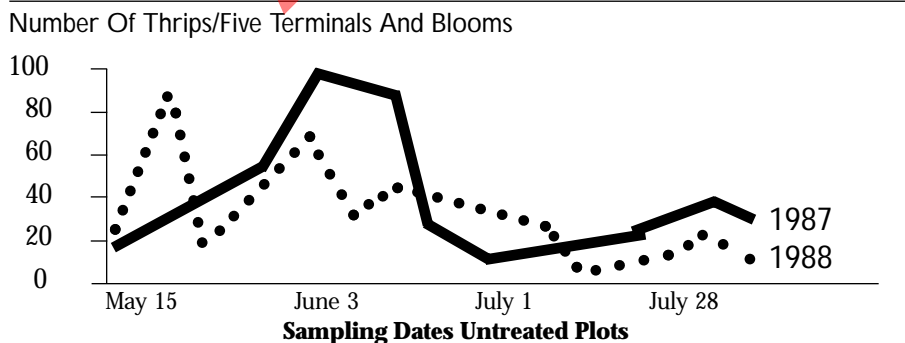
### Virus Source

To date, the overwintering source of TSWV has not been identified. Random surveys around Alabama peanut fields have not identified any TSWV-infected winter annual or perennial weed hosts. However, several common winter weeds are known hosts of the virus.

The only weed found to be infected with TSWV in Alabama has been Florida beggarweed. TSWV-infected beggarweeds have been commonly seen in peanut fields with relatively high levels of the virus. Since Florida beggarweed is a summer annual, it probably is unimportant in the season-to-season survival of TSWV.

Thrips may be the primary source of TSWV. Adult thrips carrying TSWV overwinter in the soil and crops debris and transmit the virus at or shortly after seedling emergence. More work is necessary to identify possible weed and crop reservoirs of TSWV and to determine whether virus-carrying thrips overwinter in Alabama.

**Figure 10.** Seasonal Abundance Of Thrips On Peanuts In Date-Of-Planting Test, Alabama, 1987-1988.



## Control Practices

Management practices such as cultivar selection, planting date, seed quality, soil insecticides, and possibly tillage practices when used in combination will reduce the incidence of TSWV in peanut.

1. Plant a TSWV-resistant cultivar. Virus levels in Southern Runner, Georgia Green, Georgia Brown, ViruGard, and FLA MDR 98 are usually 50 to 70 percent below those seen in the TSWV-susceptible cultivars Florunner, Georgia Runner, Sun Oleic 97R, Andru 93, GK-7, Sunrunner, AT108, and AT120.

2. The highest levels of TSWV generally are seen in peanut planted in early to mid-April. When planting peanuts before April 25, always sow a TSWV-resistant cultivar. Early to mid-May planted peanuts are at lower risk from TSWV. Virus levels often increase again on late May to early June planted peanuts.

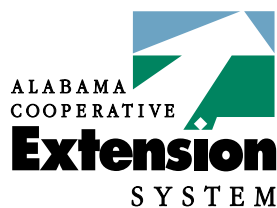
3. Plant a recommended rate of peanut seed with a high germination rate in a well-prepared seed bed when soil temperatures and moisture conditions favor uniform germination and rapid seedling growth. In cool, wet soils, do not use any pesticides that will slow seed germination or seedling

growth. Thin, skippy stands of peanut seedlings are a magnet for the thrips vectors of TSWV.

4. Apply a soil insecticide at planting to suppress the thrips vectors of TSWV. Insecticides will not prevent incoming virus-carrying thrips from transmitting TSWV to peanut, but they will slow thrips reproduction. Some soil insecticides have also been shown to reduce the incidence of TSWV in peanut.

5. If at-plant insecticides do not provide acceptable thrips control, apply a foliar insecticide. Intensive preventative foliar insecticide spray programs have not been shown to slow the spread of TSWV in peanut.

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