# Reaction of Peanut Cultivars to Spotted Wilt

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**ABSTRACT**

Field tests were conducted in 1997 and 1998 in Georgia and Florida to compare the effects of 10 and 12 peanut (*Arachis hypogaea* L.) cultivars, respectively, on epidemics of spotted wilt caused by tomato spotted wilt *Tospovirus*. Epidemics of spotted wilt were suppressed for the moderately resistant standard Georgia Green, and in Southern Runner, Florida MDR 98, ViruGard, and NC-V11. The reponse of these five cultivars to spotted wilt were similar and resulted in lower final disease intensity and areas under the disease progress curves than in the susceptible standard Georgia Runner, and in SunOleic 97R and Tamrun 96. Southern Runner and Florida MDR-98 consistently had higher yields than the TSWV-susceptible Georgia Runner. Georgia Green and NC-V11 had higher yields than Georgia Runner in three of the four tests. No consistent differences were found among the cultivars for numbers of adult tobacco thrips (*Frankliniella fusca*) or western flower thrips (*F. occidentalis*). Differences among cultivars for numbers of larvae of *Frankliniella* spp. also were few and inconsistent. There was no indication that differences in thrips populations were responsible for differences in severity of spotted wilt in the field.

Key Words: Field resistance, groundnut, vectors.

Spotted wilt of peanut (*Arachis hypogaea* L.), caused by tomato spotted wilt *Tospovirus* (TSWV), has become one of the major constraints to peanut production in the Southeastern U.S. Use of cultivars with moderate levels of field resistance to TSWV is a major tool in the current integrated management of spotted wilt, and level of resistance to TSWV is a major consideration in choosing which cultivars to use in the Southeastern U.S. Importance of cultivar selection in management of spotted wilt is reflected in the numerical weight assigned to cultivar in a tomato spotted wilt risk assessment index developed in Georgia to help growers and advisors identify and avoid high risk situations for spotted wilt (3). Of the known factors that a grower may manipulate to minimize risks to spotted wilt—including cultivar, planting date, plant population, at-plant insecticide use, row pattern, and tillage practices—cultivar selection carries the largest range of points for any category (3).

Largely because of spotted wilt, dramatic shifts in peanut cultivars grown in Georgia, Florida, and Alabama have occurred in the last 3 yr. Effects of various cultivars and breeding lines on spotted wilt epidemics have been reported (2, 5, 6, 7, 9). Southern Runner was the first cultviar reported to suppress spotted wilt epidemics compared to the long-time industry standard Florunner (2, 6). Georgia Green (7) and Florida MDR 98 (formerly UF 91108) (9) were found to be similar to Southern Runner for supppression of spotted wilt compared to Florunner. Runner-type cultivar GK-7 has been reported to be intermediate between Southern Runner and Tamrun-98 (1) or between Southern Runner and Florunner (8). In previous tests, virginia-type cultivar NC-V11 was inconsistent, with incidence of spotted wilt reported to be similar to Southern Runner in 1 yr, and similar to Florunner in the another (9). Most of the previous studies determined the effects of cultivars or breeding lines relative to the previously predominant runner-type cultivar Florunner and to Southern Runner. Based upon those comparisons, relative levels of field resistance have been inferred for several of the currently available cultivars. However, direct comparisons of a larger number of current cultivars for their effects on disease progress of spotted wilt are needed. Most of the cultivars and breeding lines evaluated in Georgia and Florida have been runner-type lines developed in the Southeastern U.S. Additional comparisons of virginia-type cultivars from the Virginia-Carolina production area and runner-type cultivars from the southwestern production area also are needed. Tamrun 96 is a runner-type cultivar developed by Texas A&M Univ. that has been reported to be moderately resistant to TSWV (13). Of particular interest in this study was the comparison of this cultivar to Georgia Green, a TSWV field-resistant cultivar that now predominates peanut acreage in the Southeastern U.S.

Most of the earlier evaluations of cultivars and breeding lines in Georgia and Florida in the early 1990s were done under relatively low levels of spotted wilt (< 20% incidence) compared to levels experienced in recent years. Therefore, performance of currently available cultivars should be compared under greater disease pressure to ensure that moderate levels of field resistance indicated in previous tests are not overwhelmed in situations with more severe epidemics.

The objective of this study was to compare the field reactions of commercially available peanut cultivars to spotted wilt. The cultivars evaluated were those most prevalent in the Georgia, Florida, and Alabama peanut production areas; Tamrun 96, a recently released cultivar from Texas; and two virginia-type cultivars, NC-V11 and

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NC 12C, commonly grown in the Virginia-Carolina production area.

## Materials and Methods

Field tests were conducted at the Univ. of Georgia, Attapulgus Res. Farm, Attapulgus (Decatur Co.), GA in 1997; at The Univ. of Georgia Coastal Plain Exp. Sta., Tifton (Tift Co.), GA in 1998; and at the Univ. of Florida, North Florida Res. and Educ. Center, Marianna (Jackson Co.), FL in 1997 and 1998. The soil type was a Dothan loamy sand (pH 5.8) for fields at Attapulgus, a Tifton sandy loam (pH 5.8) for fields at Tifton, and an Orangeburg loamy sand (pH 6.0) for fields in Florida. Randomized complete block designs with six replications were used in all tests. Tobacco thrips (*Frankliniella fusca* Hinds) and western flower thrips (*F. occidentalis* Pergande), known vectors of TSWV that occur in the Southeastern U.S., and TSWV occurred naturally at each location.

Planting dates were 1 April 1997 and 13 April 1998 in Georgia and 2 April 1997 and 16 April 1998 in Florida. In Georgia and Florida, early to mid-April planting dates typically are conducive for severe spotted wilt epidemics. In 1997, plant stands in all plots were thinned to one plant/20 cm of row. In 1998, seeding rate was 12.3 seed/m of row for all entries. Plant populations established in both years were lower than the 13 plants/m recommended for commercial production (3). Thinner plant densities also promote higher incidence and severity of spotted wilt (10). Plots consisted of two rows, 6.1 m long and 0.9 m apart. In 1997, each plot in Georgia was bordered on both sides by the susceptible cultivar Tamrun 88 to increase overall incidence of spotted wilt in all entries (1). In Florida during both years and in Georgia in 1998, each plot was bordered on one side by Tamrun 88 but was adjacent on one side to another randomly assigned plot. Plants in each plot were counted 14-21 d after planting (DAP) in each year to determine initial plant populations to ensure that differences observed in spotted wilt ratings were not due to differences in plant stand (10).

Cultivars evaluated in the 2 yr are listed in Table 1. All of these cultivars are runner types except NC-V11 and NC 12C which are virginia types. NC 12C and new runner-type cultivar Georgia Bold, which was not available in 1997, were added in 1998. NC 12C was added because Cylindrocladium black rot (caused by *Cylindrocladium parasiticum* Crous, Wingfield & Alfenas) is increasing in importance in Georgia and use of this Cylindrocladium-resistant cultivar is of interest. Others were chosen because they are available cultivars for use in the Southeastern U.S. Based on previous investigations and use in the southeastern region, Georgia Green and Georgia Runner represented moderately resistant and susceptible standards, respectively.

Ten partially unfolded quadrifoliolate terminal leaves were collected from each plot on 34 and 42 DAP in both locations in 1997 and on 30 and 36 DAP in Georgia and 25 and 32 DAP in Florida in 1998 for comparison of thrips populations among the entries. Terminal leaves were collected and processed as previously described (4)

Spotted wilt intensity was evaluated in each plot using a disease intensity rating that represented a combination of incidence and severity as described by Culbreath *et al.* (9). The number of 0.31-m portions of row containing severely stunted, chlorotic, wilted, or dead plants was counted for each plot 77, 91, 127, and 141 DAP at Attaplugus and 76, 90, 126, and 140 DAP at Marianna in 1997 and 64, 77, 92, and 112 DAP at Tifton and 62, 75, 90, and 110 DAP in Marianna in 1998. The number of row portions severely affected was converted to a percentage of total row length for comparison of cultivars. Disease intensity ratings over time were used to calculate area under the disease progress curve (AUDPC) for each plot as described by Shaner and Finney (11).

All tests were maintained as recommended for commercial production. Chlorothalonil (Bravo 720) or tebuconazole (Folicur 3.6 F) was applied as foliar sprays at 7- to 14-d intervals for control of foliar and/or soilborne fungal diseases.

Plants were dug and inverted at approximate optimum maturity for each cultivar based on the hull-scrape maturity index (15) and/or visual maturity estimates. In 1997, early maturing Andru-93 was dug 143 DAP at Attapulgus and 138 DAP at Marianna. Medium maturity cultivars (Georgia Green, ViruGard, NC-V11, GK-7, Tamrun 96, SunOleic 97R, and Georgia Runner) were dug 156 DAP at Attapulgus and 145 DAP at Marianna. Late maturity cultivars Southern Runner and Florida MDR-98 were dug 161 DAP at Attapulgus and 156 DAP at Marianna. In 1998, Andru-93 was dug 137 DAP at Tifton and 134 DAP at Marianna. Medium maturity cultivars (Georgia Green, ViruGard, NC-V11, GK-7, Tamrun 96, SunOleic 97R, Georgia Runner, NC 12C, and Georgia Bold) were dug 151 DAP at Tifton and 144 DAP at Marianna. Southern Runner and Florida MDR-98 were dug 164 DAP at Tifton and 151 DAP at Marianna. Inverted plants were dried in windrows for 3-7 d. Pods were harvested mechanically and pod yields were determined for each plot.

All data were subjected to analysis of variance (14). Data were analyzed across locations but only within years because cultivars differed each year. Fisher's protected least significant difference (LSD) values were calculated for comparison of cultivars. Differences described in the text are significant at $P \leq 0.05$ unless otherwise indicated.

## Results

Cultivar effects on *F. fusca* were significant only for the first sample date in 1997 and the second sample date in 1998. Genotype effects on larvae of *Frankliniella* spp. were significant only for the second sample date in 1998. In 1997, the numbers of *F. fusca*/10 terminals for the first sample ranged from 2.1 in SunOleic 97R to 6.5 in MDR-98. No cultivar had significantly fewer *F. fusca* adults than Georgia Runner, which had 2.2/10 terminals (LSD = 2.51, $P \leq 0.05$). In 1998, the number of *F. fusca*/10 terminals for the second sample ranged from 7.8 for ViruGard to 12.8 for MDR-98 with 12.3 for Georgia Runner and 8.3 for Georgia Green (LSD = 3.5, $P \leq 0.05$). In 1998, larvae of *Frankliniella* spp./10 terminals for the second sample ranged from 49 for Southern Runner to 83 for NC 12C with 67 and 54 occurring for Georgia Runner and Georgia Green, respectively (LSD = 19, $P \leq 0.05$). There were no other significant cultivar effects and no indication of correlation between thrips populations and spotted wilt reactions among the cultivars. Considering the lack of consistent cultivar effects, as previously reported (5, 6, 7, 9), complete thrips population data were not included in this paper.

Spotted wilt epidemics were severe in all tests, with one or more entry having final disease ratings of > 50% of the row length severely affected by spotted wilt in all cases (Table 1). In general, ranking of cultivars based on

**Table 1. Effect of peanut cultivars on tomato spotted wilt *Tospovirus* epidemics, and pod yield in Georgia (GA) and Florida (FL) in 1997 and 1998.**

| Genotype | AUDPC[a] GA[c] | AUDPC FL | AUDPC Mean | Final disease intensity[b] GA | Final disease intensity FL | Yield GA | Yield FL |
|---|---|---|---|---|---|---|---|
| | ---------% disease days--------- | | | ----------%---------- | | ---------kg/ha--------- | |
| **1997** | | | | | | | |
| Southern Runner | 922 | 1018 | - | 32.5 | 34.8 | 2366 | 3688 |
| Georgia Green | 1260 | 1384 | - | 41.7 | 44.6 | 2244 | 2934 |
| ViruGard | 1523 | 1299 | - | 51.3 | 40.0 | 1376 | 2299 |
| Florida MDR 98 | 1160 | 991 | - | 41.0 | 28.3 | 2874 | 4559 |
| NC-V11 | 1041 | 1747 | - | 36.9 | 50.4 | 1654 | 2311 |
| GK-7 | 2380 | 1723 | - | 78.8 | 52.1 | 1091 | 3183 |
| Andru-93 | 1783 | 1758 | - | 63.5 | 51.0 | 1986 | 3058 |
| Tamrun 96 | 2031 | 2326 | - | 67.9 | 64.8 | 1437 | 2107 |
| SunOleic 97R | 1814 | 2035 | - | 71.9 | 64.4 | 1735 | 2292 |
| Georgia Runner | 2158 | 2081 | - | 77.9 | 67.3 | 1016 | 2509 |
| LSD ($P \leq 0.05$) | 341 | 384 | - | 9.1 | 12.8 | 472 | 558 |
| **1998** | | | | | | | |
| Southern Runner | 1729 | 851 | 1289 | 55.2 | 19.4 | 5204 | 4013 |
| Georgia Green | 1623 | 901 | 1262 | 41.5 | 26.0 | 4672 | 4209 |
| ViruGard | 1467 | 826 | 1146 | 36.7 | 18.1 | 3984 | 4462 |
| Florida MDR 98 | 1812 | 729 | 1271 | 53.5 | 17.7 | 5171 | 4444 |
| NC-V11 | 1578 | 999 | 1289 | 38.5 | 25.2 | 5583 | 4674 |
| GK-7 | 1899 | 1641 | 1770 | 53.3 | 42.1 | 4342 | 2731 |
| Andru-93 | 2729 | 1537 | 2133 | 70.6 | 39.2 | 3589 | 4102 |
| Tamrun 96 | 2595 | 1436 | 2016 | 66.3 | 36.0 | 3497 | 3602 |
| SunOleic 97R | 2046 | 1976 | 2011 | 64.2 | 55.8 | 3849 | 2949 |
| Georgia Runner | 2704 | 1560 | 2132 | 76.0 | 44.0 | 3686 | 3220 |
| NC 12C | 1968 | 1070 | 1519 | 50.6 | 25.2 | 4520 | 3564 |
| Georgia Bold | 2291 | 1684 | 1987 | 61.3 | 44.2 | 4483 | 3321 |
| LSD ($P \leq 0.05$) | - | - | 366 | 16.4 | 9.4 | 788 | 528 |

[a]Area under the disease progress curve was calculated from evaluations of intensity of spotted wilt on 77, 91, 127, and 141 d after planting (DAP) in GA in 1997; 76, 90, 126, and 140 DAP in FL in 1997; 64, 77, 92; 112 DAP in GA in 1998; and 62, 75, 90, and 110 DAP in FL in 1998.

[b]Spotted wilt intensity rating represents the percentage of the row length severely affected (severely stunted, chlorotic, wilted or killed) by spotted wilt.

[c]Tests were conducted in Attapulgus, GA in 1997 and Tifton, GA in 1998. Tests were conducted in Marianna, FL in both years.

spotted wilt intensity early in the season was similar to that observed later in the season. In 1997, there was a significant cultivar × location interaction effect for AUDPC, and there were significant cultivar × location interaction effects for final disease ratings and pod yields in both years. Therefore, data from each of those experiments were analyzed and reported independently. AUDPC values for 1998 were pooled and means were compared across both locations.

In 1997 at Attapulgus, only Southern Runner had a final disease intensity rating that was lower than moderately resistant standard Georgia Green (Table 1). Final disease ratings were similar for Georgia Green, Florida MDR-98, and NC-V11. AUDPC values did not differ among any of those four cultivars, and final disease ratings and AUDPC values of these cultivars were lower than for any other cultivar except ViruGard. In 1997 at Marianna, UF MDR-98 had final disease ratings and AUDPC values lower than those of Georgia Green. Ratings for final disease intensity and AUDPC values were similar among Georgia Green, Southern Runner, and ViruGard; and final disease ratings and AUDPC values of NC-V11, GK-7, and Andru 93 were intermediate between these latter cultivars and Tamrun 96, SunOleic 97R, and susceptible standard Georgia Runner.

In 1998 at Attapulgus and Marianna, AUDPC values were lowest for Southern Runner, Georgia Green, ViruGard, Florida MDR 98, and NC-V11. Except for ViruGard, AUDPC values for these cultivars were similar to NC 12C (Table 1). AUDPC values for all of these cultivars were lower than those of all other cultivars except GK-7.

At Tifton in 1998, final disease ratings for Southern Runner, ViruGard, MDR-98, NC-V11, GK-7, and NC 12C did not differ from those for Georgia Green. ViruGard had lower final disease ratings than GK-7, Florida MDR-98, and Southern Runner (Table 1). ViruGard, MDR-98, NC-V11, GK-7, and NC 12C had final disease ratings lower than those for Andru 93 and SunOleic 97R.

At Marianna, final disease intensity ratings were simi-

lar among Georgia Green, Southern Runner, ViruGard, Florida MDR 98, NC-V11, and NC 12C and final disease ratings of all of these cultivars were lower than in any other cultivar. SunOleic 97R had the highest final disease ratings of any entry with final disease ratings higher than Georgia Runner.

Yields for most cultivars were much higher in 1998 than in 1997. In 1997, yields of Florida MDR 98 were higher than those of any other cultivar in both locations (Table 1). Below Florida MDR 98 at Attapulgus, yields were similar among Georgia Green, Southern Runner, and Andru 93 and were greater than for any other cultivar except NC-V11. At Marianna, only yields of Florida MDR 98, Southern Runner, and GK-7 were greater than those of Georgia Runner.

In 1998 at Attapulgus, yields were similar among NC-V11, Florida MDR 98, and Southern Runner, and only NC-V11 had yields higher than Georgia Green, NC 12C, and Georgia Bold (Table 1). Yields did not differ among ViruGard, Andru-93, Tamrun 96, SunOleic 97R, and Georgia Runner. At Marianna, yields were similar among Georgia Green, ViruGard, Florida MDR 98, and NC-V11; and only NC-V11 had yields greater than Southern Runner. The yields of all of these cultivars were greater than yields of GK-7, SunOleic 97R, Georgia Runner, and Georgia Bold.

## Discussion

This study compares the major cultivars grown in the Southeastern U.S. as well as some cultivars from Texas and North Carolina-Virginia production regions for their effects on spotted wilt disease progress as well as final disease severity. In four experiments with relatively heavy spotted wilt pressure, Southern Runner, Georgia Green, ViruGard, Florida MDR 98, and NC-V11 were similar in their final disease intensity ratings and disease progress curves. There was variation in their ranks among experiments, but none of the five cultivars was consistently lowest in AUDPC or final spotted wilt intensity ratings. Although different entries in the 2 yr and location × cultivar interactions prevented use of pooled data for means comparisons, arithmetic means of final disease ratings for these four cultivars across all four tests were similar and ranged from 35.5 % for Southern Runner to 39.6 % for Florida MDR 98. These results corroborate previous reports of similar effects of Georgia Green and Southern Runner (7), Florida MDR 98 and Southern Runner (9), and Georgia Green and ViruGard (12). Performance of NC-V11, relative to Southern Runner, was more consistent in these experiments than in those previously reported (9). In all tests in this study, NC-V11 had final disease intensity ratings lower than those of the susceptible cultivar Georgia Runner. GK-7 and Andru-93 tended to be less consistent and intermediate in response to spotted wilt as previously reported (2, 8). Although it was included only in 1998, NC 12C appears to be similar to Georgia Green and Southern Runner for effects on spotted wilt epidemics. Georgia Bold also appears intermediate in its effects on spotted wilt epidemics but was included in only 1 yr of the study. Further characterization of both of these cultivars is in progress.

This was the first report of the effects of SunOleic 97R on spotted wilt disease progress. These results corroborate preliminary studies and general observation in the field that it is very susceptible to TSWV and similar to Georgia Runner in its field response to TSWV.

Results with Tamrun 96 differ from those previously reported in Texas. Smith *et al.* (13) reported substantial increases in yield with Tamrun 96 in comparison to susceptible cultivar Florunner which corresponded with differences in spotted wilt ratings. In this study, final disease ratings for Tamrun 96 were higher than those of Southern Runner in three of four tests, and were higher than those of Georgia Green in all four.

AUDPC values and yields were similar for Tamrun 96 and susceptible standard Georgia Runner in all cases, and final intensity ratings were similar in all but one test. The reason for the differential performance of Tamrun 96 between the two studies is not known. These results emphasize, however, the importance of characterizing the response of cultivars developed in other areas of the country to spotted wilt under environmental conditions and with virus and vector populations typical of the local production areas if they are to be considered for commercial use.

This study corroborates previous reports that different field responses among cultivars are not due to corresponding differences in attractiveness to thrips or suitability for thrips reproduction (5, 6, 7, 9). In addition, these reports provide evidence that comparisons among peanut cultivars and breeding lines made in previous years with lower levels of spotted wilt infestation, such as reported for Southern Runner (6) and GK-7 (8), can be generally predictive of the relative performance of those same genotypes under heavier disease pressure.

None of the cultivars tested had a high level of resistance to TSWV. However, five cultivars—Georgia Green, Southern Runner, NC-V11, ViruGard, and Florida MDR 98—were confirmed to have a moderate level of field resistance based on suppressed epidemics of spotted wilt compared to Georgia Runner. The tomato spotted wilt risk assessment index assigns relative risk values of 50 for susceptible cultivars, 35 for intermediate cultivars, and 20 for moderately resistant cultivars (3). The results from these tests corroborate the classification of Southern Runner, Georgia Green, ViruGard, and Florida MDR 98 in the low risk category in the current Spotted Wilt Risk Assessment Index (3). These results support classification of NC-V11 likewise in the low risk category.

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