Response of New Field-Resistant Peanut Cultivars to Twin-Row Pattern or In-Furrow Applications of Phorate for Management of Spotted Wilt

A. K. Culbreath, Professor, Department of Plant Pathology, The University of Georgia Coastal Plain Experiment Station, Tifton 31793-0748; **B. L. Tillman,** Assistant Professor, and **D. W. Gorbet,** Professor Emeritus, Agronomy Department, The University of Florida, Marianna 32446; **C. C. Holbrook,** United States Department of Agriculture–Agricultural Research Service, Coastal Plain Experiment Station, Tifton; and **C. Nischwitz,** Post Doctoral Associate, Department of Plant Pathology, The University of Georgia Coastal Plain Experiment Station, Tifton

ABSTRACT

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Field experiments were conducted at Marianna, FL in 2006 and Tifton, GA in 2006 and 2007 to compare new peanut (*Arachis hypogaea*) cultivars to the moderately resistant cv. Georgia Green and the highly resistant cv. AP-3 for field resistance to *Tomato spotted wilt virus* (TSWV), genus *Tospovirus,* and to determine the effects of in-furrow application of phorate insecticide and use of twin-row versus single-row patterns on incidence of spotted wilt in these cultivars. Cvs. Georgia Green, AP-3, Georgia-03L, Georgia-01R, Florida-07, McCloud, and York were evaluated in all five experiments, and Tifguard was added in experiments at Tifton. All cultivars except McCloud had lower incidence of spotted wilt than Georgia Green in all experiments. McCloud was intermediate in resistance to TSWV and had lower incidence of spotted wilt than Georgia Green in four of five experiments. Use of the twin-row pattern also reduced incidence of spotted wilt in McCloud in both years. On Georgia Green, phorate reduced incidence of spotted wilt in 2007 and twin-row pattern reduced incidence in both years. Phorate had no effect on spotted wilt in AP-3, Georgia-03L, McCloud, Georgia-01R, or Tifguard in either year. Twin-row pattern reduced either final incidence or area under the disease progress curve in all cultivars in at least 1 year of the study. All of these new cultivars should reduce the risk of losses to spotted wilt compared with Georgia Green. In highly resistant cultivars, especially AP-3, York, and Tifguard, use of phorate insecticide or twin-row pattern may not be necessary, and may not provide noticeable benefit in reduction of spotted wilt or increased yield.

Additional keywords: *Frankliniella fusca*, thrips

In the southeastern United States, management of tomato spotted wilt, caused by *Tomato spotted wilt virus* (TSWV), genus *Tospovirus,* of peanut (*Arachis hypogaea* L.) is dependent upon integration of partially resistant cultivars with cultural practices and chemical treatments that suppress epidemics of this disease (7,9). 'Georgia Green' is a runner-type cultivar with a moderate level of field resistance to TSWV (10) and is the predominant peanut cultivar grown in the southeastern United States. In many cases, spotted wilt incidence in Georgia Green has been reduced greatly and pod yield increased when it is grown in combination with other practices such as use of optimum planting date (1,21,25), increased plant population (5,26), twin-row pattern (1,26), in-furrow application of the organophosphorus insecticide, phorate (1,30), and conservation tillage (1,8,18). With moderately resistant cultivars such as Georgia Green, it is often essential to use as many other practices that suppress spotted wilt epidemics as possible.

Several new cultivars with higher levels of field resistance to TSWV than Georgia Green are now available (3,14,16). Planting these cultivars should improve levels of control of spotted wilt in general, and allow more flexibility in spotted wilt management programs. Characterization of the responses of the new, more resistant cultivars to other specific practices that help in management of spotted wilt is needed.

Two practices that have been widely adopted in the southeastern United States for management of spotted wilt in peanut are the in-furrow application of the organophosphate insecticide, phorate, and the use of a twin-row planting pattern (7). TSWV is vectored by thrips; however, use of insecticides for control of tobacco thrips (*Frankliniella fusca* Hinds), which is the primary thrips species associated with direct damage and spread of TSWV in peanut in the southeastern United States, generally has not resulted in reductions in incidence of spotted wilt (27,28). Suppression of spotted wilt epidemics with phorate has been an exception to that trend, although effects of phorate on spotted wilt have not been consistent. Phorate is no better for thrips control than some other insecticides that provide no suppression of spotted wilt epidemics (28). The effects of phorate on incidence of spotted wilt are hypothesized to be due to factors other than vector control (13). Phorate often causes marginal chlorosis and necrosis in leaves of young peanut plants. The damage typically has no impact on yield and may be related to the effects of this insecticide on spotted wilt. However, the ability to use other options for thrips control, including using no insecticide, without increasing the risk of losses to spotted wilt would be desirable for many growers.

In the southeast, peanuts often are planted on beds 1.8 m wide. The use of two sets of twin rows spaced 18 to 24 cm apart on the same bed, instead of two single rows spaced approximately 91 cm apart on a similar bed, tends to result in lower incidence of spotted wilt, even when total plants per linear unit of bed are similar for the two row patterns (1). Diagrammatic depictions of the two row patterns are provided by Sconyers et al. (23). The mechanism for spotted wilt suppression has not been determined, but visual interference with the ability of migrating thrips to recognize host plants may be partially responsible. For growers not already equipped to plant in twin rows, cost of planters required for using this pattern may be a factor that would discourage such use.

Much of the research conducted on both of these factors for spotted wilt management has been concentrated on the moderately resistant cv. Georgia Green or cultivars with similar or slightly higher levels of resistance. Cv. AP-3 (tested previously as F90/7-3-5-1-b2-B), a runner-type cultivar released by the University of Florida, has one of the highest levels of field resistance to TSWV among available cultivars (7,11,14), but pods of AP-3 have a lower percentage of sound mature kernels than Georgia Green (14). AP-3 has been reported to have lower levels of spotted wilt when planted with twin-row pattern than with single-row pattern (26) but characterization of the response of AP-3 to phorate insecticide has not been reported. In-

Corresponding author: A. K. Culbreath
E-mail: spotwilt@uga.edu

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formation is needed on how new cultivars with high levels of field resistance compare with AP-3 and how they respond to use of phorate insecticide and twin-row pattern for management of spotted wilt.

The objective of this study was to compare the effects of several new cultivars on spotted wilt epidemics and determine how each responds to the use of twin-row pattern and in-furrow application of phorate insecticide for suppressing spotted wilt. Of particular interest was comparing incidence of spotted wilt and yield in these new cultivars to those of Georgia Green and AP-3 using similar treatments for spotted wilt management, and determining whether additional management measures are necessary in these new cultivars.

MATERIALS AND METHODS

Field experiments were conducted at the University of Florida, North Florida Research and Education Center, Marianna, FL in 2006, and University of Georgia Coastal Plain Experiment Station, Rigdon Farm, Tifton, GA in 2006 and 2007. Soil type at Marianna was an Orangeburg loamy sand and at Tifton was a Tifton loamy sand. The field at Marianna was planted to corn (*Zea maydis* L.) the previous year, and fields at Tifton were planted to cotton (*Gossypium hirsutum* L.) the preceding year. Severe epidemics of spotted wilt had occurred in peanut in these fields in previous years. Weather in both seasons was dry, especially through the first half of the season. Frequent irrigation was used to sustain the plants.

Two sets of experiments were conducted. In one set, cultivars were evaluated with and without in-furrow applications of phorate insecticide. In the other, the same cultivars were evaluated when planted in twin-row and single-row patterns.

In-furrow insecticide experiments. Field experiments were conducted in Marianna, FL in 2006 and in Tifton, GA in 2006 and 2007. Experimental design was a split-plot with four replications in the Marianna experiment and three replications in the Tifton experiments. Whole-plot treatments consisted of (i) in-furrow application of phorate (Thimet 20 G; AMVAC Chemical Corporation, Los Angeles) at 1.12 kg a.i./ha and (ii) nontreated control. Sub-plot treatments at Marianna included seven peanut cultivars: Georgia Green (2), AP-3 (14), Georgia-03L (4), McCloud, Florida-07, York, and Georgia-01R (3). Sub-plot treatments at Tifton were the same cultivars as used at Marianna but also included cv. Tifguard (tested previously as C724-19-15) (16,17) in both years. Planting dates were 10 May 2006 at Marianna and 4 May 2006 and 25 April 2007 at Tifton. Plots were 1.8 m wide and contained two single rows 91.4 cm apart. Row length was 4.5 m in 2006 at Marianna and 9.4 m in 2006 and 12.5 m in 2007 at Tifton. Seeding rates were 14.8 seed/m of row in each of the two single rows.

Row-pattern experiments. Field experiments were conducted in Tifton, GA in 2006 and 2007. The portion of the field area used for the row-pattern experiment was immediately adjacent to the area used for the insecticide experiment in each year. The experimental design was a split-plot with three replications. Whole-plot treatments consisted of (i) single-row pattern and (ii) twin-row pattern. Single-row and twin-row patterns were as described by Sconyers et al. (23). The single-row pattern consisted of two rows planted 91.4 cm apart on a 1.8-m-wide bed. The twin-row pattern had a total of four rows on the 1.8-m bed, with outside rows 91.4 cm apart, similar to the single-row configurations. A second row was positioned 20.3 cm inside each of the outer rows. Total seeding rate per plot was the same for the two treatments, with seeding rates of 14.8 seed/m of row in each of the two single rows per plot and 7.4 seed/m of row in each of the four twin rows per plot. Sub-plot treatments consisted of the same eight cultivars used in the insecticide experiments at Tifton.

Inoculum and thrips control. In all experiments, development of spotted wilt epidemics was reliant upon infection via resident thrips vectors (*F. fusca* and *F. occidentalis* Pergande). At Tifton, acephate (Orthene 75W; Valent U.S.A. Corporation, Walnut Creek, CA) at 0.84 kg a.i./ha was applied 13 to 14 days after planting in both experiments and both years for early-season control of thrips. This was done to reduce physical feeding damage by thrips larvae that might complicate early-season evaluations for spotted wilt. Such applications typically have had little effect on spotted wilt incidence in Georgia (29).

Disease assessment. Spotted wilt was evaluated on 19 July and 24 August 2006 at Marianna and in both experiments on 26 July, 23 August, and 18 September 2006 and 27 June, 24 July, 14 August, and 31 August 2007 at Tifton. Spotted wilt incidence was determined by counting the number of 0.3-m portions of row containing severely stunted, chlorotic, wilted, or dead plants for each plot and converting that number to a percentage of total row length (12). For all experiments at Tifton, area under the disease progress curve (AUDPC) for incidence of spotted wilt was calculated for each plot as described by Shaner and Finney (24).

Pod yield. Peanuts were inverted and harvested based on maturity class. At Marianna, plots of Georgia Green, AP-3, Georgia-03L, McCloud, and Florida-07 were inverted 22 September 2006, and plots of York and Georgia-01R were inverted on 6 October 2006. In both experiments at Tifton, Georgia Green, AP-3, Georgia-03L, McCloud, Florida-07, and Tifguard were inverted on 18 September 2006 and 10 September 2007. York and Georgia-01R were inverted on 26 September 2006 and 24 September 2007. Pods were harvested mechanically 4 to 11 days after they were inverted, and were dried. Yields were adjusted to 10% (wt/wt) moisture.

Statistical analysis. Data were analyzed using Proc MIXED with ddfm = satterth option on the model statement (SAS v.9.1; SAS Institute, Cary, NC). Replication was considered a random effect. Effects were considered significant when $P < 0.05$. Fisher's least significant difference (LSD) values were computed using standard errors and t values of adjusted degrees of freedom. Means presented in the text are followed by their respective standard deviations of error.

Table 1. Effect of peanut cultivar and the insecticide phorate on incidence of spotted wilt and pod yield in Marianna, FL in 2006

	Final incidence of spotted wilt (%)[a]			Yield (kg/ha)[b]		
Cultivar	Nontreated	Phorate	Cultivar mean[c]	Nontreated	Phorate	Cultivar[c]
Georgia Green	16.7	23.3	20.0	4,383	4,090	4,236
AP-3	4.6	2.5	3.5	5,369	6,172	5,771
Georgia-03L	7.9	7.9	7.9	4,860	5,350	5,105
McCloud	13.3	15.8	14.6	4,258	4,402	4,330
Florida-07	5.0	3.3	4.2	6,185	7,356	6,771
York	6.7	7.1	6.9	3,729	4,031	3,880
Georgia-01R	10.0	5.4	7.7	5,562	5,662	5,612

[a] Percentage of linear plot row severely affected by spotted wilt. Least significant difference (LSD; $P = 0.05$) = 7.4, df = 36.

[b] LSD ($P = 0.05$) = 531, df = 36.

[c] There was not a significant interaction between peanut cultivar and insecticide treatment ($P > 0.05$) for final incidence of spotted wilt. Therefore, only main effects were compared.

RESULTS

In-furrow insecticide experiments. Marginal chlorosis and necrosis on leaves of young plants were observed on all cultivars treated with phorate in both years. Although specific evaluations were not made, the phytotoxic effects were more prevalent in 2006 than in 2007.

In 2006, there was no significant phorate or phorate–cultivar effect on final incidence of spotted wilt or yield at Marianna. Therefore, cultivar comparisons were made across phorate treatments. Averaged across cultivars, incidence of spotted wilt at Marianna was 9.1 (±6.9)% in nontreated

plots and 9.3 (±10.3)% (P = 0.92) in plots treated with phorate. Averaged across phorate treatments, final incidence of spotted wilt was higher in Georgia Green than in any other cultivar except McCloud (Table 1). Final incidence of spotted wilt was similar for AP-3, Georgia-03L, Florida-07, York, and Georgia-01R.

At Marianna, only cultivar main effects were significant for yield. Averaged across cultivars, yields were 4,907 (±961) kg/ha for nontreated plots and 5,294 (±1,248) kg/ha (P = 0.11) for plots treated with phorate. Averaged across phorate treatments, yields were similar for Georgia Green, McCloud, and York, and yields of all of these entries were lower than any other cultivar (Table 1). Yields were significantly higher in Florida-07 than in any other cultivar.

In 2006 at Tifton, only cultivar main effects were significant for final incidence of spotted wilt and AUDPC. Averaged across genotypes, final incidence of spotted wilt was 17.0 (±11.5)% for nontreated plots and 13.7 (±8.5)% for plots treated with phorate (P = 0.20), and AUDPC was 671 (±489) for nontreated plots and 512 (±350) for plots treated with phorate (P = 0.19). Averaged across phorate treatments, final incidence of spotted wilt was highest in Georgia Green and was higher in McCloud than in any other cultivar except Georgia Green (Table 2). Final incidence of spotted wilt did not differ among Florida-07, York, Georgia-01R, or Tifguard (Table 2). Final incidence of spotted wilt was lower in Georgia-01R and Tifguard than in AP-3. Averaged across phorate treatments, AUDPC values were highest in Georgia Green. AUDPC values did not differ among Florida-07, York, Georgia-01R, or Tifguard (Table 2). Tifguard had AUDPC values that were lower than those of AP-3.

In 2007, phorate, cultivar, and phorate–cultivar effects were significant for both final incidence of spotted wilt and AUDPC. Within nontreated plots, final incidence of spotted wilt was highest for Georgia Green (Table 2). Final incidence did not differ among AP-3, York, and Tifguard (Table 2). In plots treated with phorate, final incidence of spotted wilt was higher in Georgia Green than in all cultivars except McCloud and Georgia-01R (Table 2). Within plots treated with phorate, final incidence did not differ among AP-3, Georgia-03L, Florida-07, York, or Tifguard (Table 2). Within nontreated plots, AUDPC values were highest for Georgia Green (Table 2). AUDPC values were similar for AP-3, Georgia-03L, York, and Tifguard (Table 2). Within plots treated with phorate, AUDPC values of Florida-07 and York were lower than those of Georgia Green and Georgia-01R (Table 2). AUDPC values did not differ among AP-3, Georgia-03L, McCloud, Florida-07, York, or Tifguard (Table 2).

Within cultivars, phorate-treated plots had lower final incidence of spotted wilt than the nontreated plots for Georgia Green and Florida-07 (Table 2). Plots treated with phorate had lower AUDPC values than the respective nontreated plots of Georgia Green, Florida-07, and York (Table 2).

In 2006, cultivar main effects were significant for yield but phorate main effects and phorate–cultivar interaction effects were not significant. Across cultivars, yields were 5,204 (±792) kg/ha and 5,266 (±754) kg/ha (P = 0.79) for nontreated and phorate treatments, respectively. Across phorate treatments, yields were lower for Georgia Green than for any other cultivar except Georgia-03L (Table 2). Yields were higher for Florida-07 than any other cultivar except York and Georgia-01R (Table 2). In 2007, phorate and cultivar main effects were significant for yield, but phorate–cultivar interaction effects were not. Averaged across cultivars, yields were 3,928 (±681) kg/ha for nontreated plots and 4,454 (±629) kg/ha (P < 0.01) for plots treated with phorate. Across phorate treatments, yields were lower in Georgia Green than for any other cultivar except Georgia-01R (Table 2). Yields did not differ among AP-3, McCloud, Florida-07, York, or Tifguard (Table 2).

Row-pattern experiments. In 2006, row pattern and cultivar main effects were significant for final incidence of spotted wilt but the row pattern–cultivar interaction was not. Averaged across cultivars, final incidence of spotted wilt was 15.2 (±11.4)% for single-row-pattern treatments and 6.6 (±6.3)% for twin-row-pattern treatments (P < 0.01). Averaged across row patterns, final incidence was highest in Georgia Green (Table 3). Final incidence of spotted wilt in McCloud was higher than that in Tifguard, but final incidence did not differ among the other cultivars

Table 2. Effect of peanut cultivar and in-furrow applications of the insecticide phorate on incidence of spotted wilt and yield in Tifton, GA in 2006 and 2007[a]

	Final incidence (%)[b]			AUDPC[c]			Yield (kg/ha)		
Year, cultivar	NT	Phorate	CM[d]	NT	Phorate	CM[d]	NT	Phorate	CM[d]
2006									
Georgia Green	41.2	30.8	36.0	1,670	1,148	1,409	4,402	4,119	4,261
AP-3	15.2	14.4	14.8	500	497	498	5,166	5,618	5,392
Georgia-03L	14.4	11.1	12.8	490	460	475	4,903	4,677	4,790
McCloud	24.2	20.5	22.3	1,115	845	979	4,834	5,116	4,975
Florida-07	12.6	8.3	10.5	360	301	331	6,289	6,119	6,204
York	13.4	9.3	11.4	469	318	394	5,745	5,634	5,690
Georgia-01R	8.8	9.1	9.0	347	347	462	5,429	5,708	5,568
Tifguard	6.3	6.8	6.6	203	210	206	4,862	5,137	5,000
2007[e]									
Georgia Green	55.9	30.1*	…	2,095	900*	…	2,889	3,739	3,314
AP-3	16.9	13.6	…	543	427	…	4,347	4,890	4,619
Georgia-03L	23.4	17.5	…	878	676	…	3,774	4,154	3,964
McCloud	26.8	22.4	…	1,131	795	…	3,936	4,524	4,230
Florida-07	28.5	10.2*	…	960	338*	…	4,272	5,284	4,778
York	16.4	6.9	…	841	329*	…	3,974	4,485	4,230
Georgia-01R	24.0	26.4	…	1,086	1,103	…	3,566	3,927	3,747
Tifguard	12.0	9.8	…	483	430	…	4,666	4,631	4,648

[a] NT = nontreated and CM = cultivar mean.
[b] Percentage of linear plot row severely affected by spotted wilt.
[c] Area under the disease progress curve (AUDPC) calculated from evaluations of incidence of tomato spotted wilt over time.
[d] There was not a significant (P > 0.05) interaction between insecticide and cultivar. Therefore, least significant difference (LSD) values are for comparison of cultivars across insecticide treatments. LSD (P = 0.05): final incidence = 5.3, df =36; AUDPC = 217, df = 28; and yield = 667, df = 28 in 2006 and 587, df = 30 in 2007.
[e] There was a significant (P < 0.05) interaction between insecticide and cultivar. Therefore, LSD values are for comparison of cultivars within insecticide treatments. LSD (P = 0.05): final incidence = 10.5, df = 28 and AUDPC = 476, df = 28. For comparison of insecticide treatments, asterisks indicate significant differences between nontreated plots and plots treated with phorate insecticide within a cultivar. In 2007, the LSD (P = 0.05) for incidence of tomato spotted wilt comparisons between insecticide treatments within cultivars was 10.8, df = 31.2, and the LSD (P = 0.05) for AUDPC comparisons between insecticide treatments within cultivars was 475, df = 32.

and Tifguard. Row pattern and cultivar main effects as well as row pattern–cultivar interaction effects were significant for AUDPC in 2006. Within single-row-pattern treatments, AUDPC values were highest in Georgia Green (Table 3). AUDPC values from single rows did not differ among AP-3, Georgia-03L, York, Georgia-01R, or Tifguard (Table 3). Within twin-row-pattern treatments, AUDPC was highest in Georgia Green and did not differ among any of the other cultivars (Table 3). Within cultivars, AUDPC values were lower for twin-row plots than single-row plots for Georgia Green, Georgia-03L, McCloud, and Florida-07 (Table 3).

In 2007, row pattern and cultivar main effects as well as row pattern–cultivar interaction effects were significant for final incidence of spotted wilt and AUDPC. Within single-row plots, final incidence of spotted wilt was highest in Georgia Green (Table 3). Final incidence did not differ among AP-3, Florida-07, York, or Tifguard (Table 3). Within twin-row plots, final incidence of spotted wilt was highest in Georgia Green but did not differ among any of the other cultivars (Table 3). In single-row plots, AUDPC values were highest for Georgia Green, and AUDPC values did not differ among AP-3, Florida-07, York, or Tifguard (Table 3). In twin-row plots, AUDPC values were highest in Georgia Green and did not differ among the other cultivars (Table 3). Final incidence of spotted wilt was lower for twin-row plots than for single-row plots of Georgia Green, Georgia-03L, McCloud, and Florida-07 (Table 3). AUDPC values were lower for twin-row plots than for single-row plots for all cultivars except AP-3 (Table 3).

In 2006, row pattern main effects, cultivar main effects, and row pattern–cultivar interaction effects were significant for yield. Within single-row treatments, yields were lower for Georgia-03L than for any cultivar except Georgia Green, AP-3, and McCloud (Table 3). Yields did not differ among McCloud, Florida-07, York, Georgia-01R, or Tifguard (Table 3). Within twin-row pattern plots, yields were higher in Florida-07 than in any other cultivar except AP-3 (Table 3). Yields were higher in twin-row treatments than single-row treatments for AP-3 and Florida-07 (Table 3). In 2007, cultivar main effects were significant for yield, but neither row pattern main effects nor row pattern–cultivar interaction effects were significant. Across cultivars, yields were 4,013 (±877) kg/ha for single-row-pattern treatments and 4,198 (±626) kg/ha for twin-row-pattern treatments ($P = 0.51$). Across row patterns, yields were lower for Georgia Green than for any other cultivar except Georgia-03L (Table 3). Yields did not differ among AP-3, Florida-07, and Tifguard (Table 3).

DISCUSSION

Results from all of these experiments corroborate previous reports of greater field resistance to TSWV in cvs. AP-3 (tested previously as F90/7-3-5-1-b2-B) (11,26), Georgia-01R (8), and Tifguard (tested as C724-19-15) (17) than in Georgia Green. The respective final incidences of spotted wilt from nontreated and single-row plots in the experiments at Tifton are similar to reported intensity ratings of 53.9% for Georgia Green and 11.7% for AP-3 across experiments in Marianna, FL and Tifton, GA in 1998 (11) and to the ratings of 44% for Georgia Green and 11% for Tifguard across experiments in 2004 and 2005 (17). These results indicate that all of the new cultivars included in this study have greater levels of field resistance to TSWV than Georgia Green. In all experiments in which they were included, York and Tifguard had final incidence of spotted wilt and AUDPC values that were similar to or slightly lower than those of AP-3. In most cases, Georgia-03L, Florida-07, and Georgia-01R also were similar to AP-3 for spotted wilt incidence and AUDPC. The results of this study indicate that the field reaction to TSWV in McCloud is intermediate between Georgia Green and AP-3, and that the field reaction of each of the other cultivars is similar to AP-3.

Effects of phorate on spotted wilt were not consistent, with no significant effect in 2006 and significant reductions in spotted wilt incidence in only three cultivars in 2007. There were large reductions in spotted wilt incidence and AUDPC in response to phorate in Georgia Green and Florida-07 in 2007. However, phorate had a positive effect on yield in most cultivars in 2007, whereas there was no effect of phorate on yield in either location in 2006. Variability among experiments in the effects of phorate on spotted wilt epidemics in peanut has been common in previous studies. Application of phorate in-furrow at

Table 3. Effect of peanut cultivar and row pattern (single versus twin) on incidence of tomato spotted wilt and yield in Tifton, GA in 2006 and 2007

	Final incidence (%)[a]			AUDPC[b]		Yield (kg/ha)		
Year, cultivar	Single	Twin	Cultivar mean[c]	Single	Twin	Single	Twin	Cultivar mean[c]
2006[d]								
Georgia Green	39.9	20.7	30.3	1,608	647*	4,751	4,903	…
AP-3	12.9	4.8	8.8	408	121*	5,154	6,562*	…
Georgia-03L	12.4	5.8	9.1	481	120*	4,694	5,341*	…
McCloud	16.4	7.6	12.0	758	273*	5,322	5,955	…
Florida-07	15.2	1.8	8.4	534	33*	5,939	7,084*	…
York	9.6	3.0	6.3	386	136	5,634	5,515	…
Georgia-01R	9.8	6.6	8.2	431	305	5,580	5,092	…
Tifguard	5.8	2.5	4.2	193	60	5,708	5,507	…
2007[d]								
Georgia Green	68.7	30.7*	…	2,269	1,124*	2,765	3,501	3,133
AP-3	16.3	8.5	…	579	387	4,513	4,586	4,550
Georgia-03L	27.4	11.7*	…	1033	346*	3,224	3,871	3,548
McCloud	31.3	10.4*	…	1,310	376*	3,580	3,877	3,729
Florida-07	18.7	6.1*	…	764	228*	4,941	4,821	4,882
York	15.9	7.3	…	882	295*	4,175	4,204	4,190
Georgia-01R	24.6	10.6*	…	1,022	476*	3,818	4,195	4,006
Tifguard	11.8	3.7	…	547	102*	5,090	4,530	4,810

[a] Percentage of linear plot row severely affected by spotted wilt. Asterisks indicate significant differences between single-row-pattern and twin-row-pattern plots within a cultivar when significant interaction ($P < 0.05$) between row pattern and cultivar was observed.

[b] Area under the disease progress curve (AUDPC) calculated from evaluations of incidence of tomato spotted wilt over time.

[c] There was not a significant ($P > 0.05$) interaction between peanut cultivar and row pattern. Therefore, least significant difference (LSD) values are for comparison of cultivars across row patterns. LSD ($P = 0.05$) for cultivar mean in 2006 = 5.9, df = 32 and in 2007 = 517, df = 28.

[d] There was a significant ($P < 0.05$) interaction between insecticide and cultivar. Therefore, LSD values are given for comparison of cultivars within row pattern treatments. For comparison of row pattern treatments, asterisks indicate significant differences between single-row and twin-row patterns within a cultivar. In 2006, the LSD ($P = 0.05$) was 297, df = 32 for AUDPC comparisons between row pattern treatments within cultivars and was 677, df = 30 for yield comparisons. In 2007, the LSD ($P = 0.05$) was 9.4, df = 32 for final incidence of spotted wilt comparisons between row pattern treatments within cultivars and 398, df = 32 for AUDPC comparisons.

planting reduced incidence of spotted wilt compared with the nontreated control in 63 of 93 experiments in Georgia and Florida conducted between 1987 and 2000 (9). Herbert et al. (15) reported lower final incidence of spotted wilt in peanut treated with phorate than nontreated peanut in all three field experiments conducted from 2000 to 2002. Baldwin et al. (1) reported significant reductions in spotted wilt incidence with use of phorate in two of four experiments, and Wells et al. (30) reported significant reductions in incidence of spotted wilt with phorate in two of five experiments. Marois and Wright reported that phorate had no effect on spotted wilt in two experiments in 2000 and 2001 (20).

There was little effect of phorate in the most resistant cultivars in 2007 but there were large reductions in spotted wilt final incidence and AUDPC with the use of phorate in Georgia Green in 2007. Although AUDPC response with McCloud was not significant, it is noteworthy that, in 2007 in nontreated plots, McCloud had AUDPC values higher than those of AP-3, whereas AUDPC values for McCloud did not differ from those of the lowest-ranking cultivars in plots treated with phorate. Incidence of spotted wilt and AUDPC for nontreated plots of AP-3, York, and Tifguard were consistently lower than those of plots of Georgia Green treated with phorate.

The effects of row pattern on spotted wilt were consistent across the 2 years. All cultivars had reductions in either final incidence of spotted wilt or AUDPC in at least 1 year when planted in twin rows compared with single rows. There were large reductions in final incidence of spotted wilt and AUDPC in Georgia Green and McCloud with the use of twin rows in both years. There was no significant response of Tifguard in final incidence of spotted wilt to the twin-row-pattern treatment in 2007 but AUDPC was lower in the twin-row-pattern treatment than the single-row-pattern treatment in 2007. Baldwin et al. (1) also reported more consistent suppression of spotted wilt by twin-row pattern than with phorate application, and Tillman et al. (26) reported consistently lower spotted wilt ratings in twin rows than in single rows in 10 cultivars, including AP-3. Differential effects of row pattern on spotted wilt for different peanut cultivars have been noted previously. Lanier et al. (19) reported lower spotted wilt severity in twin-row pattern than with single-row pattern in the peanut cv. Perry but not in the more resistant cv. NC-V11. Results from this study indicate that even the more resistant cultivars may benefit from use of twin-row pattern for management of spotted wilt. However, that may not result in increased yield.

Cultivar effects on final incidence or AUDPC of spotted wilt epidemics were more consistent and, in general, larger than effects of either phorate insecticide or row pattern. This is consistent with previous observations (1,9,26). Results from these experiments indicate that, although the effects may not be consistent, management practices such as the use of phorate insecticide or twin-row pattern can have large effects on spotted wilt and yield in Georgia Green. Results from the 2006 Tifton experiment indicated that the use of twin-row pattern can greatly increase yield of Florida-07. Similarly, large increases in yield of Florida-07 were observed with use of phorate in 2007. It should be noted that yield effects of cultivars, phorate, or twin-row pattern may not be due solely to spotted wilt suppression. Although no other disease or insect problems were noticed in these experiments that would explain the large increases in Florida-07, factors other than spotted wilt should not be ruled out. Results from this study indicate that all of the new cultivars evaluated may help reduce losses to spotted wilt compared with the standard moderately resistant cv. Georgia Green. These results also indicate that all of the cultivars evaluated may respond to some extent to additional practices that suppress spotted wilt. In more highly resistant cultivars, additional practices are not as critical as with Georgia Green and would not be expected to result in noticeable benefits in all cases.

Although none of the new cultivars showed better field resistance to TSWV than AP-3, each has characteristics that may make them more desirable than AP-3. AP-3 typically has a percentage of total sound mature kernels (TSMK) that is lower than for Georgia Green (14). This grade component is a key factor in calculation of crop value (8). The percentages of TSMK were not compared in this study; however, Georgia-01R has been reported to have percent TSMK similar to (3) or higher than (8) that of Georgia Green. Peanut cultivars with oil composed of at least 80% of oleic fatty acid have been reported to have greater shelf-life than peanut with normal oil composition (53% oleic acid; 22). McCloud, Florida-07, and York all have seed oil that is at least 80% oleic acid (D. Gorbet and B. Tillman, *unpublished*), whereas AP-3 has a normal oil composition (14). Georgia-01R (3,8), Georgia-03L (6) (A. Culbreath, *unpublished*), York (A. Culbreath, *unpublished*), and Tifguard (A. Culbreath, *unpublished*) have moderate levels of resistance to *Cercospora arachidicola* Hori or *Cercosporidium personatum* (Berk & M.A. Curtis) Deighton, the pathogens that cause early leaf spot and late leaf spot, respectively, of peanut, and show potential for reducing fungicide requirements to manage these diseases (3,8) (A. Culbreath, *unpublished*). Tifguard also has a high level of resistance to the peanut root-knot nematode (*Meloidogyne arenaria* (Neal) Chitwood race 1) (17).

Although the two treatments were not compared directly, results from the two sets of experiments suggest that there would be a greater likelihood of benefit from using twin-row pattern than use of phorate insecticide in the new cultivars evaluated. Cv. McCloud has a more moderate level of field resistance than cultivars such as Tifguard and AP-3. However, this cultivar responded strongly to use of twin-row pattern for reducing spotted wilt. In some of the more resistant cultivars, especially AP-3, York, and Tifguard, the level of field resistance to TSWV appears to be high enough that use of the management practices tested here may not be necessary under levels of spotted wilt observed in this study. Additional studies are in progress and others are planned to determine whether these more resistant cultivars might allow more flexibility in other factors such as planting date and plant population that are critical for managing spotted wilt in a cultivar like Georgia Green.

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