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IMPACT OF SOIL INSECTICIDE TREATMENTS ON THE YIELD OF NEWLY RELEASED RUNNER PEANUT CULTIVARS AND THEIR REACTION TO DISEASES

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Previously, Thimet 20G insecticide has been shown to suppress the incidence of TSWV and, when disease incidence is high, increase peanut yield. The actual mode of action for the suppression of TSWV with Thimet 20G, which does not directly involve thrips control, is not known. In contrast, Temik 15G is widely used for thrips control in peanuts but has not proven as consistent as Thimet 20G in suppressing TSWV.

Within the past few years, a number of runner peanut cultivars have been released. While nearly all have better resistance to TSWV than the current industry standard Georgia Green, many reportedly have partial resistance to leaf spot diseases and/or white mold as well.

The objective of this study was to assess the impact of soil insecticides Thimet 20G and Temik 15G on the incidence of tomato spotted wilt (TSWV) as well as other diseases and on the yields of newly released commercial runner peanut cultivars at the Gulf Coast Research and Extension Center in Fairhope, AL and the Wiregrass Research and Extension Center, Headland, AL and to their performance in comparison to the current industry standard Georgia Green.

GULF COAST RESEARCH AND EXTENSON CENTER TRIAL

Production Methods: On May 27, ten commercial runner-market type peanut cultivars were planted at a rate of 6 seed/ft of row using conventional tillage practices in a Malbis fine sandy loam (OM$\leq$1%) soil in a field cropped to peanut every third year. Weed control and soil fertility recommendations of the Alabama Cooperative Extension System were followed. The test area was not irrigated. A split plot design with cultivars as whole plots and an at-plant soil insecticide treatment as sub-plots was used. Whole plots were randomized in six complete blocks. Individual sub-plots consisted of four 30-foot rows spaced 3.2-feet apart. Sub-plot insecticide treatments were Thimet 20G at 4 pounds per acre, Temik 15G at 6.5 pounds per acre, and a non-treated control.

To control leaf spot diseases and white mold, full canopy sprays of Tilt 3.6E at 4 fluid ounces per acre + Bravo Weather Stik 6F at 1.5 pints per acre on 2 July 2 and July 16 were followed by applications of Abound 2SC at 18.5 fluid ounces per acre on July 29, Bravo Weather Stik 6F at 1.5 pints per acre on August 6, Abound 2SC at 18.5 fluid ounces per acre on August 28, and Bravo Weather Stik 6F at 1.5 pints per acre on September 8 and September 24. Fungicides were applied with an All Terrain Vehicle-mounted boom sprayer with 3 TX-8 nozzles per row at 10 gallons of spray volume per acre at 45 psi.

Disease Assessment: Final TSWV hit counts (1 hit was defined as $\leq$ 1 foot of consecutive severely TSWV-damaged plants per row) were made on October 3. Early and late leaf spot were rated on 26 September using the 1-10 Florida peanut leaf spot scoring system where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and $\leq$ 10% defoliation, 5 = lesions noticeable and $\leq$ 25% defoliation, 6 = lesions numerous and $\leq$ 50% defoliation, 7 = lesions very numerous and $\leq$ 75% defoliation, 8 = numerous lesions on few remaining leaves and $\leq$90% defoliation, 9 = very few remaining leaves covered with lesions and $\leq$ 95% defoliation, and 10 = plants defoliated or dead. Rust severity was assessed using the ICRISAT 1-9 rating scale where 1 = no disease and 9 = 80 to 100% of leaves withered on September 26. Stem rot hit counts (1 hit was defined as $\leq$ 1 foot of consecutive stem rot damaged plants per row) were made immediately after plot inversion on October 14. Yields are reported at 10% moisture. Significance of treatment effects were tested by analysis of variance and the least significant difference (LSD) test ($P \leq 0.05$).

Results: In 2009, monthly rainfall totals except in June equaled or exceeded the 30 year average. Since the cultivar x treatment interaction for leaf spot, rust, and yield is significant; data presented in Table 1 was pooled by insecticide treatment and peanut cultivar. While peanut cultivar had a significant impact on TSWV and white mold incidence, leaf spot and rust severity, and yield, the soil insecticide treatment had a significant effect on TSWV incidence, rust severity, and yield.

While TSWV pressure was low, disease incidence was significantly higher in the non-treated control than in the Temik 15G and Thimet 20G-treated peanuts (Table 1). When compared with the non-treated control, rust severity was lower for the Thimet 20G-treated peanuts. While yields for the Temik 15G and Thimet 20G-treated peanuts were higher than the non-treated controls, highest yields were obtained with Temik 15G.

Incidence of TSWV was equally high for McCloud, Georgia Green, Georgia 06G, Georgia 02C, and AP-4. Tifguard had lower levels of TSWV than McCloud, Georgia Green, and Georgia 02C (Table 1). Late leaf spot was the dominant leaf spot disease. Among all peanut cultivars, Georgia 07W had the highest leaf spot rating. Noticeable leaf spotting with some defoliation was also noted on AP-4, Georgia Green, Georgia 06G, Florida 07, and McCloud. Lowest leaf spot severity was recorded for Georgia 02C and York. Due to frequent late summer and early fall showers, rust pressure was high. Georgia 07W and Georgia 06G, which had the highest rust ratings, suffered considerable disease-related leaf damage. Noticeable rust damage was also seen on AP-4, McCloud, and Georgia Green. Florida 07, Georgia 02C, Georgia Greener, Tifguard, and York had the lowest rust ratings. Although white mold pressure was low, differences in disease incidence between cultivars were seen. Equally high white mold hit counts were noted for Florida 07 and McCloud. Lowest white mold incidence was seen on Georgia 02C and York. Yield was higher for York compared with all other cultivars except for Georgia 02C. Georgia 06G, Georgia Green and Georgia Greener had yields similar to Georgia 02C. With Georgia 07W and McCloud, high leaf spot and/or rust ratings translated into the lowest pod yields.

Summary for Gulf Coast: Despite low TSWV pressure, soil insecticides Thimet 20G and Temik 15G reduced disease incidence and increased peanut yield when compared with the non-treated control. Higher yields obtained with Temik 15G when compared with Thimet 20G could not be attributed to control of any disease or the peanut root knot nematode, which was not present. The significant reduction in rust severity that was also obtained with Thimet 20G was not reflected in higher pod yields.

Lower leaf spot, rust, and white mold ratings for York and Georgia 02C translated into the highest yields. With the exception of the leaf spot and rust damaged cultivars McCloud and Georgia 07W, yields for AP-4, Florida 07, Georgia 06G, Georgia Greener, and Tifguard were similar to those reported for the current industry standard Georgia Green.

Table 1. Disease ratings and yields for soil insecticide treatments and peanut cultivars at the Gulf Coast Research and Extension Center in 2009.

Split plot analysis ***P*(F value)**	TSWV hits/60 ft[y]	Leaf spot rating[x]	Rust Rating[w]	White mold[y]	Yield lb/A
Peanut cultivar ……..	0.0481*[z]	<0.0001***	<0.0001***	<0.0001***	<0.0001***
Soil insecticide …….	<0.0001***	0.2281	0.0354*	0.3277	<0.0001***
Soil insecticide x cultivar ….	0.2009	0.2073	0.0933	0.7333	0.2796
Soil insecticide means					
Temik 15G 6.5 lb/A …….	2.4 b[v]	4.0 a	4.9 ab	2.0 a	4115 a
Thimet 20G 4 lb/A ……...	2.4 b	3.9 a	4.7 b	1.9 a	3758 b
Non-treated control ……..	4.0 a	4.1 a	5.2 a	2.2 a	3365 c
Cultivar means					
Mid-season (130-145 DAP)					
AP-4 ……..	3.2 abc	4.2 bc	5.4 b	2.3 bc	3660 cd
Florida 07 …….	2.7 bc	4.3 b	4.3 d	3.7 a	3688 cd
Georgia 06G …….	3.3 abc	4.4 b	5.6 ab	1.6 bcd	3928 bc
Georgia 07W …….....	2.6 bc	4.8 a	6.2 a	2.0 bcd	3293 de
Georgia Green ……..	3.6 ab	4.2 bc	5.0 bc	2.4 b	3841 bc
Georgia Greener ……...	2.4 bc	3.9 c	4.4 cd	1.6 bcd	3806 bc
McCloud ……...	4.6 a	4.3 b	5.3 b	3.6 a	3145 e
Tifguard …….....	2.0 c	3.6 d	4.5 cd	1.5 cd	3557 cd
Late (140-165 DAP)					
Georgia 02C …….	3.4 ab	3.1 e	4.3 d	0.4 e	4100 ab
York ……	2.9 bc	3.1 e	4.1 d	1.2 de	4427 a

[z]Significance at the 0.05, 0.01, and 0.001 levels is indicated by *, **, or ***, respectively.
[y]TSWV and white mold incidence is expressed as the number of hits per 80 feet of row.
[x]Leaf spot was rated using the Florida 1 to 10 rating scale.
[w]Rust severity was assessed using the ICRISAT 1 to 9 rating scale.
[v]Means in each column that are followed by the same letter are not significantly different according to Fisher's protected least significant difference (LSD) test ($P \leq 0.05$).

WIREGRASS RESEARCH AND EXTENSON CENTER TRIAL

Production methods: The study area was turned with a moldboard plow and worked to seed bed condition with a disk harrow on May7. Nine commercial runner-market type peanut cultivars were planted on June 2 at a rate of 6 seed/ft of row using conventional tillage practices in a Dothan sandy loam (OM≤1%) soil in a field cropped to peanut every other year. Weed control and soil fertility recommendations of the Alabama Cooperative Extension System were followed. The test area was irrigated as needed. A split plot design with cultivars as whole plots and an at-plant soil insecticide treatment as sub-plots was used. Whole plots were randomized in six complete blocks. Individual sub-plots consisted of four 40-foot rows spaced 3.2-feet apart. Sub-plot insecticide treatments were Thimet 20G at 4 pounds per acre, Temik 15G at 6.5 pounds per acre, and a non-treated control. Full canopy sprays of Bravo Weather Stik 6F at 1.5 pints per acre on June 30 and July 14 were followed by applications of Abound 2SC at 18.5 fluid ounces per acre on July 28, Bravo Weather Stik 6F on August 11, Abound 2SC at 18.5 fluid ounces per acre on August 25, and Bravo Weather Stik 6F at 1.5 pints per acre on September 8 and September 24 to control leaf spot diseases and white mold. Fungicides were applied with a tractor mounted boom sprayer with 3 TX-8 nozzles per row at 15 gallons of spray volume per acre at 45 psi.

Disease Assessment: Final TSWV hit counts (1 hit equaled ≤ 1 foot of consecutive TSWV-damaged plants per row) were made on October 19. Early and late leaf spot were rated on October 19 using the 1-10 Florida peanut leaf spot scoring system where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and ≤ 10% defoliation, 5 = lesions noticeable and ≤ 25% defoliation, 6 = lesions numerous and ≤ 50% defoliation, 7 = lesions very numerous and ≤ 75% defoliation, 8 = numerous lesions on few remaining leaves and ≤90% defoliation, 9 = very few remaining leaves covered with lesions and ≤ 95% defoliation, and 10 = plants defoliated or dead. White mold hit counts (1 hit equaled ≤ 1 foot of consecutive diseased plants per row) were made immediately after plot inversion on October 22 on the mid-season and November 3 on the late maturing peanut cultivars. Yields are reported at 9% moisture. Significance of treatment effects were tested by analysis of variance and the least significant difference (LSD) test ($P \leq 0.05$).

Results: In 2009, monthly rainfall totals except for June equaled or exceeded the 30 year average. While peanut cultivar had a significant impact on TSWV and white mold incidence as well as, leaf spot severity and yield, soil insecticides had a significant effect on only TSWV incidence (Table 2). According to the significant soil insecticide x cultivar interaction for TSWV, the impact of the soil insecticide treatments on TSWV incidence differed between peanut cultivars (Table 1). Since the soil insecticide x cultivar interactions for leaf spot, white mold incidence, and yield were not significant; data was pooled by peanut cultivar in Table 3 and soil insecticide treatment in Table 4.

Table 2. ANOVA for impact of soil insecticides on disease and yields of peanut at the Wiregrass Research and Extension Center in 2009.

Split plot analysis *P*(F value)	TSWV	Leaf spot	White mold	Yield
Peanut cultivar ……	<0.0001***[z]	<0.0001***	<0.0001***	<0.0001***
Soil insecticide ……...	<0.0001***	0.8236	0.1329	0.3154
Soil insecticide x cultivar ……...	0.0090**	0.0688	0.8159	0.6920

[z]Significance at the 0.05, 0.01, and 0.001 levels is indicated by *, **, or ***, respectively.

While overall TSWV pressure was low due to the early June planting date, one or both of the soil insecticides significantly reduced disease incidence when compared with the non-treated control on all cultivars except for Florida 07 and Georgia 06G (Table 3). On Georgia 02C, Georgia 07W, Georgia Green, McCloud, and Tifguard, similar reductions in TSWV incidence were obtained with Temik 15G and Thimet 20G. When compared with the non-treated control, TSWV incidence was lower in Georgia Greener and York treated with Temik 15G but not with Thimet 20G. On the latter two cultivars, the Thimet 20G and Temik 15G-treated peanuts had similar TSWV ratings.

Leaf spot ratings and yield for the soil insecticide-treated peanuts and the non-treated control were similar (Table 4). While white mold incidence was lower with Thimet 20G than Temik 15G, hit counts in peanuts treated with both soil insecticides and the non-treated controls were similar. Yields for the insecticide- and non-treated controls did not significantly differ.

Table 3. Impact of soil insecticides on TSWV incidence on selected peanut cultivars at the Wiregrass Research and Extension Center in 2009.

	TSWV incidence[z]		
Peanut cultivar	Temik 15G 6.5 lb/A	Thimet 20G 4 lb/A	Non-treated Control
Mid-season (130-145 DAP)			
Florida 07 ……...	2.5 a[y]	2.8 a	3.7 a
Georgia 06G ……..	3.0 a	4.2 a	4.3 a
Georgia 07W …….....	2.2 b	2.3 b	3.7 a
Georgia Green ……...	3.3 b	5.2 b	9.8 a
Georgia Greener ……	2.2 b	2.8 ab	4.3 a
McCloud ……	2.5 b	2.5 b	4.5 a
Tifguard …….....	2.0 b	2.8 b	4.3 a
Late (140-165 DAP)			
Georgia 02C ……...	2.3 b	3.0 b	5.7 a
York ……...	2.5 b	3.2 ab	4.3 a

[z]TSWV incidence is expressed as the number of hits per 80 feet of row.
[y]Means in each row that are followed by the same letter are not significantly different according to Fisher's protected least significant difference (LSD) test ($P \leq 0.05$).

Highest leaf spot ratings were recorded for Georgia 07W (Table 4). While lower than the latter cultivar, McCloud, Florida 07, Georgia Green, and Georgia 06G had equally high leaf spot ratings. The least leaf spotting and premature defoliation was noted on Tifguard and York. While overall white mold incidence was low, differences in damage levels were found between peanut cultivars. Disease incidence was higher on McCloud than on all other cultivars except for Georgia Green and Georgia 06G. Georgia 07W, Georgia 02C, and York suffered the least white mold damage. With the exception of Florida 07, highest yield was recorded for Georgia 07W. Lowest yielding cultivars included the late maturing Georgia 02C and York as well as Tifguard and the current industry standard Georgia Green.

Summary for Wiregrass Trial: When compared with the non-treated control, significant reductions in TSWV incidence were obtained on five and seven of nine peanut cultivars with the soil insecticides Temik 15G and Thimet 20G, respectively. Of the nine cultivars, neither soil insecticide reduced TSWV incidence in Florida 07 or Georgia 06G. While Thimet 20G did reduce white mold incidence compared with Temik 15G, leaf spot ratings and yield for the soil insecticide-treated peanuts and the non-treated control were similar.

Low disease ratings often were not associated with the highest yields. With the exception of Georgia Green, TSWV incidence probably had no impact on yield. Georgia 07W, which had the highest leaf spot rating, also outyielded all peanut cultivars except for Florida 07. McCloud, which was one of the higher yielding cultivars, also had high leaf spot and white mold ratings. Low yields for the late maturing Georgia 02C and York, which displayed good disease resistance, could be attributed to the June planting date as well as the unseasonably wet and cold October weather that probably slowed crop maturation.

Trial Summary: Despite low TSWV pressure, reductions in the incidence of this disease were obtained at both locations with Thimet 20G and Temik 15G when compared with the non-treated control. Significant yield gains were obtained with the soil insecticide treatments in the Gulf Coast but not the Wiregrass Trials. In the former study, yields were higher for the Temik 15G- than the Thimet 20G-treated peanuts.

Table 4. Disease ratings and yield response to soil insecticide treatments and peanut cultivars at the Wiregrass Research and Extension Center in 2009.

	Leaf spot rating[x]	White mold hits/80 ft[y]	Yield lb/A
Soil insecticide and rate/A			
Temik 15G 6.5 lb/A ……..	3.9 a	2.5 a	4551 a
Thimet 20G 4 lb/A ……...	3.9 a	1.8 b	4443 a
Non-treated control ……...	3.9 a	2.1 ab	4576 a
Cultivar means			
Mid-season (130-145 DAP)			
Florida 07 …….	4.1 bc	1.9 cd	4953 ab
Georgia 06G …….	3.9 bcd	2.8 abc	4668 bc
Georgia 07W …….....	4.6 a	1.1 de	5173 a
Georgia Green ……..	4.0 bcd	3.6 ab	4114 e
Georgia Greener ……...	3.7 de	2.4 bc	4453 cd
McCloud ……..	4.2 b	3.7 a	4730 bc
Tifguard …….....	3.4 ef	2.3 c	4332 de
Late (140-165 DAP)			
Georgia 02C …….	3.8 cd	0.9 de	4111 e
York …….	3.2 f	0.6 e	4157 de

[x]Leaf spot was rated using the Florida 1 to 10 rating scale.
[y]White mold incidence expressed as the number of hits per 80 feet of row.
[w]Means in each column that are followed by the same letter are not significantly different according to Fisher's protected least significant difference (LSD) test ($P \leq 0.05$).

In both trials, late planting dates greatly reduced TSWV pressure and minimized disease-related yield loss. So, differences in the TSWV levels between peanut cultivars at both locations may not reflect the reaction of those cultivars to this disease should planting dates be advanced to late April or early May.

Sizable differences in late leaf spot severity were noted at both sites. Cultivars with the lowest leaf spot ratings at both locations were Tifguard and York. In contrast, Florida 07, Georgia 06G, Georgia 07W, and McCloud were as if not more susceptible to late leaf spot than Georgia Green.

Rust was an issue in the Gulf Coast but not the Wiregrass trial. The high level of rust damage on Georgia 07 suggests that this cultivar may not be a good fit for southwest Alabama peanut producers. Given the right weather patterns and fungicide program, Georgia 06G, AP-4, and McCloud may be prone to significant rust damage. In contrast, Florida 07, Georgia 02C and York proved least sensitive to rust.

As was noted above for TSWV, the late May and early June planting dates are largely responsible for the low level of white mold damage observed at both locations. With earlier planting dates, larger differences in the level of white mold damage probably would be noted between peanut cultivars.

Sizable differences in yield response of individual peanut cultivars were seen between study sites. Disease damage as well as fall weather patterns were partially responsible for yield differences. As a group, the mid-season cultivars had higher yields in the Wiregrass than the Gulf Coast trial. Across both locations, Georgia 06G and possibly Florida 07 had the most consistent yields of all the cultivars tested.