THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

Tobacco Research Report

2009

2009 Tobacco Research Report

(Summary Report of 2009 Data)

Edited by Stephen W. Mullis

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Foreword

The face of agriculture is changing rapidly. Like most agricultural enterprises, the tobacco industry has changed dramatically in recent years and continues to evolve. Many challenges exist, including those associated with plant disease, fertility, insects and changing markets, all of which impact profitability. The University of Georgia aims to conduct the research and education programs necessary to provide the science-based information growers need to make informed decisions and enhance profitability.

There is a long history of tobacco research and Extension programming at the University of Georgia in Tifton, where dedicated scientists and technical staff work to address issues facing growers. Partnerships and financial support from the Georgia Tobacco Commission and from the tobacco industry have provided resources over the years to enable scientists to conduct the work that addresses issues facing the tobacco industry. This report contains the most recent results of tobacco research programs at the University of Georgia. We hope that you find the information in this report useful in moving the tobacco industry forward.

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Flue-Cured Tobacco Variety Evaluation in Georgia

S.S. LaHue, C.E. Troxell and J.M. Moore

Introduction

Tobacco varieties play a discerning role in yield and quality improvement programs. A vital part of any breeding program is the appropriate testing and evaluation of new tobacco varieties. Important characteristics of these varieties include yield, disease resistance, desirable plant qualities, ease of handling and market acceptability. For a variety to be recommended it must be superlative in one or more of these areas and contain a balance of the remainder of the factors. It is undesirable for a variety to have an excellent yield and poor disease resistance or to yield well and have poor cured quality.

The Regional Variety Test is conducted to obtain data on yield, disease resistance, quality (as judged by physical appearance) and chemical analysis for quality characteristics. Once this information is analyzed, the desirable varieties and breeding lines in these tests advance to the Official Variety Test for further evaluation under growing and marketing conditions in Georgia. As in previous years, we have included the Regional Farm Test so that when varieties are selected from this test UGA Cooperative Extension will have a second data set to use in making recommendations to growers.

Materials and Methods

The 2009 Official Variety Test and Regional Small Plot Test consisted of 32 and 34 entries, respectively, while the Farm Test had 11 entries. These tests were conducted at the University of Georgia Bowen Farm on an Ocilla loamy coarse sand. All transplants were treated with the low labeled rate of Actigard and Admire for Tomato spotted wilt virus (TSWV). The test was mechanically transplanted on April 5-6 with 22 plants per field plot and was replicated three times. Fertilization consisted of 500 lbs/acre of 6-6-18 at first cultivation, 200 lbs/acre of 15-0-14 at second cultivation, and an additional 200 lbs/acre of 15.5-0-0 at lay-by, for a total of 90 lbs/acre of nitrogen.

Cultural practices, harvesting and curing procedures were uniformly applied and followed the current University of Georgia recommendations. Data normally collected included plant stand, yield in lbs/A, value/A in dollars, dollars per hundred weight, grade index, number of leaves/plant, plant height in inches and days to flower. The chemical determinations would have consisted of total alkaloids, total soluble sugars, and the ratio of sugar to total alkaloids; however, this data is not presented due to disease and nematode damage.

Results and Discussion

The 2009 Variety Tests began well with a good survival rate but, as in the past, a small amount of Rhizoctinia developed. Although this is usually not a problem since air and soil temperatures rise in April, temperatures remained at record low levels in March, April and May and Rhizoctinia development was further aggravated by record rainfall in March and April of 10.55 inches and 7.40 inches, respectively. The March rainfall also eliminated any trace of fumigation with Mocap and Nemacur. Also, the crop suffered from a major root knot nematode infestation. The cool, moist conditions kept the Tomato spotted wilt virus from appearing until the end of May, which reduced the efficacy of the Actigard/Admire treatments. Even at nearly eight weeks, the treated plants were at 30% infection compared to 50% for the non-treated plants.

A table is presented for each test showing the disease condition by June 8, at which point the tests were terminated. This includes the number of TSWV infected plants in each replication, total symptomatic and percent symptomatic. Nematode damage is illustrated by the number of small, immature surviving plants versus plants reaching normal harvest size. After the test was terminated, all roots were dug and inspected for root knot; all plants were infected. In order to reduce this problem, the tobacco plot area for 2010 has been treated with 10lbs/A of Telone.

Tomato Spotted Wilt Virus (TSWV) and Nematode Damage of Released Varieties Evaluated in the 2009 Official Flue-Cured Tobacco Variety Test at the University of Georgia, Tifton, Ga.							
	TSWV Damage					Nematode Damage	
	TSWV Plants / Plot			Total Symptomatic[1]	Percent Symptomatic[2]	Surviving Plants/Plot[3]	Mature Plants/Plot[4]
Variety	Rep 1	Rep 2	Rep 3				
NC 2326	12	4	4	20	30	20	3.3
NC 95	12	2	8	22	33	21	12.6
C 371 Gold	6	5	5	16	24	18	0
K 326	5	9	3	17	26	19	2.6
K 346	3	10	7	20	30	18	0.6
K 399	5	5	3	13	20	19	0
K 326 CC	3	6	5	14	21	19	0
NC 71	4	8	6	18	27	19	0
NC 72	5	11	10	26	39	17	0.6
NC 297	3	9	3	15	23	21	0
NC 810	5	6	7	18	27	20	0.3
NC 55	3	5	9	17	26	18	1.0
NC 291	4	16	6	26	39	19	0.3
NC 299	6	4	5	15	23	16	0.6
NC 196	6	6	3	15	23	18	1.3
NC 102	3	9	5	17	26	18	0
GL 973	4	4	7	15	23	18	0
GL 350	5	8	9	22	33	18	1.6
GL 939	3	17	17	37	56	20	6.6
GL 390	2	9	4	15	23	17	0
GL 600	3	4	9	16	24	16	2.0
GL 737	6	3	3	12	18	17	0
CC 301	8	9	5	22	33	21	3.6
CC 27	1	16	7	24	36	15	0
CC 801	7	10	13	30	45	18	3.6
Speight 168	1	5	10	16	24	18	0
Speight 179	3	2	6	11	17	22	0.6
Speight 210	5	4	5	14	21	18	0.6
Speight 220	2	5	8	15	23	18	1.0
Speight 225	7	12	7	26	39	20	3.3
Speight 227	5	8	2	15	23	19	1.3
Speight 234	5	5	5	15	23	19	0.3

1 Total number of TSWV symptomatic plants across 3 replications.
2 Percent of TSWV symptomatic plants across 3 replications.
3 Mean of the number of living plants in a 22-plant plot across replications.
4 Mean of the number of plants that could be harvested across replications.

Researched by Stevan S. LaHue and M.G. Stephenson, under project S1-71 and supported by grants from the Georgia Tobacco Commission.

Tomato spotted wilt virus (TSWV) and Nematode Damage of Varieties Evaluated in the 2009 Regional Small Plot Flue-Cured Variety Test at the University of Georgia, Tifton, Ga.							
	TSWV Damage					**Nematode Damage**	
	TSWV Plants / Plot			**Total Symptomatic[1]**	**Percent Symptomatic[2]**	**Surviving Plants/Plot[3]**	**Mature Plants/Plot[4]**
Variety	**Rep 1**	**Rep 2**	**Rep 3**				
NC 2326	12	4	4	20	30	20	3.3
NC 95	12	2	8	22	33	21	12.6
K 326	5	3	4	12	18	20	3.6
NC 606	6	7	8	21	32	21	1.3
Speight 179	9	4	8	21	32	20	6.0
RJR 352	3	9	6	18	27	19	5.6
NC TG 139	3	8	6	17	26	20	6.3
RX 409	5	5	3	13	20	20	1.6
Speight 239	5	4	6	15	23	18	3.0
RJR 33	4	8	8	20	30	21	5.6
NC TG 138	3	6	8	17	26	21	6.0
XP 257	10	2	9	21	32	22	3.0
CU 83	4	9	7	20	30	19	4.0
XP 201	3	9	4	16	24	19	2.0
CU 87	3	2	2	7	11	20	0
NCTG 141	3	6	5	14	21	18	3.0
RJR 227	3	10	4	17	26	21	5.3
Speight 240	2	5	3	10	15	21	0.6
CU 22	3	2	2	7	11	20	0.6
CU 61	9	3	10	22	33	20	3.0
RJR 37	7	3	4	14	21	22	0.6
XP 253	6	4	4	14	21	18	2.3
RX 408	6	5	4	15	23	20	3.3
XP 239	5	8	6	19	29	19	3.6
RX 452	5	7	7	19	29	19	0.3
ULT 138	2	7	5	14	21	21	1.6
NC TG 142	1	6	5	12	18	21	2.0
Speight 241	6	11	10	27	41	21	3.6
XP 256	4	6	11	21	32	20	3.6
NC TG 140	10	4	6	20	30	19	3.3
RX483	4	7	7	18	27	21	5.0
ULT 220	8	5	5	18	27	22	4.3
CU 105	7	4	5	16	24	19	6.0
RX 463	5	7	3	15	23	20	5.6

[1] Total number of TSWV symptomatic plants across 3 replications.
[2] Percent of TSWV symptomatic plants across 3 replications.
[3] Mean of the number of living plants in a 22-plant plot across replications.
[4] Mean of the number of plants that could be harvested across replications.

Researched by Stevan S. LaHue and M.G. Stephenson, under project S1-71 and supported by grants from the Georgia Tobacco Commission.

Tomato Spotted Wilt Virus (TSWV) and Nematode Damage of Varieties Evaluated in the 2009 Regional Farm Flue-Cured Tobacco Variety Test at the University of Georgia, Tifton, Ga.

	TSWV Damage					Nematode Damage	
	TSWV Plants / Plot			Total	Percent	Surviving	Mature
Variety	**Rep 1**	**Rep 2**	**Rep 3**	**Symptomatic[1]**	**Symptomatic[2]**	**Plants/Plot[3]**	**Plants/Plot[4]**
NC 2326	7	5	5	17	26	15	1.0
NC 95	7	7	11	25	38	18	3.3
ULT 135	6	8	4	18	27	18	0
Speight 236	5	5	5	15	23	16	0
XP 2110	9	7	5	21	32	17	0
Speight 235	4	3	1	8	12	13	0
NCTG 135	3	8	6	17	26	16	2.0
XP 2035	5	8	5	18	27	19	0
GL 330	5	9	6	20	30	12	0
NCTG 121	6	12	5	23	35	21	3.3
RX 121	4	5	4	13	20	14	0
CU 95	2	5	3	10	15	13	0
CC 700	6	2	1	9	14	14	0
RJR 13	7	11	12	30	45	21	3.3
RX 123	5	10	3	18	27	17	3.3
Mean	5.4	7.0	5.07	17.5	26.5	16.3	1.0

[1] Total number of TSWV symptomatic plants across 3 replications.
[2] Percent of TSWV symptomatic plants across 3 replications.
[3] Mean of the number of living plants in a 22-plant plot across replications.
[4] Mean of the number of plants that could be harvested across replications.

Researched by Stevan S. LaHue and M.G. Stephenson, under project S1-71 and supported by grants from the Georgia Tobacco Commission.

Regional Small Plot - Black Shank Evaluation
Black Shank Farm, Tifton, Ga., 2009

A.S. Csinos, L. Mullis and L.L. Hickman

Introduction
Black Shank continues to be a persistent and serious root and stem disease of tobacco. In this study, several tobacco cultivars with monogenic resistance to Race 0 of Black Shank and cultivars with polygenic resistance (FL301) were evaluated in the disease nursery, which has a mixture of Race 0 and Race 1 of the pathogen.

Methods and Materials
The study was located at the University of Georgia's Black Shank Farm, Tifton, Ga., in a field with a continuous history of Black Shank in tobacco. The plot design was a randomized complete block consisting of single row plots that were replicated three times. Each plot was 32 feet long with an average of 23 plants per test plot.

On 20 January, 38 tobacco varieties were seeded in a greenhouse in 242-cell flats.

2009 varieties for field evaluation were:

NC 2326	NC EX 25	NC EX 10	CU 113
1071	CU 118	ULT 112	NC EX 19
K 326	RJR 911	CC 151	CU 110
CC 920	RJR 908	GL 395	CU 100
EXP 480	CU 95	EXP 822	RJR 901
XP 278	NC EX 16	XP 254	NC EX 24
NC EX 23	ULT 142	RJR 909	XP 340
EXP 819	EXP 388	AOV 911	NC 71
CC 304	XP 248	RJR 910	PVH 1452
			PVH 2110

The field was prepared on 18 February by disc harrowing the area. Fertilizer 4-8-12 at 500lbs/A was broadcast in plot areas and tilled in on 25 March. On 26 March, applications of Prowl 3.3 at 2.0 pts/A, Lorsban 4E at 3qt/A, and Nemacur 3 at 2gal/A were incorporated into the plot area. Plots were subsoiled and bedded on 26 March.

Tobacco transplants were treated in the greenhouse on 27 March with Admire Pro at 1 fl.oz/1,000 plants and Actigard 50WG at 4 grams/7,000 plants. Both materials were tank mixed. Plants were pre-wet with materials being washed in after spraying.

Tobacco was transplanted on 13 and 14 April on 48-inch-wide rows with an 18-inch plant spacing. Cultivation and side-dress fertilizer were as follows: 90lbs/A of 15.5-0-0 calcium nitrate on 23 April; and 500lbs/A of 4-8-12 on 06 May and 29 May. Layby was done on 29 May.

Additional pesticide applications on tobacco were applied as follows: 3 June, sprayed Actigard 50 WG at 0.5 oz/A in a 12-inch band, one nozzle over row in 10.35 GPA H_2O.

Tobacco was topped and suckered on 17 June. Royal MH 4% solution at 50 gal/A was applied on 19 June.

Total rainfall recorded at the Black Shank Farm during this period (March through August 2009) was 34.22 inches.

Summary
With the high level of disease in NC1071, we feel that this location has a very low level of Race 0 present. Lines RJR911, CU113 and RJR901 had the lowest levels of disease. TSWV levels ranged from a high of 10% to a low of 2%. (Data detailed in table.)

Acknowledgements
The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco for financial support. Thanks are also extended to Clint Powell, Cody Singletary, Haley Gibbs, Remigio Padilla- Hernandez, Mac Denny and Trevor Cook for their technical support.

2009 Regional Small Plot -Black Shank Nursery - Tifton, Georgia

Table 1. Percent Black Shank disease and Percent Tomato Spotted Wilt Virus A

	% Disease from Black Shank[2] (*Phytophthora parasitica* var. *nicotianae*)				
Tobacco Variety	**Rep I**	**Rep II**	**Rep III**	**Mean**	**% TSWV[3]**
1. NC 2326	90.48	100.00	47.37	79.28a-e	10.36abc
2. 1071	80.95	100.00	100.00	93.65a	3.18cd
3. K 326	68.18	70.00	87.5	75.23a-f	10.11a-d
4. CC 920	28.57	80.95	100.00	69.84a-g	1.59d
5. EXP 480	81.82	90.48	100.00	90.76ab	4.62bcd
6. XP 278	68.18	71.43	70.0	69.87a-h	12.79a
7. XP 275	40.00	75.00	61.1	58.7d-i	12.22ab
8. NC EX 23	70.00	90.91	95.24	85.38a-d	1.67d
9. EXP 819	65.22	94.12	77.27	78.87a-e	7.38bcd
10. CC 304	50.00	76.19	64.71	63.63b-h	1.59d
11. NC EX 25	77.27	100.00	100.00	94.42ab	1.52d
12. CU 118	66.67	60.87	86.67	71.4a-g	6.71bcd
13. RJR 911	10.00	0.00	55.56	20.69j	8.89a-d
14. RJR 908	85.71	66.67	69.57	73.98a-f	3.18cd
15. CU 95	35.00	55.56	35.00	41.85hij	3.52cd
16. NC EX 16	90.91	90.48	85.71	89.03abc	5.48bcd
17. ULT 142	100.00	90.48	90.00	93.49a	3.25cd
18. EXP 388	52.17	90.00	100.00	80.72a-e	5.80bcd
19. XP 248	13.04	71.43	78.95	54.47e-i	16.97a
20. NC EX 10	81.82	38.10	83.33	67.75a-h	7.79bcd
21. ULT 112	100.00	100.00	68.42	89.47ab	5.26bcd
22. CC 151	71.43	100.00	58.82	76.75a-e	1.59d
23. GL 395	72.73	95.65	100.00	89.46ab	1.52d
24. EXP 822	47.62	61.91	69.57	59.70c-h	4.62bcd
25. XP 254	100.00	71.43	90.00	87.14a-d	6.43bcd
26. RJR 909	33.33	66.67	92.86	64.29a-h	3.44cd
27. AOV 911	81.82	80.95	91.30	84.69a-d	7.65bcd
28. RJR 910	45.0	31.82	56.52	44.45g-j	7.66bcd
29. CU 113	6.67	31.58	23.81	21.85j	7.95bcd
30. NC EX 19	100.00	85.00	80.95	88.65abc	1.67d
31. CU 110	47.37	89.47	100.00	78.95a-e	5.26bcd
32. CU 100	45.46	86.67	5.26	45.79f-j	7.25bcd
33. RJR 901	18.18	38.10	33.33	29.87ij	3.10cd
34. NC EX 24	66.67	90.48	90.00	82.38a-e	4.84bcd
35. XP 340	89.47	90.48	90.48	90.14ab	4.93bcd
36. NC 71	58.82	90.91	44.44	64.73a-h	7.29bcd
37. PVH 1452	63.64	90.48	36.36	63.49b-h	3.10cd
38. PVH 2110	68.18	77.78	80.95	75.64a-e	6.54bcd

[A] TSWV infected plants were removed from total stand counts to calculate % Disease and Disease Index for Black Shank

[1] Data are means of three replications. Means followed by the same letter are not different (P=0.05) according to Fisher's LSD test.

[2] Percent death by Black Shank was calculated by subtracting the final number of harvest plants from the original base count. The number of flagged plants with TSWV was subtracted from that total to get the number of plants killed by Black Shank. The number was then divided by the original base count and multiplied by 100.

[3] Death by TSWV was calculated by subtracting the final number of harvest plants from the original base count. Plants flagged that were dead or missing were considered killed by TSWV.

Black Shank Chemical Evaluation Trial on Tobacco
Black Shank Farm, Tifton, Ga., 2009

A.S. Csinos, L. Mullis and L.L. Hickman

Introduction
Black Shank continues to be a serious disease of tobacco in Georgia. This test evaluates two formulations of mefenoxam in a disease nursery with both Race 0 and Race 1 of *Phytophthora parasitica* var. *nicotianae* (Ppn).

Methods and Materials
The study was located at the Black Shank Farm, CPES, Tifton, Ga. in a field with a history of Black Shank in tobacco. The plot design was a randomized complete block consisting of single row plots, and was replicated five times. Each plot was 32 feet long with an average of 23 plants per test plot.

On 30 January, tobacco variety K-326 was seeded in a greenhouse in 242-cell flats. The field was prepared on 17 February by disc harrowing area. Fertilizer 4-8-12 at 500lbs/A was broadcast in plot areas and tilled in on 25 March. On 10 April, applications were made of Devrinol 50DF at 4lb/A and Vydate L at 1 gal/A. Materials were incorporated into the soil and plots were sub-soiled and bedded.

Treatment 7, metam sodium at 37.5gal/A, was applied preplanting on 24 March. Material was applied using a tractor-mounted injection unit with 4 shanks on a 4-foot bed, 12 inches apart and approximately 11 inches deep. Material was incorporated immediately after soil injection and sealed with a drag pulled behind a tractor. The treated area was irrigated with approximately .65 inches of water to create a barrier seal.

Tray drench treatments were applied in the greenhouse on 15 April. First cultivation treatments were applied on 14 May, and layby treatments applied on 27 May.

Tobacco variety K-326 transplants (seeded on 30 January) were treated in the greenhouse on 14 April with Admire Pro at 1 fl.oz/1,000 plants and Actigard 50WG at 4 grams/7,000 plants. Both materials were tank mixed. Plants were pre-wet with materials being washed in after spraying. Tobacco was transplanted on 16 April on 48-inch-wide rows with an 18-inch plant spacing. On 21 April, Treatment 4 (Ridomil Gold 4 SL) plots had to be replanted due to tray drench phytotoxicity and plant death. Tray drench treatment for this treatment was replaced with an over-the-top at-plant treatment.

Cultivation and side-dress fertilizer was as follows: 90 lbs/A of 15.5-0-0 calcium nitrate on 22 April and 28 May; and 500 lbs/A of 4-8-12 on 08 and 28 May.

Additional pesticide applications on tobacco were applied as follows: sprayed Actigard 50 WG at 0.5 oz/A in a 12-inch band, one nozzle over row in 10.35 GPA H_2O and Orthene 97 at 1 lb/A on 3 June.

Tobacco was topped and suckered on 18 June and again on 24 June. Royalto M 4% solution at 55 gal/A was applied on 23 and 26 June. Flupro at 2 qt/A was tank mixed with Fair 30 (MH-30 Extra) at 2 gal/A + Butralin at 2 qts/A in 55 GPA water.

Stand counts were conducted every two weeks, noting percent disease from TSWV and Black Shank. Tobacco plots were also scouted for signs of phytotoxicity.

Vigor ratings were done on a 1-10 scale with 10 equaling vigorous and healthy plants and 1 equaling poor vigor plants. Ratings were conducted on 11 May and 09 June.

Height measurements were conducted on 15 June. Plants were measured individually from the soil level to the tip of the longest leaf and recorded in centimeters.

Due to severe disease incidence, only two harvests were conducted, on 07 July and 06 August. Harvests were done by collecting half of the plant's leaves at one time and weighing each plot in pounds.

Total rainfall recorded at the Black Shank Nursery during this period (March through August, 2009) was 39.80 inches.

Summary
Disease pressure was high and plants died early. High disease losses were noted on all treatments. Vigor was generally high on all early treatments. No significant differences were noted among treatments for percent Black Shank. Only Presidio significantly increased yield over the non-treated control.

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The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco for financial support.

Black Shank Chemical Evaluation Trial on Tobacco, Black Shank Farm, 2009

Table 1. Plant vigor, Percent Black Shank, and Percent Tomato Spotted Wilt Virus

Treatment[1]	Product Rate	Application Schedule	Vigor[2]	% death by Black Shank[3]	% Symptomatic TSWV[4]	Dry Weight Yield[5]
1. Presidio (fluopicolide)	4.0oz/A	Tray Drench, 1st Cultivation and at Layby	7.4ab	46.7a	3.5b	1037.7a
2. Ranman (cyazofamid)	2.75oz/A	Tray Drench, 1st Cultivation and at Layby	7.7ab	84.2a	6.0ab	183.4b
3. BASF 65100F	7.0oz/A 13.7oz/A	Tray Drench, 1st Cultivation and at Layby	7.5ab	81.7a	10.0ab	30.9b
4. Ridomil Gold 4 SL	1pt/A	At plant, 1st Cultivation and at Layby	6.5c	50.2a	6.0ab	349.2b
5. Revus (mandipropamid)	7.0oz/A 8.0oz/A	Tray Drench, 1st Cultivation and at Layby	8.0ab	52.1a	9.4ab	422.0b
6. Metam sodium	37.5gal/A	Pre-plant incorporated	8.2a	71.8a	13.4a	198.7b
7. Non-treated Control	N/A	N/A	7.3bc	83.1a	5.0ab	13.5b

[1] Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Fisher's LSD test. No letters signifies non-significant difference.

[2] Vigor was rated a 1-10 scale, with 10 = live and healthy plants and 1 = dead plants, on 11 May and 09 June.

[3] Percent death by Black Shank was calculated by subtracting the final number of harvest plants from the original base count. The number of plants flagged with TSWV were subtracted from that total to get the number of plants killed by Black Shank. That number was then divided by the original base count and multiplied by 100.

[4] Percent TSWV symptomatic plants was calculated by using stand counts that were made from 21 April to 1 July with TSWV being flagged every week.

[5] Dry weight yield was calculated by multiplying green weight totals of tobacco by .15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 7260 divided by the base stand count.

Syngenta Ridomil Evaluation on Tobacco for Control of *Phytophthora parasitica* var. *nicotianae* (Black Shank)
Black Shank Farm, Tifton, Ga., 2009

A.S. Csinos, L. Mullis and L.L. Hickman

Introduction
Black Shank continues to be a serious disease of tobacco in Georgia. This test evaluates two formulations of mefenoxam in a disease nursery with both Race 0 and Race 1 of *Phytophthora parasitica* var. *nicotianae* (Ppn).

Methods and Materials
The study was located at the Black Shank Farm, CPES, Tifton, Ga. in a field with a history of Black Shank in tobacco. The plot design was a randomized complete block consisting of single row plots, and was replicated five times. Each plot was 32 feet long with an average of 23 plants per test plot.

On 30 January, tobacco variety K-326 was seeded in a greenhouse in 242-cell flats. The field was prepared on 17 February by disc harrowing area. Fertilizer 4-8-12 at 500 lbs/A was broadcast in plot areas and tilled in on 25 March. On 10 April, applications were made of Devrinol 50DF at 4 lb/A and Vydate L at 1 gal/A. Materials were incorporated into the soil and plots were sub-soiled and bedded.

Treatments of Ridomil Gold 480SL were applied at planting in the transplant water at a rate of either .33 pt/A (Treatments 3, 4, 6, 8) or 1 pt/A (Treatments 5, 7, 9) on 16 April. Starter fertilizer of 9-45-15 at 6 lbs/100gal water was applied to Treatment 2 alone and Treatment 4 along with the Ridomil Gold at transplant. Original protocol specified that a starter fertilizer rate of 10-34-0 at 14.7 lb/A to be used; however, due to previous experience with using 10-34-0 fertilizer and incidence of phytotoxicity, a decision was made to use an alternative fertilizer.

Tobacco variety K-326 transplants (seeded on 30 January) were treated in the greenhouse on 14 April with Admire Pro at 1 fl.oz/1,000 plants and Actigard 50WG at 4 grams/7,000 plants. Both materials were tank mixed. Plants were pre-wet with materials being washed in after spraying. Tobacco was transplanted on 16 April on 48-inch-wide rows with 18-inch plant spacing.

Cultivation and side-dress fertilizer was as follows: 90 lbs/A of 15.5-0-0 calcium nitrate on 22 April; and 500 lbs/A of 4-8-12 on 27 May. Field applications of the treatments Ridomil Gold 480SL at 1 pt/A were applied at first cultivation to Treatments 6 and 7 on 14 May and at layby to Treatments 8 and 9 on 27 May. Treatments were applied using a CO_2 with two TX-12 tips/row with 50 mesh ball check screens per row at 20 PSI for 16.36 gallons of water/A. Tips were arranged to form a 12-inch band to either side of the rows, angled, and aimed at the base of plants to give a 12-inch band. Plots were then cultivated by throwing soil to the plant for incorporation of treatment chemicals. Additional pesticide applications on tobacco were applied as follows: sprayed Actigard 50 WG at 0.5 oz/A in a 12-inch band, one nozzle over row in 10.35 GPA H_2O on 3 June. Tobacco was topped and suckered on 18 June. Royalto M 4% solution at 55 gal/A was applied on 23 and 26 June. Flupro at 2 qt/A was tank mixed with Fair 30 (MH-30 Extra) at 2 gal/A + Butralin at 2 qts/A in 55 GPA water. Stand counts were conducted every two weeks, noting percent disease from TSWV and Black Shank. Tobacco plots were also scouted for signs of phytotoxicity.

Vigor ratings were done on a 1-10 scale with 10 equaling vigorous and healthy plants and 1 equaling poor vigor plants. Ratings were conducted on 11 May and 09 June.

Due to severe disease incidence, only two harvests were conducted, on 07 July and 06 August. Harvests were done by collecting half of the plant's leaves at one time and weighing each plot in pounds. Total rainfall recorded at the Black Shank Nursery during this period (March through August, 2009) was 39.80 inches.

Summary
Black Shank levels were very high in this trial. All of the treatments sustained high levels of disease, and no differences among disease levels or yields were noted.

Acknowledgments
The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco for financial support. Thanks are also extended to Alana Heath, Holly Hickey, Brice Crawford, Seth Dale and Travis Brown for their excellent support.

Syngenta Ridomil Evaluation on Tobacco, Black Shank Farm, 2009

Table 1. Plant Vigor, Percent Black Shank, and Percent Tomato Spotted Wilt Virus

Treatment[1]	Product Rate	Application Schedule	Vigor[2]	% death by Black Shank[3]	% Symptomatic TSWV[4]	Dry Weight Yield[5]
1. Non-Treated	N/A	N/A	7.0a	79.8a	5.8a	383.0a
2. Non-Treated	14.7 lb/a	Stater Fertilizer (10-34-0) At Transplant	7.7ab	87.9a	5.6a	74.5a
3. Ridomil Gold 480 SL	0.33 pt/a	At Transplant (water)	6.7c	75.1a	7.5a	136.4a
4. Ridomil Gold 480 SL Stater Fertilizer (10-34-0)	0.33 pt/a 14.7 lb/a	At Transplant (water) At Transplant (water)	8.0a	79.3a	3.9a	150.3a
5. Ridomil Gold 480 SL	1 pt/a	At Transplant (spray)	6.9c	65.7a	6.5a	494.0a
6. Ridomil Gold 480 SL Ridomil Gold 480 SL	0.33 pt/a 1 pt/a	At Transplant (water) At 1st Cultivation	7.1bc	68.9a	2.5a	190.6a
7. Ridomil Gold 480 SL Ridomil Gold 480 SL	1 pt/a 1 pt/a	At Transplant (spray) At 1st Cultivation	7.2bc	67.5a	6.4a	450.4a
8. Ridomil Gold 480 SL Ridomil Gold 480 SL Ridomil Gold 480 SL	0.33 pt/a 1 pt/a 1 pt/a	At Transplant (water) At 1st Cultivation Layby	7.0bc	82.63a	5.7a	110.4a
9. Ridomil Gold 480 SL Ridomil Gold 480 SL Ridomil Gold 480 SL	1 pt/a 1 pt/a 1 pt/a	At Transplant (spray) At 1st Cultivation Layby	7.3abc	70.4a	8.2a	259.6a

[1] Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Fisher's LSD test. No letters signifies non-significant difference.
[2] Vigor was rated a 1-10 scale, with 10 = live and healthy plants and 1 = dead plants, on 11 May and 09 June.
[3] Percent death by Black Shank was calculated by subtracting the final number of harvest plants from the original base count. The number of plants flagged with TSWV were subtracted from that total to get the number of plants killed by Black Shank. That number was then divided by the original base count and multiplied by 100.
[4] Percent TSWV symptomatic plants was calculated by using stand counts that were made from 21 April to 1 July with TSWV being flagged every week.
[5] Dry weight yield was calculated by multiplying green weight totals of tobacco by .15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 7260 divided by the base stand count.

Sampling the Tobacco Farmscape for Thrips Vectors of Tomato Spotted Wilt Virus

R. McPherson, W. Stephens, and S. Diffie

Introduction

Thrips and the economically important disease that they transmit, Tomato spotted wilt virus (TSWV), remain key pest problems of Georgia's flue-cured tobacco crop. The tobacco thrips, *Frankliniella fusca*, is the most common foliage thrips on tobacco, and this species is a confirmed vector of TSWV. Other thrips species, including *F. occidentalis*, *F.tritici, F. bispinosa*, *Limothrips cerealium*, *Haplothrips* spp. and *Chirothrips* spp., are also collected on tobacco and on the weed and alternate host plants in the tobacco farmscape. *F. occidentalis*, the western flower thrips, is also a reported vector of TSWV. This study surveyed the weed host plants in the tobacco farmscape and recorded the thrips species present during January through mid-May, 2009. Sticky traps were used to monitor thrips movement in the farmscape on a weekly basis throughout the entire year, and were used for a comparison against the thrips populations developing on the tobacco crop. Results from this study will help to document where TSWV thrips vectors are overwintering and their movement into the tobacco crop.

Materials and Methods

From January through May 2009, the commonly observed weeds and volunteer crop plants were collected every week from the flue-cured tobacco farmscape at the Coastal Plain Experiment Station Bowen Farm in Tift County, Ga. The plant material was separated by species, placed into brown paper bags and returned to the laboratory. Up to 10 plants were placed into each bag, if that many plants were available for each species. In the laboratory, individual plant material (by species) was either visually examined for the presence of thrips or placed into aluminum Berlese extraction funnels. All thrips collected in the farmscape were placed into labeled 1-dram glass vials containing 70% ethyl alcohol. The thrips specimens were mounted on microscope slides for detailed study and species identification.

On 1 January, 10 3 inch x 5 inch yellow sticky traps with coating on both sides were randomly placed in a tobacco field at the Bowen Farm. Five traps were placed in a North/South orientation and five traps were placed in an East/West orientation. Traps were placed in the field between 8:00 and 9:00 a.m. and retrieved one week later. After field exposure, the traps were placed in clear plastic bags, labeled and returned to the laboratory. Thrips were counted separately on each side of the trap, with the aid of a dissecting microscope, to determine the direction from which the thrips arrived at the trap (N, S, E or W). Thrips species were identified as *F. fusca*, flower thrips species, and other thrips species. Thrips monitoring with sticky traps continued throughout the entire calendar year.

The tobacco plants at the Bowen Farm also were sampled weekly, beginning soon after transplanting and continuing until mid-June. This test site was planted on 13 April with NC-71 flue-cured tobacco. Four plants were observed (both sides of all leaves) at four different locations in the field (16 total plants) on each sampling date. These thrips densities, recorded as the mean number per plant, were compared to the thrips numbers collected on the sticky traps randomly placed at each farm site.

Results and Discussion

The numbers of thrips collected from the different weed hosts in the tobacco farmscape are recorded in Table 1. A total of 1,209 adult thrips were identified from the tobacco farmscape during this study. Seventeen different plant hosts (plus tobacco foliage and blooms) had thrips collected from them between January and mid-May, 2009. *F. fusca*, the tobacco thrips, was collected on 14 of these plant species, and *F. occidentalis* was collected from seven of the plant hosts. Both species also were collected from tobacco foliage and blooms. Other thrips species were collected on all of the plant hosts examined (Table 1). Some immature thrips also were observed on all of the plant species. Thus, it appears that the weed complex in the tobacco farmscape is very important in providing thrips with the refuge (shelter) and nutrients for survival and a virulent innoculant source for TSWV. One or more thrips vector species was present in the farmscape on every date that thrips were collected.

The sticky trap captures of thrips in the tobacco field document when the thrips were moving in the tobacco farmscape. Low numbers of thrips were collected during January and February. In March and April, both *F. fusca* and the flower thrips complex began to rise. *F. fusca* were collected on the traps every month of the year except January, and peaked at more than 20 per trap during May. From early April through May 2009, there was a mean of five or more *F. fusca* per trap during this 9-week period. This is significant because *F. fusca* is the most abundant thrips species on tobacco foliage (75% of the thrips on tobacco foliage) and this thrips species is a reported vector of TSWV. Flower thrips were also collected every month of the year and peaked at 137 per trap in May.

Thrips on tobacco foliage were very low at the field site during April. On 15 May, there were around 20-40 thrips per plant, and on 29 May, there were 5-15 thrips per plant. Then, thrips rapidly declined, with less than one thrips per plant on 6 June.

In conclusion, it is apparent that numerous plant hosts are available in the tobacco farmscape to maintain thrips populations and reproduction during the winter and early spring, prior to transplanting tobacco. This plant reservoir is undoubtedly an important factor in determining the potential severity of TSWV infection in the tobacco crop, as well as other susceptible cultivated crops (tomatoes, peppers, peanuts, etc.). Sticky traps can be useful in determining the movement of thrips into and throughout the tobacco farmscape and to determine when peak movements of the TSWV vectors are occurring in the field.

Acknowledgments

The authors thank Charlie Hill and Dale Clark for their technical support, and the Georgia Agricultural Commodity Commission for Tobacco and the Georgia Agricultural Experiment Stations for financial assistance.

Table 1. Numbers of thrips collected from different plant hosts in and around the tobacco farmscape at the Bowen Research Farm, Tift County, Ga., 2009.

	Total number of thrips collected from host plant			
Plant Species	***F. fusca***	***F. occident***	**Other**	**Immatures**
Evening primrose	8	0	8	18
Wild radish	59	44	139	377
Chickweed	4	0	3	20
Narrow leaf vetch	0	14	61	814
Broomsedge	0	0	82	10
Nutsedge	7	3	46	29
Red sorrel	1	2	33	51
Clover	9	0	4	13
Honeysuckle	0	0	4	4
Thistle	1	0	3	63
Carolina geranium	9	0	5	21
Peanut	6	0	4	126
Soybean	4	0	9	50
Wheat	2	2	92	36
Snap bean	2	0	20	33
Corn spurry	2	2	1	20
Dandelion	2	1	12	109
Tobacco foliage	109	1	36	50
Tobacco bloom	17	4	332	150
TOTALS	**242**	**73**	**891**	**1994**

Thrips collected from January through mid-May, 2009, on plant hosts and from tobacco during April through June 2009. *F. fusca* is the tobacco thrips and *F. occidentalis* is the western flower thrips, both vectors of Tomato spotted wilt virus. Other species include *F. tritici*, *F. bispinosa, Limothrips cerealium, Neohydatothrips variabilis, Chirothrips* spp. and *Haplothrips* spp.

Survey of Weeds as Hosts of Tomato Spotted Wilt Virus (TSWV) in the Farmscape of Southern Georgia

S.W. Mullis, A.S. Csinos and R.D. Gitaitis

Introduction

Tomato spotted wilt virus has been one of the most devastating diseases in the Georgia agricultural community for the last two decades. Georgia, North Florida and southern South Carolina continue to be the tobacco areas that are the hardest hit by the disease; however, small pockets in North Carolina and Kentucky have also reported high losses. This virus has been variable in its infection patterns and observations have indicated that wild plant hosts may play a vital role in TSWV disease epidemiology.

The fact that TSWV is transmitted by a small ubiquitous insect called thrips make detection and management of the disease complicated. Viruses have traditionally been difficult to manage since we do not have materials that kill viruses in a living plant. Control of the major thrips vectors (Frankliniella fusca and Frankliniella occidentalis) is not possible primarily because of the pervasive nature of the insects and their mobility from neighboring vegetation. Thus, the level of disease in tobacco is controlled primarily by the dynamics of thrips populations and level of infection of weed hosts. These weeds may serve as reservoirs for the virus as well as reproductive hosts for the known thrips vectors of the disease.

TSWV is a distinctive disease that threatens the livelihood of all tobacco growers in North Florida, Georgia and South Carolina. In addition, evidence is mounting that the disease is moving north and could become a major problem in North Carolina. Major efforts need to be initiated to first be able to predict outbreaks, and second to be able to develop management programs to reduce losses from the disease.

A study of the weeds surrounding tobacco fields was begun in 2002 with 10 locations in southern Georgia being sampled on a monthly basis to determine levels of TSWV naturally occurring in the wild plants. More than 63,000 plants have been sampled over the past six years of this study to garner an understanding of the general levels of the virus in the farmscape.

Materials and Methods

The sample areas include the Bowen Farm, Blackshank Farm and Blackshank nurseries in the Tifton, Ga., area. Atkinson, Berrien, Burke, Coffee and Tattnall counties are additional areas under study at this time. A total of 990 plants are screened on a monthly basis for TSWV using Double Antibody Sandwich-Enzyme Linked Immunosorbent Assay (DAS-ELISA) using commercially available kits (Agdia, Elkhart, Ind.). The plants chosen are ones identified in the first three-year phase of the study as plants that were susceptible to the virus and ones that were commonly infected with TSWV.

Results to Date

Tomato spotted wilt virus (TSWV) impacts increased dramatically in 2005 and leveled off in 2006. Where statewide incidence of TSWV in 2003 was at relatively low levels (>6%), 2006 saw similar numbers to 2004 and 2005 with yield losses of about 18% and 44% of all plants showing TSWV. Levels of TSWV at our experimental site at the Bowen Farm, CPES-Tifton, Ga., remained higher than the surrounding areas, as expected, at around 45% in 2009.

Currently, we are in the eighth year of the overall study of the weed host survey. This study originally started in February 2002, and as of December 2009, 68,261samples have been collected from all locations. Samples are continually collected from six sites every month.

In summary for 2006-2009, TSWV levels in the weeds remained low (1.01%) during the winter, increasing dramatically to 13.34% during the spring and remaining relatively level throughout the summer months. Fall saw an increase (14.18%) before the levels dropped to negligible levels for the winter months of November and December. April (15.6%) and June (18.75%) had the highest incidences of TSWV during the year. Overall, 2009 had a slight increase in TSWV infections in the weeds, and this corresponds to the slight increase in the TSWV seen in tobacco during the 2009 growing season.

These levels correspond to the levels seen throughout the study. One of the main observations is the dramatic increase in weed infection levels during the late spring and fall. This has been a consistent feature of this study even during the years when levels have spiked higher or been markedly lower. The environmental observations have indicated that there may be an association of the higher incidences of TSWV infections and moderate conditions. Adverse weather, either colder winters or warmer summers, along with increased rainfall patterns may have a depressing effect on the levels on infection seen during the corresponding season. There also seems to be an effect regarding the changeover period of weed species seen from one season to the next.

The higher infection levels observed during the fall preceding the spring growing period corresponds favorably to a higher incidence of TSWV at the Bowen farm (Figures 1 and

2). Conversely, the infection levels seen immediately preceding the tobacco growing cycle inversely corresponded to the infection levels seen in the field.

Significance of Accomplishments

These studies' findings seem to validate the importance of weeds as natural reservoirs for tospoviruses. These data will allow us to hone the study in the future to further understand the relationship of TSWV levels in the weeds with the TSWV levels in tobacco fields. We may be able to elicit an early indication of TSWV incidence in an upcoming growing season by understanding the relationship of winter weed infection levels with spring and summer crop TSWV incidence.

The relationship emerging between the weed infection levels and the corresponding growing seasons is a potential tool in the management of TSWV. The establishment of an early indicator of the TSWV pressure during a growing season would be extremely valuable in determining what chemical, cultural or other management practices need to be utilized to lessen the effect that TSWV may impart on a season's tobacco crop. This host study has shown that environment, geography and host species all play a part in the epidemiology of TSWV and they all may be used as a disease indicator model.

Relationship to Programs in Neighboring States

Studies and observations have shown that our location is the epicenter of TSWV. Due to the high disease pressure at our locations, we are able to observe in detail the interactions of TSWV and the farmscape. This information is important to the region due to the devastating losses that have been attributed to TSWV. The neighboring states can use the information garnered in south Georgia to mitigate possible TSWV losses in their crops.

Acknowledgements

The authors want to thank Altria for their support of this valuable study.

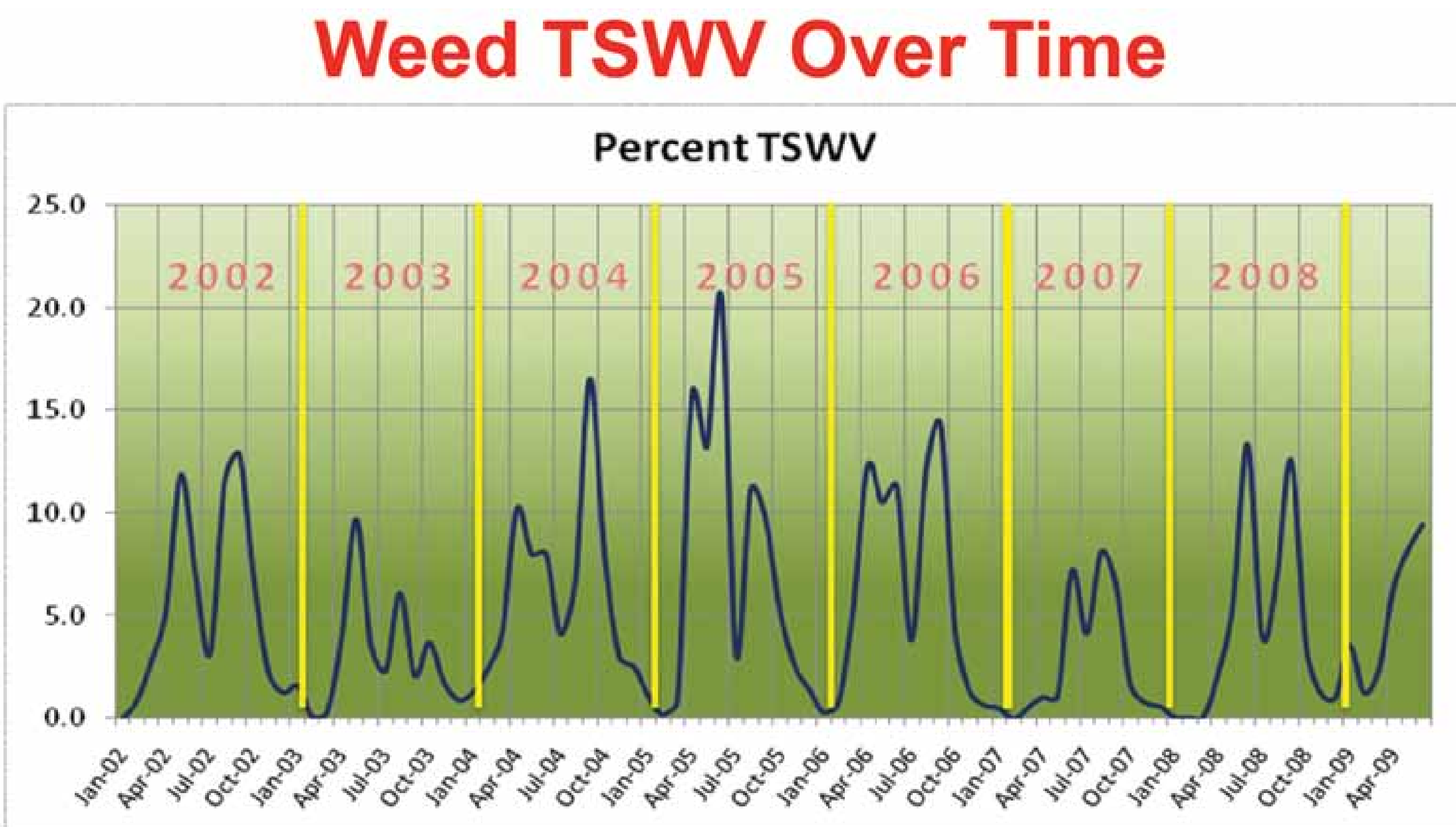

Figure 1. Infection Levels in the Weed Hosts by Month, 2002-2009

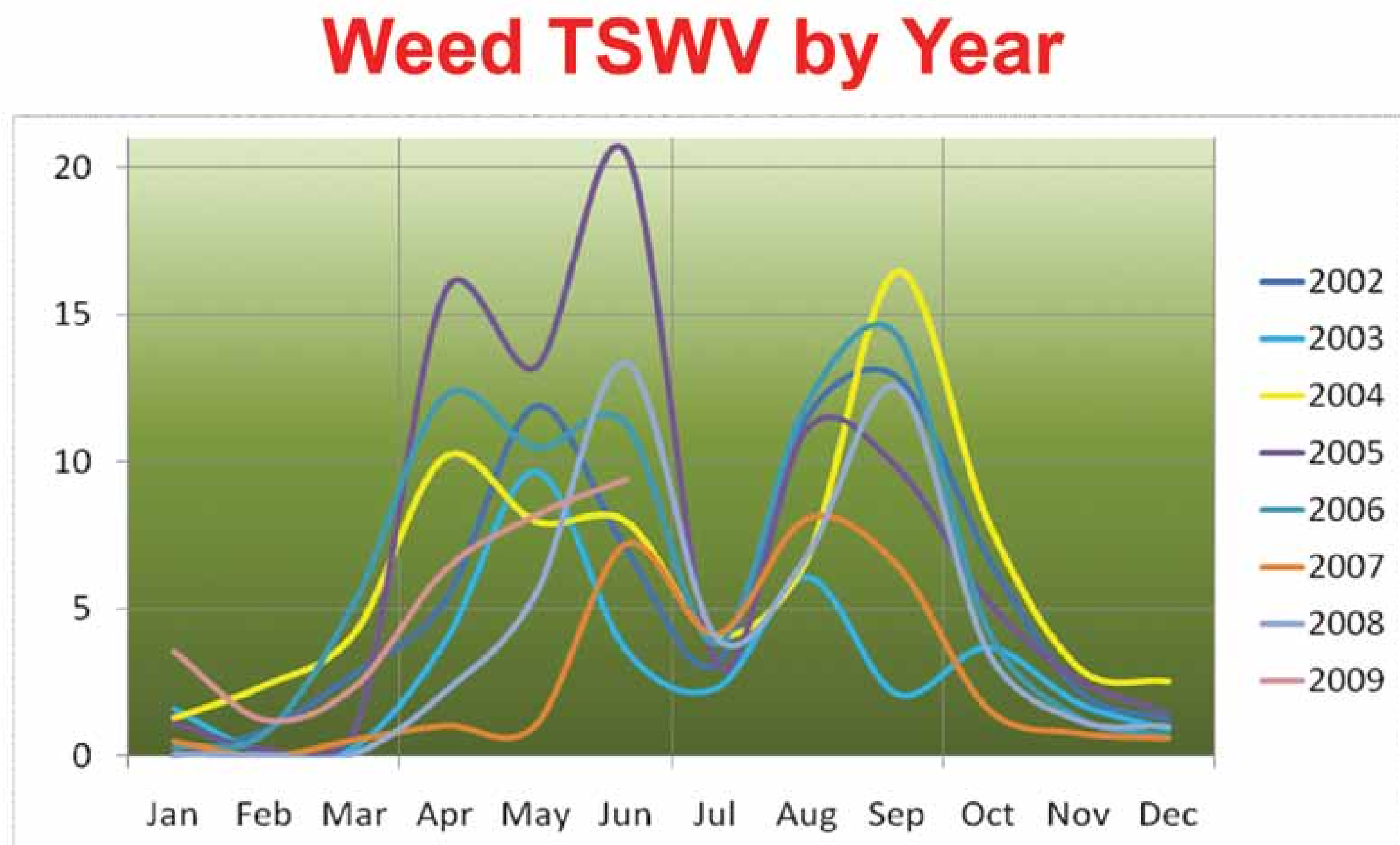

Figure 2. TSWV Infection Levels of Weed Hosts

Insect Pest Control with Selected Foliar Insecticide Applications

R. McPherson and W. Stephens

Introduction

Tobacco budworms and hornworms continue to cause annual economic losses to Georgia's flue-cured tobacco crop due to costs of control and reduction in yields. These pests cost Georgia tobacco producers millions of dollars every year, even though they are effectively controlled with certain pesticides. Tobacco splitworms, also known as the potato tuberworm, can cause economic losses in Georgia's tobacco crop; however, damage is sporadic across the state. Insecticides continually need to be evaluated to document their effectiveness in controlling these and other tobacco insect pests. Also, new products and new application rates or use patterns of labeled insecticides need to be examined thoroughly before they can be registered for use and included in the pest control guidelines. This study was conducted to evaluate numerous products for control of budworms, hornworms and splitworms, and assess the effectiveness of these worm controls on non-target tobacco aphid infestations. Those reviewing this report are cautioned not to use any unlabeled product on their tobacco, and to review the most current issue of the Georgia Pest Management Handbook for the most up-to-date pesticide recommendations.

Materials and Methods

Flue-cured tobacco, K-326, was transplanted on 24 March at the Georgia Coastal Plain Experiment Station Bowen Farm. In a second entomology trial site, NC-71 flue-cured tobacco was transplanted on 13 April at the Bowen Farm. Production practices were used according to the University of Georgia Cooperative Extension guidelines and included a preplant tank mixture of Prowl and Spartan for weed control, Ridomil for disease control, Lorsban for soil insect control, and Mocap for nematode suppression. Fertilizer (6-6-18) was applied in a split application at a total of 1,000 pounds per acre; 100 pounds of 16-0-0 was applied at lay-by.

Plots three rows wide (44-inch row spacing) by 40 feet long were arranged in an RCBD with four replications. Plots were separated on each side with an untreated border row and on each end with a 4-foot-wide fallow alley. Twelve foliar spray treatments were applied on 26 May and 3 June at the K-326 tobacco site using a CO2-powered backpack sprayer equipped with three TX-12 nozzles directed over a single row, delivering 20.5 gpa at 40 psi. The number of live budworms and hornworms per plot (60 plants) was recorded prior to treatment (Pre-t) plus three and seven days after the first application and seven days after the second application. In addition to the worm counts, all plants in each plot were sampled for splitworm damage in mid-June. From mid-June to mid-July, 10 plants on Row 2 were harvested a total of three times. Green weights were obtained and then converted to cured weight (x 0.15). All the insect count, splitworm damage and yield data were analyzed with an analysis of variance (P=0.05) and means were separated using the Waller-Duncan K-ratio t-test.

In the NC-71 tobacco site, two additional worm and tobacco aphid trials were conducted. One trial had 12 foliar insecticide treatments applied on 17 June and 26 June. A CO2 -powered sprayer was used, delivering 20.5 gpa at 40 psi. The number of live budworms per plot (60 plants) was recorded Pre-t plus five and eight days after the first application and three and six days after the second application in the first trial. In addition, a worm damage rating was obtained in each plot on 16 July, using a rating scale of 0-3, with 0 = no defoliation, 1 = 5-10% defoliation, 2 = 10-20% defoliation and 3 = 20-30% defoliation. All plots also were rated for aphid infestation level (0-3 scale) with 0 = no aphids present, 1 = a few aphids present (1-50 aphids on a few plants), 2 = moderate aphid infestation (100-500 aphids on numerous plants) and 3 = heavy infestation (1,000+ aphids per plant).

The second entomology trial in the NC-71 tobacco site had nine foliar insecticide treatments applied on 19 June and 29 June using the same CO2- powered sprayer as described in the previous trial. The number of budworms per plot was recorded Pre-t, and three and seven days after both insecticide applications. In addition, a worm damage score (0-3) was obtained on 26 July; aphid infestation ratings (0-3) were obtained on 26 June, 1 July and 5 July. All worm count data, worm damage ratings and aphid infestation ratings were analyzed with an analysis of variance and treatment means were separated using the Waller-Duncan K-ratio t-test (P=0.05).

Results and Discussion

All of the insecticide treatments had lower budworm populations than in the untreated plots on three and seven days after the first application and most of the treatments were effective seven days after the second application (Table 1). Hornworm densities also were lower in all of the treated plots than in the untreated plots on all of the post-treatment sampling dates (Table 2). Tobacco splitworm damage was lower in the treated plots, but yields were not different between the treatments (Table 1).

In the first entomology trial in the NC-71 test site, budworms were lower in most of the treated plots five days after the first application was made and three days after the second application (Table 3). Worm damage ratings were lower in all of the treated plots compared to the untreated control (Table 3).

Aphid infestation ratings were higher in the Tracer, Belt and untreated plots than in several of the other treatments (Table 4). In the second trial conducted in the NC-71 tobacco, budworms were lower in the treated plots than in the untreated plots on three and seven days after the first application and three days after the second application, except for the Rimon treatment (Table 5). Worm damage scores were lower in all the treated plots on 16 July (Table 5). Aphid infestation ratings were similar between all treatments in this trial (Table 6).

In conclusion, many of the products examined in this study demonstrated effectiveness in controlling budworms, hornworms, splitworms and aphids.

Acknowledgments

The authors thank Charlie Hill, Ed Troxell and Steve LaHue for technical support and Bayer, Chemtura, Syngenta, Dow AgroSciences, DuPont, FMC, Valent and the Georgia Agricultural Commodity Commission for Tobacco for financial support.

Table 1. Effects of selected foliar insecticide treatments on cured yield, controlling tobacco budworms and reducing tobacco splitworm tunnels on flue-cured tobacco, Tift County, Ga., 2009.

Treatment and Formulation/acre	Budworms per plot (60 plants)				Splitworm	Yield
	Pre-T	3 day	7 day	7 day (2nd)	Tunnels per plot	lbs./acre
Tracer 4 SC – 2.5 oz	3.3a	0.7bc	0.0c	0.0b	0.7b	3501a
Orthene 97 PE – 0.775 lbs	3.0a	1.7b	0.7bc	1.3ab	0.3b	3132a
Coragen 1.67 SC – 5 oz	3.0a	0.0c	0.0c	0.3b	1.7b	3695a
Brigade 2 EC – 4 oz	2.7a	0.7bc	0.3bc	0.0b	0.7b	2995a
Rimon 0.83 EC – 12 oz	4.0a	1.7b	1.3b	1.7ab	2.7b	3749a
Warrior 1 CS – 3.2 oz	2.7a	1.0bc	0.7bc	0.7ab	0.7b	3452a
HGW86 10 OD – 20 oz	2.7a	0.3bc	0.0c	1.0ab	0.0b	3524a
Belt 480 SC – 3 oz	3.0a	1.3bc	0.0c	0.7ab	0.7b	3186a
Durivo 2.5 SC – 10.3 oz	2.7a	0.0c	0.3bc	0.3b	0.7b	3085a
Voliam Flexi 40WG – 4 oz	2.0a	0.7bc	0.3bc	0.0b	0.0b	3231a
Voliam Xpress 1.25 ZC – 1.25 oz	1.7a	0.3bc	0.3bc	0.0b	1.0b	3512a
Untreated	2.0a	3.3a	2.7a	2.3a	7.0a	3175a

K-326 flue-cured tobacco transplanted on 24 March. Foliar applications applied on 26 May and 3 June with CO_2-powered backpack sprayer delivering 20.5 gpa through 3 TX-12 nozzles per row at 40 psi. Column means with the same letter are not significantly different, Waller-Duncan K-ratio t Test, P >0.05.

Table 2. Effects of selected foliar insecticide treatments on controlling tobacco hornworms on flue-cured tobacco, Tift County, Ga., 2009.

Treatment and Formulation per acre	Hornworms per plot (60 plants)			
	Pre-T	3 day	7 day	7 day (2nd)
Tracer 4 SC – 2.5 oz.	11.7a	0.3bc	0.0	0.0c
Orthene 97 PE – 0.775 lbs.	16.3a	2.0bc	1.0b	1.3b
Coragen 1.67 SC – 5 oz.	20.3a	1.3bc	0.0c	0.0c
Brigade 2 EC – 4 oz.	11.3a	0.7bc	0.0c	0.0c
Rimon 0.83 EC – 12 oz.	17.5a	3.0b	1.0b	1.3b
Warrior 1 CS – 3.2 oz.	13.0a	0.3b	0.0c	0.0c
HGW86 10 OD – 20 oz.	12.0a	2.3bc	0.7bc	0.3c
Belt 480 SC – 3 oz.	14.7a	0.7bc	0.0c	0.3c
Durivo 2.5 SC – 10.3 oz.	11.7a	0.3bc	0.0c	0.0c
Voliam Flexi 40WG – 4 oz.	13.7a	1.0bc	0.3bc	0.0c
Voliam Xpress 1.25 ZC – 1.25 oz.	21.0a	0.0c	0.3bc	0.0c
Untreated	14.7a	8.3a	3.7a	3.0a

K-326 flue-cured tobacco transplanted on 24 March. Foliar applications applied on 26 May and 3 June with CO_2-powered backpack sprayer delivering 20.5 gpa through 3 TX-12 nozzles per row at 40 psi. Column means with the same letter are not significantly different, Waller-Duncan K-ratio t Test, P >0.05.

Table 3. Effects of selected foliar insecticide treatments on controlling tobacco budworms on flue-cured tobacco, Tift County, Ga., 2009.							
		Budworms per plot (60 plants)					**Worm Damage***
Treatment and lbs. AI/acre		**Pre-T**	**5DAT**	**8DAT**	**3DAT (2nd)**	**6DAT (2nd)**	**07/16/2009**
Voliam Flexi 40WG	0.0625	1.0a	1.0cd	1.0a	0.3bc	0.3a	0.2cd
Voliam Flexi 40WG	0.10	1.0a	0.3d	0.3a	0.0c	0.3a	0.0d
Voliam XPress 1.25ZC	0.05	2.0a	2.0bcd	1.0a	1.0bc	1.0a	0.4bc
Voliam XPress 1.25ZC	0.068	2.0a	2.3abcd	2.0a	1.3abc	0.7a	0.5bc
Voliam XPress 1.25ZC	0.088	1.3a	0.7cd	1.0a	0.3bc	0.7a	0.2bc
Tracer 4SC	0.09	2.7a	0.7cd	1.7a	0.3bc	1.0a	0.2cd
Belt 480SC	0.094	1.0a	0.3d	1.0a	0.0c	0.0a	0.2cd
Belt 480SC	0.094 + NIS*	2.0a	0.7cd	1.0a	0.7bc	0.3a	0.2cd
Coragen 1.67SC	0.052	2.7a	1.3cd	0.3a	0.3bc	1.3a	0.2cd
Orthene 97PE	0.73	2.3a	3.0abc	1.3a	1.7abc	1.3a	0.7b
Brigadier 2EC	0.1	2.3a	4.0ab	1.7a	2.0ab	1.0a	0.4bc
Untreated		1.0a	4.7a	3.3a	3.0a	1.3a	1.8a

NC-71 flue-cured tobacco transplanted on 13 April. Foliar insecticides applied on 17 June and 26 June with a CO_2- powered backpack sprayer delivering 20.5 gpa with 3 TX-12 nozzles per row at 40 psi. Plots were 3 rows wide by 40 ft. long and arranged in a RCB design with 3 replications. Column means with the same letter are not significantly different, Waller-Duncan K-ratio t Test, P >0.05.

* Worm damage of 0 = no defoliation, 1 = 5-10%, 2 = 10-20%, and 3 = 20-30%.

Table 4. Effects of selected foliar insecticide treatments on tobacco aphid infestations on flue-cured tobacco, Tift County, Ga., 2009.					
		Aphid infestation rating (0-3)			
Treatment and lbs. AI/acre		**25 June**	**29 June**	**2 July**	**16 July**
Voliam Flexi 40WG	0.0625	0.0e	0.0e	0.0c	0.0d
Voliam Flexi 40WG	0.10	0.3de	0.2de	0.0c	0.0d
Voliam XPress 1.25ZC	0.05	1.0cd	1.0abcd	0.8ab	1.3c
Voliam XPress 1.25ZC	0.068	2.0ab	1.2abc	1.3a	1.7bc
Voliam XPress 1.25ZC	0.088	1.0cd	0.7bcde	0.3bc	1.2c
Tracer 4SC	0.09	1.8abc	1.5ab	1.5a	2.2ab
Belt 480SC	0.094	1.3bc	1.5ab	1.5a	2.2ab
Belt 480SC	0.094 + NIS*	2.3a	1.7a	1.2a	2.3a
Coragen 1.67SC	0.052	1.2bcd	1.0abcd	0.8ab	1.7bc
Orthene 97PE	0.73	1.3bc	0.3cde	1.3bc	0.2d
Brigadier 2EC	0.1	0.0e	0.8abcde	0.0c	0.0d
Untreated		1.5abc	1.7a	1.0ab	2.2bc

NC-71 flue-cured tobacco transplanted on 13 April. Foliar insecticides applied on 17 June and 26 June with a CO_2- powered backpack sprayer delivering 20.5 gpa with 3 TX-12 nozzles per row at 40psi. Plots were 3 rows wide by 40 ft. long and arranged in a RCB design with 3 replications. Column means with the same letter are not significantly different, Waller-Duncan K-ratio t Test, P >0.05.

* Aphid infestation rating of 0 = no aphids present, 1 = a few aphids present (1-50), 2 = moderate infestation (100-500), and 3 = heavy infestation (1000+ aphids)

Table 5. Effect of selected foliar insecticide applications on control of tobacco budworms on flue-cured tobacco, Tift County, Ga., 2009.

Treatment and Formulation per acre	Budworms per plot					Worm Damage**
	Pre-T	3 DAT	7 DAT	3 DAT (2nd)	7 DAT (2nd)	07/16/2009
Coragen 1.67 SC – 3.5 oz.	4.0a	3.0b	1.7b	0.7b	0	0.2de
Coragen 1.67 SC – 5.0 oz.	4.3a	2.3b	1.7b	0.3b	0	0.1e
HGW86 10 OD – 13.5 oz.	4.7a	3.3b	1.3b	0.7b	0	0.4dc
HGW86 10 OD – 27.0 oz.	3.0a	1.0b	2.3b	0.3b	0	0.4dc
Denim 0.16 EC – 10.0 oz.	3.7a	2.3b	1.0b	0.0b	0	0.5c
Tracer 4SC – 2.9 oz.	5.7a	3.3b	1.0b	0.3b	0	0.3cde
Rimon 0.83 EC – 12.0 oz.	3.7a	3.3b	2.0b	1.3ab	0	0.8b
Rimon + Tracer*	5.3a	2.7b	2.7b	0.7b	0	0.5c
Untreated	3.0a	6.3a	6.7a	2.0a	0	2.3a

NC-71 flue-cured tobacco transplanted on 13 April, plots 3 rows wide by 40 feet long with 6 feet alley arranged in a RCB Design with 3 replications. Foliar applications applied on 19 June and 29 June with a CO_2 –powered backpack sprayer delivering 20.5 gpa through 3 TX-12 nozzles per row at 40 psi. Column means with the same letter are not significantly different (Waller-Duncan K-ratio t Test, P>0.05).

* Rimon insecticide applied on 19 June and Tracer insecticide applied on 29 June.

** Worm damage of 0 = no defoliation, 1 = 1-5%, 2 = 10-20%, and 3 = 20-30%.

Table 6. Effects of selected foliar insecticide applications on tobacco aphid infestations on flue-cured tobacco, Tift County, Ga., 2009.

Treatment and Formulation per acre	Aphid Infestation Rating (0-3)		
	7 DAT	3 DAT (2nd)	7 DAT (2nd)
Coragen 1.67 SC – 3.5 oz.	1.5a	1.3ab	2.3a
Coragen 1.67 SC – 5.0 oz.	1.2a	2.0a	2.3a
HGW86 10 OD – 13.5 oz.	0.7a	0.3b	1.0a
HGW86 10 OD – 27.0 oz.	1.2a	1.3ab	1.5a
Denim 0.16 EC – 10.0 oz.	1.2a	1.5ab	1.0a
Tracer 4SC – 2.9 oz.	1.2a	1.3ab	1.8a
Rimon 0.83 EC – 12.0 oz.	1.3a	1.7a	1.8a
Rimon + Tracer*	1.7a	1.5ab	1.5a
Untreated	1.5a	2.2a	1.5a

NC-71 flue-cured tobacco transplanted on 13 April, plots 3 rows wide by 40 feet long with 6 feet alley arranged in a RCB Design with 3 replications. Foliar applications applied on 19 June and 29 June with a CO_2 –powered backpack sprayer delivering 20.5 gpa through 3 TX-12 nozzles per row at 40 psi. Column means with the same letter are not significantly different (Waller-Duncan K-ratio t Test, P >0.05).

Aphid infestation of 0 = no aphids, 1 = a few aphids(1-50 per plant), 2 = moderate aphid populations (100 – 500), and 3 = heavy aphid population (1000+).

* Rimon insecticide applied on 19 June and Tracer insecticide applied on 29 June.

Regional Chemical Sucker Control Test

S.S. LaHue, C.E. Troxell, and J.M. Moore

Introduction

Chemical growth regulators are extensively used by tobacco growers in Georgia to control sucker growth. These materials are an essential component of the production process because they increase yield and reduce labor costs. The need for more effective materials and methods continues because of the necessity of reducing residues, specifically maleic hydrazide (MH). Some foreign markets require maleic hydrazide residues of 80 ppm or less. Since exports are a major outlet for the Georgia crop, residues above 100 ppm must be reduced.

The tobacco season has lengthened because recent cultivars benefit from irrigation and higher nitrogen use. Moreover, the incidence of Tomato spotted wilt virus (TSWV) has increased in recent years, causing additional sucker pressure and difficulty in control due to variability in stands and flowering. The use of dinitroanalines in combination with maleic hydrazide have shown success in controlling suckers over the lengthened season while a third or even forth contact has dealt with the variable stand due to TSWV. These problems can be managed while reducing MH residues.

The purpose of this study is to report the effectiveness of some new combinations and formulations of existing materials used in combination (sequential) with fatty alcohols (a contact) and the potassium salt of maleic hydrazide (a systemic) with and without the added benefit of dinitroanalines. These treatments are compared with topped but not suckered and the standard treatment of two contacts followed by the recommended rate of maleic hydrazide. Each treatment is analyzed with respect to agronomic characteristics and chemical properties of the cured leaf.

Materials and Methods

The field experiment was conducted at the University of Georgia Tifton Campus Bowen Farm. All cultural practices, harvesting and curing procedures were uniformly applied and followed current University of Georgia recommendations. Fertilization consisted of 480 lbs/acre of 6-6-18 at first cultivation and 510 lbs/acre of 6-6-18 at second cultivation followed with 145 lbs/acre of 15.5-0-0 at lay-by. Plots consisted of two rows of 30 plants each. Ten uniform plants were sampled from each plot for sucker data. The test involved four replications randomized with 11 sucker control treatments as follows:

1. TNS - Topped Not Suckered.
2. Fair 85 / Fair 85 / (Fair 30 + Flupro) - Two treatments of the contact Fair 85 (Fair Products Inc.) at 4% solution, then 5% solution three to five days apart, followed in five to seven days by a tank mix of Fair 30 (2.25 lbai/gal Fair Products Inc.) potassium malic hydrazide at the labeled rate of 1.0 gal/A and Flupro (1.2 lb ai/gal Chemtura Chemical) at 0.5 gal/A.
3. O-TAC / O-TAC / O-TAC / O-TAC - One treatment of the contact O-TAC (Fair Products Inc.) at 4%, then 5% three to five days later, followed in five to seven days with two successive treatments of O-TAC at 5%.
4. Fair 85 / Fair 85 / Fair 85 / Fair 85 - One treatment of the contact Fair 85 (Fair Products Inc.) at 4%, then 5% three to five days later, followed in five to seven days with two successive treatments of Fair 85 at 5%.
5. Fair 85 / Fair 85 / Drexalin Plus - Two treatments of Fair 85 at 4%, then 5% three to five days apart, followed in five to seven days with Drexalin Plus (Drexel Chemical Corp.) at the rate of 0.5 gal/A.
6. Fair 85 / Fair 85 / Flupro - Two treatments of Fair 85 at 4%, then 5% three to five days apart followed in five to seven days with Flupro at the rate of 0.5 gal/A.
7. Fair 85 / Fair 85 + Flupro / Fair 85 + Flupro - One treatment of Fair 85 at 4%, then in three to five days Fair 85 at 5% tank mixed with Flupro at the rate of 0.25 gal/A, followed in five to seven days with the same rate of Fair 85 and Flupro.
8. Fair 85 / Fair 85 / Flupro / Fair 30 - Two treatments of Fair 85 at 4%, then 5% three to five days apart, followed in five to seven days with Flupro at 0.5 gal/A, followed in five to seven days with Fair 30 at 0.75 gal/A.
9. Fair 85 / Fair 85 / Flupro / Fair 30 - Two treatments of Fair 85 at 4%, then 5% three to five days apart, followed in five to seven days with Flupro at 0.5 gal/A followed in five to seven days with Fair 30 at 1.0 gal/A.
10. Fair 85 / Fair 85 / (Fair 30 + Flupro) - Two treatments of the contact Fair 85 at 4% solution, then 5% solution three to five days apart, followed in five to seven days by a tank mix of Fair 30 at 0.75 gal/A and Flupro at 0.5 gal/A.
11. Fair 85 / Fair 85 / (Fair 30 & Flupro) - Two treatments of the contact Fair 85 at 4%, then 5% three to five days apart, followed in five to seven days by a tank mix of Fair 30 at 0.5 gal/A and Flupro at 0.25 gal/A, then the same tank mix at Fair 30 and Flupro again in five to seven days.

Results and Discussion

The first contact was applied on 10 July, the second on 15 July, with the third set of treatments applied on 22 July. The fourth treatment for entries 3, 4, 8, 9 and 11 was applied on 29 July. The final harvest was on 31 August, with the test concluding after the suckers were pulled, counted and weighed off 10 plants from each plot on 2 September.

The 2009 growing season was hampered by excessive rains in the spring followed by high temperatures in June and early July. The original test location was abandoned due to significant growth variation in the field, which was caused by erosion and herbicide movement. Overall, the crop was light and had variable growth, which may explain some of the inconsistencies of the test.

For 2009, there was no significant difference in yield or value across treatments (Table 1). Yield was average for the year but not significantly different for all chemical treatments and ranged from 2,180 lbs/A for Treatment 9 to 1,843 lbs/A for Treatment 7. The TNS control was not significantly lower yielding at 1,745 lbs/A. Grade indices were good for all treatments and showed no significant difference with all treatments in the low 80s. Sucker number per plant was good with a value of less than one for all chemical treatments that incorporated malic hydrazide. However, the sequential contact treatments (3 and 4) proved to be less than adequate with sucker numbers near the topped-not-suckered control. However, if additional weekly sprays had been applied control might have improved. In addition, percent control was lower for Treatments 3 and 4, having only 68.6% and 54% control, respectively. Percent control was excellent for Treatments 2 and 8-11, with those treatments ranging from 96.9% to 100%.

Acknowledgments

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Table 1. 2009 Regional Tobacco Growth Regulator Test, Effects of Advanced Growth Regulating Material on Sucker Growth, Cured Leaf Yields and Value of Flue-Cured Tobacco.

	Sucker Growth					Cured Leaf			
Treatments	% Control	Green Wt./ Plant (g)	No./ Plant	Green Wt./ Sucker (g)	Plant Injury[1]	Yield (lbs/A)	Price Index[2] ($/cwt)	Value ($/A)	Grade Index[3]
1. Topped-Not-Suckered	0.0	277.8	1.9	146.2	0	1745	164	2859	81
2. Fair 85/Fair 85/(Fair 30 + Flupro) 4%/5% / (1.0gal/A+0.5 gal/A)	100.0	0.0	0.0	0.0	0	1884	164	3098	83
3. OTAC/OTAC/OTAC/OTAC 4% / 5% / 5% / 5%	68.6	87.2	1.4	61.2	0	2011	164	3299	81
4. Fair 85/Fair 85/Fair 85/Fair 85 4% / 5% / 5% / 5%	54.0	127.9	1.4	94.7	0	1892	164	3112	83
5. Fair 85/Fair 85/Drexalin 4% / 5% / (0.5 gal/A)	73.3	74.1	0.9	66.7	0	2073	165	3420	83
6. Fair 85/Fair 85/ Flupro 4% / 5% / (0.5 gal/A)	87.0	36.1	0.5	18.1	0	1902	164	3124	81
7. Fair 85/(Fair 85 + Flupro) / (Fair 85 + Flupro) - 4% / (5% + 0.25gal/A) (5% + .25gal/A)	91.4	23.9	1.5	12.0	0	1843	166	3064	83
8. Fair 85/Fair 85/ Flupro/ Fair 30 4%/ 5%/ 0.5gal/A / 0.75gal/A	96.9	8.7	0.4	3.48	0	1915	164	3142	82
9. Fair 85/Fair 85/ Flupro / Fair 30 4%/ 5%/ 0.5gal/A / 1.0gal/A	99.3	2.0	0.1	0.2	0	2180	162	3549	82
10. Fair 85/Fair 85/(Fair 30 & Flupro) - 4% / 5% / (0.75gal/A+0.5 gal/A)	100.0	0.0	0.0	0.0	0	2135	162	3488	82
11. Fair 85/Fair 85/(Fair 30 & Flupro)/ - 4% / 5% / (0.5gal/A+0.25 gal/A) / (0.5gal/A+0.25 gal/A)	100.0	0.0	0.0	0.0	0	2034	163	3229	80
LSD-0.05						483.1	6.5	311.8	4.1

[1] Injury rating on a scale of 0-10 with 0 = no damage and 10 = plant killed.
[2] Price Index based on two year average (2008-2009) prices for U.S. government grades.
[3] Grade Index is a 1-99 rating based on government grade. High ratings are best.
* Mention of a trade name does not constitute a guarantee or warranty of a product by the University of Georgia and does not imply its approval to the exclusion of other products.

Effects of Selected Tray Drench and Transplant Water Insecticide Treatments on Suppressing Thrips Vectors and Tomato Spotted Wilt Virus

R. McPherson, J.M. Moore, W. Stephens, S.S. LaHue, and E. Troxell

Introduction
Two thrips species commonly collected on flue-cured tobacco in Georgia are reported as vectors of Tomato spotted wilt virus (TSWV): the tobacco thrips, Frankliniella fusca, and the western flower thrips, F. occidentalis. TSWV is a serious economic problem for Georgia's tobacco producers, causing millions of dollars in losses each year. This study was designed to examine the impact of eight tray drench and transplant water applications of selected insecticides for suppressing early-season thrips populations and how these control options impact TSWV infection (symptomatic plants) of flue-cured tobacco produced in Georgia.

Materials and Methods
Flue-cured tobacco, variety NC-71, was transplanted on 10 April on the Bowen Research Farm in Tift County, Ga. Production practices were used according to University of Georgia Cooperative Extension guidelines for weed control, disease control, nematode suppression and fertilization.

Two days prior to transplanting, three insecticide treatments were applied as tray drench treatments on transplants using 200 ml of water per 242-cell tray. Four additional insecticide treatments were applied at transplanting in the transplant water in 2 oz of water per transplant (109 gpa). At transplanting, 32 field plots, two rows wide (44-inch row spacing) by 50 feet long, were arranged in an RCBD with four replications of the eight treatments (seven insecticides plus untreated control).

The number of live thrips on plants 2, 4, 6 and 8 of the second row of each plot was counted weekly during April and May. All plants in each plot were visually examined weekly for symptoms of TSWV from April through June. Symptomatic plants were flagged and dated, and the cumulative percentage of symptomatic plants was determined. All thrips counts and TSWV data were subjected to analysis of variance with P=0.05. Treatment means were separated using the Tukey test.

Results and Discussion
Thrips populations were low in all plots until the late May sampling dates, when populations were between 25 and 40 thrips per four plants. Tobacco thrips (F. fusca) comprised more than 80% of the thrips species on tobacco foliage at this test site. The Admire TD insecticide treatment reduced the TSWV symptomatic plants to 30.6%, compared to 46.5% in the untreated plots (Table 1). Although several other treatments suppressed TSWV symptoms, only Admire TD was significantly lower than the untreated control. In fact, two of the TPW treatments actually had higher levels of TSWV than the untreated control. No phytotoxicity, chlorosis or stunting symptoms were observed in any of the plots.

In conclusion, suppressing thrips with insecticide treatments can help reduce TSWV, even in years with relatively low TSWV symptomatic plants. Several new insecticide products and new formulations appear to be about as effective as Admire in suppressing TSWV, based on numerous entomology trials conducted during the past 10 years. Tray drench applications of effective treatments tend to be more efficient in reducing TSWV than TPW applications. Additional studies on rates and usage patterns of these materials are needed under different natural infection rates of TSWV to effectively evaluate these new thrips vector/TSWV management options.

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The authors thank Dale Clark and Charlie Hill for technical support and the Georgia Agricultural Commodity Commission for Tobacco and the Georgia Agricultural Experiment Stations for financial assistance.

Table 1. Effects of selected transplant water (TPW) and greenhouse tray drench (TD) insecticide treatments on the incidence of Tomato spotted wilt virus symptomatic flue-cured tobacco plants, Tift County, Ga., 2009.

Treatment and Formulation / Acre	% TSW Symptomatic Tobacco Plants				
	13 May	20 May	27 May	3 June	17 June
Coragen 1.67SC 5.0oz TPW	1.9 ± 1.5a	13.4 ± 5.2a	35.4 ± 7.3a	45.3 ± 4.2a	49.3 ± 3.3a
Coragen 1.67SC 7.0oz TPW	2.0 ± 2.8a	10.7 ± 6.7a	33.9 ± 6.2a	40.9 ± 3.7ab	47.5 ± 6.7a
HGW 86 20SC 10.3oz TPW	0.5 ± 1.0a	7.3 ± 9.1a	32.4 ± 11.2a	46.7 ± 14.0a	53.5 ± 10.1a
Admire Pro 4.6 4.2oz TD	0.0 ± 0.0a	3.6 ± 2.5a	17.3 ± 6.8a	25.5 ± 11.5b	30.6 ± 14.0b
HGW 86 20SC 10.3oz TD	0.5 ± 1.0a	5.1 ± 2.0a	26.4 ± 7.1a	37.2 ± 7.9ab	47.0 ± 4.8a
Durivo 2.5SC 10.3oz TD	3.1 ± 3.5a	9.7 ± 2.6a	24.6 ± 6.7a	30.7 ± 7.5ab	39.9 ± 4.6ab
Durivo 2.5SC 10.3oz TPW	3.1 ± 2.1a	8.4 ± 3.1a	26.0 ± 13.9a	32.7 ± 9.5ab	37.9 ± 9.5ab
Untreated	2.1 ± 0.1a	16.0 ± 5.3a	33.0 ± 9.3a	38.1 ± 7.4ab	46.5 ± 7.7ab

NC-71 flue-cured tobacco transplanted on 10 April. Column means with the same letter are not significantly different, Tukey test, $P>0.05$.

Evaluation of MANA Nematicides for Control of Root Knot Nematode on Tobacco

A.S. Csinos, L.L. Hickman, S.S. Lahue and B. Crawford

Introduction

Root knot nematodes are becoming an increasing problem on commercial tobacco production and can cause significant yield and stand reduction with heavy populations. The primary nematodes that attack tobacco are *Meloidogyne incognita*, *Meloidogyne arenaria* Race 2 and *Meloidogyne javanica*. There currently are no resistant cultivars for *M. arenaria* Race 2 and *M. javanica,* which complicates the traditional control method of crop rotation. Loss of the fumigant methyl bromide, reduced supply of petroleum-based fumigants and general lack of effective nematicides have resulted in a high priority search for finding an effective nematode control. This study evaluates a product from MANA and several industry standards and their effectiveness in reducing nematode damage.

Methods and Materials

The study was located at the Bowen Farm, CPES, Tifton, Ga., in a field with a history of crops such as corn, peanuts, tobacco, soybeans and assorted vegetables. The area was prepared using all current University of Georgia Cooperative Extension recommendations. The plot design was a randomized complete block design (RCBD) consisting of single row plots replicated six times. Each plot was 37 feet long with 5-foot alleys between repetitions.

On 28 January 2008, variety NC-71 was seeded into 242 cell flats. On 19 March, the pre-plant treatments of Admire Pro and Actigard 50WG were sprayed on in 200 ml of water per flat. Admire Pro and Actigard 50WG were tank mixed, then washed in with 0.25 inches of water. Actigard 50WG greenhouse treatments were applied at 2 g ai/7,000 plants. Admire Pro greenhouse treatments were applied at 1 oz/1,000 plants. The plants were transplanted 30 April in plots on 44-inch rows with a 22-inch plant spacing. An average of 20 plants per test plot were planted.

Crop maintenance was achieved by using University of Georgia Cooperative Extension recommendations for the control of weeds, suckers and insects. Chemicals used for maintenance of the crop were Orthene 97 at 0.5 lbs/A for insect control, Prowl 3.3 EC at 2 pts/A for weed control and Royal MH-30 Extra at 1.5 gal/A for sucker control.

Field Treatments

Field treatments 1-5 (MANA 09 and Nemacur 3 SC) were applied on 27 April using a CO_2 sprayer with one TX-12 tip/row with a 50-mesh ball check screen. Tips were angled at plants and sprayed in a 12-inch band at the rate of 40 PSI for 10.0 gal H_2O per acre. All treatments were mixed in 3 liters of water unless otherwise noted. Treatment 6 (Temik) was applied same-day, but was applied with a handheld applicator that delivered 24.4 grams of material per plot in a linear application. Field treatments were rototilled into the soil to incorporate and then watered overhead.

Field Data

Tobacco plots were scouted every two weeks beginning 14 May to record the number of plants still living and to determine other disease incidence, and to identify any phytotoxicity problems that may be associated with the various treatment chemicals being applied.

Three harvests were conducted on 29 June, and 13 and 27 August. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot in pounds. Stand counts were conducted every 14 days from 14 May through 13 July. One height measurement was conducted on 28 May. Plants were measured in centimeters from the base of the plant to the tip of the longest leaf.

Three vigor ratings were conducted on a 1-10 scale, with 10 equaling vigorous healthy plants and 1 equaling poor vigor plants. Vigor ratings were conducted on 21 May, 11 June and 02 July.

Soil samples to determine nematode population and genus were taken on 27 April (pre-plant) and again at final harvest on 02 September. Eight to 10 cores of soil, 2.5-cm-diam x 25 cm-deep (approximate) were collected from each plot. Nematodes were extracted from a 200 cm^2 sifted sub-sample using the centrifugal flotation method. The extracted nematodes were then counted.

On 04 June, a mid-season root gall evaluation was conducted on six plants per plot using a 0-10 Zeck's scale (Zeck, 1971), whereby 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small galls and some big galls, 5 = 25% of roots severely galled, 6 = 50% of roots severely galled, 7 = 75% of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, and 10 = plant and roots dead. A second root gall rating was conducted 03 September (at final harvest) on 10 plants per plot using the same scale.

Summary

This trial was planted very late and thus the yield was significantly reduced from its potential. The area was known to have a history of high nematode numbers and was determined to have *Meloidogyne arenaria* Race 2 as the principle nematode pathogen. Nemacure was used at only 1 gal/A, while the recommendation for tobacco is 2 gal; thus, Nemacure efficiency was low.

MCW-2 promoted high vigor levels and early plant heights were comparable to the non-treated and standards, indicating no evidence of phytotoxicity. Yields were low throughout the trial; however, the higher rates of MCW-2 numerically provided the highest yields in the trial.

Tobacco values are currently $1.50-$1.80 per pound. Treatments having 200-300 pounds increase in yield over the standard could provide growers a substantial increase in income over the standard.

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Evaluation of MANA Nematicides for Control of Root Knot Nematode on Tobacco

Table 1. Plant Height, Plant Vigor and Dry Weight Yield of Tobacco

Treatment		Rate	Plant Height[2] (cm)	Vigor Ratings (1-10 Scale)[3]				Dry weight Yield [4] (lb./Acre)
				21 May	11 June	02 July	Average	
1.	MCW-2	.842l/A	18.6a	8.0bc	8.2b	7.8c	8.0c	1003.6b
2.	MCW-2	1.684l/A	18.9a	8.8ab	9.6a	8.4bc	8.9ab	1140.4ab
3.	MCW-2	2.530l/A	18.7a	8.8ab	9.4a	9.0ab	9.1ab	1490.4a
4.	MCW-2	3.360l/A	18.5a	9.2a	9.6a	9.2a	9.3a	1228.2ab
5.	Nemacur 3 SC	1 gal/A	21.0a	7.2cd	8.0b	6.0d	7.1d	897.1bc
6.	Temik	20 lbs. formulated product/A	18.7a	8.4ab	9.0a	7.8c	8.4bc	1147.5ab
7.	Non-Treated Control	No treatment	20.7a	6.8d	6.6c	3.8e	5.7e	507.9c

1 Data are means of five replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test.
2 Height measurements were done in centimeters from the soil level to the tip of the longest leaf. A height measurement was conducted on 28 May.
3 Vigor ratings were done on a 1-10 scale, with 10=live and healthy plants and 1= dead plants, on 21 May, 11 June and 02 July.
4 Dry weight yield was calculated by multiplying green weight totals by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 6,491 divided by the base stand count. Tobacco was planted in 44-inch rows, with 22 inches between plants, which equals 6,491 plants/A.

Evaluation of MANA Nematicides for Control of Root Knot Nematode on Tobacco

Table 2. Nematode Root Gall Ratings and Number of Plant Parasitic Nematodes

Treatment		Rate	Root Gall Ratings (Zeck Scale 0-10)[2]		Nematodes (# Larva/ 200 cc Soil)[3]
			04 June	03 September	02 September
1.	MCW-2	.842l/A	.433b	8.1a	8.1a
2.	MCW-2	1.684l/A	.30b	4.6bc	4.6bc
3.	MCW-2	2.530l/A	.10b	3.6c	3.6c
4.	MCW-2	3.360l/A	.07b	3.4c	3.4c
5.	Nemacur 3 SC	1 gal/A	.20b	7.4ab	7.4ab
6.	Temik	20 lbs. formulated product/A	.70b	6.9ab	6.9ab
7.	Non-Treated Control	No treatment	2.8a	9.3a	9.3a

1 Data are means of five replications. Means in same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test.
2 Gall Ratings were done using the Zeck's scale (Zeck, 1971) a 0-10 Scale where 10=dead plants and roots, and 0= no galls and a healthy plant. An average was taken of the gall ratings on 04 June (mid-season) rating three plants per plot and again on 03 September (at final harvest) rating ten plants per plot.
3 Soil samples were collected from plots on 02 September. Root Knot Nematode (*Meloidosyne sp.*)

Evaluation of Application Techniques and Reduced Phytotoxic Effects of Actigard and Admire Pro for Control of Tomato Spotted Wilt Virus
Trial I Bowen Farm, Tifton, Ga., 2009

A.S. Csinos, L.L. Hickman, S. Lahue and S.W. Mullis

Introduction
Tomato spotted wilt virus on tobacco is a serious problem in Georgia. Applications of Admire Pro and Actigard are recommended in the float house. Some positive influence over the control of TSWV has been shown in past studies by applying Actigard to plants in the field after transplant. Field applications of Actigard and application techniques are under development to determine its best use.

Methods and Materials
The study was located at the Bowen Farm, CPES, Tifton, Ga., in a field with a crop rotation history of cotton, peanuts, soybeans, assorted vegetables and tobacco. The area was prepared using all current University of Georgia Cooperative Extension recommendations. The plot design was a randomized complete block design (RCBD) consisting of single row plots replicated five times. Each plot was 37 feet long with 10-foot alleys between repetitions.

On 20 January, variety NC-71 was seeded into 242-cell flats. On 20 March, the pre-plant treatments of Actigard 50WG and Admire Pro were tank mixed and sprayed on in 200 ml of water per flat then washed in with 0.25 inch of water. Actigard 50WG was applied at 2 g ai/7,000 plants. Admire Pro greenhouse treatments were applied at 1 oz/1,000 plants.

The plants were transplanted on 26 March in plots on 44-inch rows with a 22-inch plant spacing. An average of 20 plants per test plot were planted.

Crop maintenance was achieved by using University of Georgia Cooperative Extension recommendations for the control of weeds, suckers and insects. Chemicals used for maintenance of the crop were Orthene 97 at 0.5 lbs/A for insect control, Prowl 3.3EC at 2 pts/A for weed control and Royal NH-30 Extra at 1.5 gal/A for sucker control.

Field Treatments
Spray field treatments were applied using a CO_2 sprayer with one TX-12 tip/row with a 50-mesh ball check screen. Tips were angled at plants and sprayed in a 12-inch band at the rate of 40 PSI for 10.0 gal water per acre.

Drench treatments were applied by hand by pouring 50 ml of a stock solution into a hole next to the base of each plant in the plot. Field application rates of Actigard 50WG were 1 oz/A and the Admire Pro rate was applied at 6 oz/A. First symptom treatments were applied on 01 May. Additional treatments of + 1 week + 1 week (Treatments 2-11) and first symptom + 2 weeks (Treatment 12) were applied on 07 May and 14 May.

Tobacco plots were scouted weekly to determine TSWV disease incidence and percentage of infection in non-treated plots. Percent infection levels were noted and triggered specific treatments. The first symptom of TSWV was noted 31 days post transplant.

Stand counts were taken beginning 17 April with the final stand count being conducted on 26 June. Plants displaying symptoms of TSWV were flagged in the field.

Tobacco plots were scouted weekly to determine TSWV disease incidence and percentage of infection in non-treated as compared to treated plots. Stand counts were conducted beginning 15 April with a final stand count being done on 18 June.

Three harvests were conducted on 01, 16 and 30 July. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot separately in pounds.

Following the final harvest, root samples were collected from 10 plants per plot and an ELISA test was performed to determine TSWV incidence. The screen for TSWV was accomplished by the use of double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphase antisera kits (Agdia, Inc. Elkhart,IN). Samples of 1.0 gram were subjected to DAS-ELISA, and any sample eliciting an absorbance reading (A405) of three times the average plus two standard deviations of a healthy negative control were considered positive results.

Summary
2009 was very wet, windy and cool during the month of April. TSWV ranged from a high of 43% in the non-treated control to 10% in the Actigard and Admire float house plus field applications of Actigard. Spray applications tend to perform better than injected treatments for TSWV management.

Treatments that received the Admire Pro as field applications tended to have higher levels of TSWV than those that were treated with Actigard.

Almost all of the treatments with Actigard as field sprays were significantly higher in yield than the non-treated. Admire Pro (float house) plus Actigard field spray had the highest yield numerically.

Acknowledgments
The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco and Altria Services (Philip Morris) for their support of this work. Thanks are also extended to Alana Heath, Brice Crawford, Holly Hickey, Seth Dale and Travis Brown for their assistance.

Evaluation of Application Techniques and Reduced Phytotoxic Effects of Actigard and Admire for Tomato Spotted Wilt Virus (TSWV) Trial I, Bowen Farm, Tifton, Ga., 2009

Table 1. Plant Height in Centimeters, Plant Vigor, and Dry Weight Yield of Tobacco Leaf Harvests

Treatment[1] (Greenhouse)	Field Treatment[2]	Plant Height[3]	Vigor Ratings[4]	Dry Weight Yield[5]
1. Non treated Control	No field treatment	34.3a	4.25f	1056.6c
2. Non treated Control	Actigard 1st symptom - Inject + 1 week + 1 week	32.9a	4.6ef	1869.7ab
3. Non treated Control	Actigard 1st symptom - Spray + 1 week + 1 week	32.8a	4.8ef	1905.9ab
4. Actigard & Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	27.8a	4.7ef	1777.0ab
5. Actigard & Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	31.4a	5.0de	1862.4ab
6. Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	34.8a	5.5d	2102.7a
7. Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	26.5a	5.45d	1423.7bc
8. Actigard & Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	33.7a	6.25c	1621.7abc
9. Actigard & Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	32.9a	6.25c	1761.1ab
10. Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	33.3a	6.5bc	1773.5ab
11. Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	36.8a	6.9ab	1703.3abc
12. Admire Pro	Actigard 1st symptom - Spray + 2 weeks	36.6a	7.2a	1905.8ab

[1] Data are means of five replications. Means in same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test.
[2] Treatments consisted of field applications applied when first symptom of TSWV was identified through scouting control plots. Plots received additional applications 1 week and 2 weeks afterwards according to the treatment list. Treatments were either sprayed on or injected into the root zone of plants. All Actigard and Admire Pro treatments were applied as pre-plant treatments in the greenhouse at a rate of 2gai/7000 plants-Actigard and 1.0z/1000 plants-Admire Pro.
[3] Height measurements were done in inches from the soil level to the tip of the longest leaf. A height measurement was conducted on 26 May.
[4] Vigor ratings were done on a 1-10 scale with 10=live and healthy plants and 1= dead plants on 15 and 26 May.
[5] Dry weight yield was calculated by multiplying green weight totals by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 6491 divided by the base stand count. Tobacco was planted in 44-inch rows, with 22-inches between plants, which equals 6,491 plants/A.

Evaluation of Application Techniques and Reduced Phytotoxic Effects of Actigard and Admire for Tomato Spotted Wilt Virus (TSWV) Trial I, Bowen Farm, Tifton, Ga., 2009

Table 2. Incidence of TSWV infection and % TSWV positive plants as identified through ELISA testing of root samples

Treatment[1] (Greenhouse)	Field Treatment[2]	% TSWV[3]	% ELISA (+) Plants[4]
1. Non treated Control	No field treatment	43.44a	36.0a-d
2. Non treated Control	Actigard 1st symptom - Inject + 1 week + 1 week	19.75bcd	24.0bcd
3. Non treated Control	Actigard 1st symptom - Spray + 1 week + 1 week	10.75d	24.0bcd
4. Actigard & Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	10.05d	20.0cd
5. Actigard & Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	11.28d	12.0d
6. Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	14.34cd	16.0cd
7. Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	17.17bcd	20.0cd
8. Actigard & Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	29.01abc	48.0ab
9. Actigard & Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	17.02bcd	16.0cd
10. Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	31.33ab	56.0a
11. Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	24.64bcd	32.0a-d
12. Admire Pro	Actigard 1st symptom - Spray + 2 weeks	23.98bcd	40.0abc

[1] Data are means of five replications. Means in the same column followed by the same letter are not significantly diffrent (P=0.05) according to Fisher's LSD test.

[2] Treatments consisted of field applications applied when first symptom of TSWV was identified through scouting control plots. Plots received additional applications 1 week and 2 weeks afterwards according to the treatment list. Treatments were either sprayed on or injected into the root zone of plants. All Actigard and Admire Pro treatments were applied as pre-plant treatments in the greenhouse at a rate of 2gai/7000 plants-Actigard and 1.0z/1000 plants-Admire Pro.

[3] Percent TSWV was calculated by using stand counts that were made from 11 April through 26 June with TSWV being recorded and flagged every seven days.

[4] Final harvest testing was completed on 24 July. Ten root samples were collected per plot. ELISA testing was performed in the lab using double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphatase antisera kits. ELISA test results are percent positive plants.

Evaluation of Application Techniques and Reduced Phytotoxic Effects of Actigard and Admire Pro for Control of Tomato Spotted Wilt Virus
Trial II Bowen Farm, Tifton, Ga., 2009

A.S. Csinos, L.L. Hickman, S. Lahue and S.W. Mullis

Introduction
Tomato spotted wilt virus on tobacco is a serious problem in Georgia. Applications of Admire Pro and Actigard are recommended in the float house. Some positive influence over the control of TSWV has been shown in past studies by applying Actigard to plants in the field after transplant. Field applications of Actigard and application techniques are under development to determine its best use.

Methods and Materials
The study was located at the Bowen Farm, CPES, Tifton, Ga., in a field with a crop rotation history of cotton, peanuts, soybeans, assorted vegetables and tobacco. The area was prepared using all current University of Georgia Cooperative Extension recommendations. The plot design was a randomized complete block design (RCBD) consisting of single row plots replicated five times. Each plot was 37 feet long with 10-foot alleys between repetitions. On 09 February, variety NC-71 was seeded into 242-cell flats. On 17 April, the preplant treatments of Actigard 50WG and Admire Pro were tank mixed and sprayed on in 200 ml of water per flat, then washed in with 0.25 inch of water. Actigard 50WG was applied at 2 g ai/7,000 plants. Admire Pro greenhouse treatments were applied at 1 oz/1,000 plants.

The plants were transplanted on 21 April in plots on 44-inch rows with a 22-inch plant spacing. An average of 20 plants per test plot were planted.

Crop maintenance was achieved by using University of Georgia Cooperative Extension recommendations for the control of weeds, suckers and insects. Chemicals used for maintenance of the crop were Orthene 97 at 0.5 lbs/A for insect control, Prowl 3.3EC at 2 pts/A for weed control and Royal NH-30 Extra at 1.5 gal/A for sucker control.

Field Treatments
Spray field treatments were applied using a CO_2 sprayer with one TX-12 tip/row with a 50-mesh ball check screen. Tips were angled at plants and sprayed in a 12-inch band at the rate of 40 PSI for 10.0 gal water per acre.

Drench treatments were applied by hand by pouring 50 ml of a stock solution into a hole next to the base of each plant in the plot. Field application rates of Actigard 50WG were 1 oz/A and the Admire Pro rate was applied at 6 oz/A. First symptom treatments were applied on 04 June. Additional treatments of + 1 week + 1 week (Treatments 2-11) and first symptom + 2 weeks (Treatment 12) were applied on 11 June and 18 June.

Tobacco plots were scouted weekly to determine TSWV disease incidence and percentage of infection in non-treated plots. Percent infection levels were noted and triggered specific treatments. Stand counts were taken beginning 30 April, with the final stand count being conducted on 13 July. Plants displaying symptoms of TSWV were flagged in the field.

Tobacco plots were scouted weekly to determine TSWV disease incidence and percentage of infection in non-treated as compared to treated plots. Stand counts were conducted beginning 15 April with a final stand count being done on 18 June.

Three harvests were conducted on 29 July, 13 August and 01 September. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot separately in pounds.

Following the final harvest, root samples were collected from 10 plants per plot and an ELISA test was performed to determine TSWV incidence. The screen for TSWV was accomplished by the use of double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphase antisera kits (Agdia, Inc. Elkhart,IN). Samples of 1.0 gram were subjected to DAS-ELISA, and any sample eliciting an absorbance reading (A405) of three times the average plus two standard deviations of a healthy negative control were considered positive results.

Summary
This trial was planted three weeks later than its sister trial having all the same treatments. The level of disease was several-fold lower with disease levels ranging from a low of 2.6% to high of 9.6%, with no significant differences among treatments.

Yields were high across the treatments with a low of 1,998 lbs/acre and a high of 2,572 lbs/acre. No significant differences were noted among treatments.

Acknowledgments
The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco and Altria Services (Philip Morris) for their support of this work. Thanks are also extended to Alana Heath, Brice Crawford, Holly Hickey, Seth Dale and Travis Brown for their assistance.

Evaluation of Application Techniques and Reduced Phytotoxic Effects of Actigard and Admire for Tomato Spotted Wilt Virus (TSWV) Trial II, Bowen Farm, Tifton, Ga., 2009

Table 1. Plant Height in Centimeters, Plant Vigor, and Dry Weight Yield of Tobacco Leaf Harvests

Treatment[1] (Greenhouse)	Field Treatment[2]	Plant Height[3]	Vigor Ratings[4]	Dry Weight Yield[5]
1. Non treated Control	No field treatment	27.3 ab	7.5 b	2580.6 a
2. Non treated Control	Actigard 1st symptom - Inject + 1 week + 1 week	26.6 ab	8.4 a	2223.8 a
3. Non treated Control	Actigard 1st symptom - Spray + 1 week + 1 week	22.3 b	8.5 a	2125.4 a
4. Actigard & Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	24.7 ab	8.7 a	2025.7 a
5. Actigard & Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	27.9 ab	9.1 a	2569.6 a
6. Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	25.8 ab	9.0 a	2451.8 a
7. Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	22.4 b	8.7 a	2021.5 a
8. Actigard & Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	29.2 a	8.4 a	2342.8 a
9. Actigard & Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	24.1 ab	8.7 a	2126.6 a
10. Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	26.8 ab	8.4 a	2238.3 a
11. Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	23.4 ab	9.1 a	1998.0 a
12. Admire Pro	Actigard 1st symptom - Spray + 2 weeks	25.0 ab	8.6 a	2572.7 a

[1] Data are means of five replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test.

[2] Treatments consisted of field applications applied when the first symptom of TSWV was identified through scouting control plots. Plots received additional applications one week and two weeks afterwards, according to the treatment list. Treatments were either sprayed on or injected into the root zone of plants. All Actigard and Admire Pro treatments were applied as pre-plant treatments in the greenhouse at a rate of 2 g ai/7,000 plants-Actigard and 1 oz/1,000 plants-Admire Pro.

[3] Height measurements were done in inches from the soil level to the tip of the longest leaf. A height measurement was conducted on 03 June.

[4] Vigor ratings were done on a 1-10 scale, with 10 = live and healthy plants and 1 = dead plants, on 21 May and 03 June.

[5] Dry weight yield was calculated by multiplying green weight totals by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 6,491 divided by the base stand count. Tobacco was planted in 44-inch rows, with 22 inches between plants, which equals 6,491 plants/A.

Evaluation of Application Techniques and Reduced Phytotoxic Effects of Actigard and Admire for Tomato Spotted Wilt Virus (TSWV) Trial II, Bowen Farm, Tifton, Ga., 2009

Table 2. Incidence of TSWV infection and % TSWV positive plants as identified through ELISA testing of root samples

Treatment[1] (Greenhouse)	**Field Treatment[2]**	**% TSWV[3]**	**% ELISA (+) Plants[4]**
1. Non treated Control	No field treatment	8.7a	
2. Non treated Control	Actigard 1st symptom - Inject + 1 week + 1 week	8.1a	
3. Non treated Control	Actigard 1st symptom - Spray + 1 week + 1 week	2.6a	
4. Actigard & Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	4.5a	
5. Actigard & Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	5.3a	
6. Admire Pro	Actigard 1st symptom - Spray + 1 week + 1 week	4.8a	
7. Admire Pro	Actigard 1st symptom - Inject + 1 week + 1 week	4.8a	
8. Actigard & Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	9.6a	
9. Actigard & Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	5.8a	
10. Admire Pro	Admire Pro 1st symptom - Spray + 1 week + 1 week	3.7a	
11. Admire Pro	Admire Pro 1st symptom - Inject + 1 week + 1 week	7.2a	
12. Admire Pro	Actigard 1st symptom - Spray + 2 weeks	3.7a	

[1] Data are means of five replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test.

[2] Treatments consisted of field applications applied when the first symptom of TSWV was identified through scouting control plots. Plots received additional applications one week and two weeks afterwards, according to the treatment list. Treatments were either sprayed on or injected into the root zone of plants. All Actigard and Admire Pro treatments were applied as pre-plant treatments in the greenhouse at a rate of 2 g ai/7,000 plants-Actigard and 1 oz/1,000 plants-Admire Pro.

[3] Percent TSWV was calculated by using stand counts that were made from 30 April through 13 July with TSWV being recorded and flagged every seven days.

[4] Final harvest testing was completed on 24 July. Ten root samples were collected per plot. ELISA testing was performed in the lab using double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphatase antisera kits. ELISA test results are percent positive plants.

Evaluation of Soil Fumigants for Control of Southern Root Knot Nematode on Tobacco, 2009

A.S. Csinos, L.L. Hickman, L. Mullis and U. Hargett

Introduction

With the shortage of Telone II and subsequent increase in cost, the choices for tobacco nematode control are very limited. This research investigates other possibilities for nematode control in tobacco.

Methods and Materials

This trial was conducted at the Black Shank Farm, CPES, Tifton, Ga., in a field with a history of assorted vegetable production. Trial was setup in Block 5 of an area that has been maintained as a nematode nursery with a strong population of *Meloidogyne sp.* nematodes. Field plot areas were turned on 12 March. A fertilizer application of 04-08-12 was broadcast over the plot area and incorporated into the soil after application on 25 March.

On 24 March, trial fumigant treatments were applied to test plots. Fumigant treatments per treatment number were: Trt. 2 - Telone II at 6 gal/A, Trt. 3 - Chloropicrin Plus (Hendrix & Dail) 4 gal/A, Trt. 4 - Vapam 25 gal/A, Trt. 5 - Vapam 25 gal/A + Chloropicrin Plus 1 gal/A, Trt. 6 -Vapam 25 gal/A + Chloropicrin Plus 2 gal/A, Trt. 7 - Vapam 25 gal/A + Chloropicrin plus 3 gal/A, Trt. 8 - Vapam 37.5 gal/A, Trt. 9 - Vapam 37.5 gal/A + Chloropicrin Plus 2 gal/A.

Vapam (metham sodium) was injected approximately 10-12 inches into soil using a fumigation rig with four shanks spaced 12 inches apart and the soil was sealed using a ring roller. Telone II and Chloropicrin Plus were injected approximately 12-14 inches into the soil using a subsoil bedder with two shanks spaced 12 inches apart. Beds were immediately tilled and sealed using a concrete drag. All plots received 0.4 inch of irrigation after fumigant applications to provide a water seal.

On 09 April, applications of Devrinol 50DF at 4 lbs/A and Lorsban 4E at 3 qt/A were incorporated into the plot area. Plots were sub-soiled and bedded on [INFORMATION MISSING] April. The trial was set up in a randomized complete block design (RCBD) with five replications. Each plot was 30 feet long, with 32-inch-wide beds with 10-foot alleys.

Tobacco transplants were treated in the greenhouse on 14 April with Admire Pro at 1 fl. oz./1,000 plants and Actigard 50WG at 4 grams/7,000 plants. Both materials were tank mixed. Plants were pre-wet with materials being washed in after spraying.

Tobacco variety K394 was transplanted on 17 April on 48-inch-wide rows with an 18-inch plant spacing. Cultivation and side-dress fertilizer were as follows: 90 lbs/A of 15.5-0-0 calcium nitrate on 23 April and 28 May; and 500 lbs/A of 4-8-12 on 08 May and 28 May. Layby was done on 28 May.

Additional pesticide applications on tobacco were as follows: applied Ridomil Gold 4 SL at 1 pt/A on 17 April and 07 May, and on 11 June at .25 pt/A; applied Actigard 50 WG at 0.5 oz/A in a 12-inch band, one nozzle over row in 10.35 GPA H_2O on 07 May and 03 June. Orthene 97 was applied for insect control on 03 and 11 June.

Tobacco was topped on 18 June and topped and suckered on 24 June. Royal MH 4% solution at 55 gal/A was applied on 23 June. Fair 30 (MH-30) at 2 gal/A and Butralin at 2 qt/A were applied in 55 gal/A on 26 June.

Total rainfall recorded at the Black Shank Farm during this period (March through August 2009) was 39.8 inches.

Field Trial Data

A stand count was conducted on 24 April to establish a base count. Stand counts were conducted thereafter every two weeks beginning 01 May and ending 09 July to monitor any loss of plants.

Vigor ratings were conducted on 11 May (four weeks post-plant) and 26 May (six weeks post-plant). Plant vigor was rated on a scale of 1-10, with 10 representing live and healthy plants and 1 representing dead plants.

Height measurements were conducted on 16 June. Plants were measured individually from the soil level to the tip of the longest leaf and recorded in centimeters.

Three harvests were conducted on 08 and 22 July and 06 August. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot in pounds.

A mid-season root gall rating was conducted on 02 June on three plants per plot using the Zeck's scale of 0-10, whereby 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some large galls, 5 = 25% of roots severely galled, 6 = 50% of roots severely galled, 7 = 75% of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plants dying, and 10 = plants and roots dead. A second root gall rating was conducted following the final harvest on 17 August, rating 10 plants per plot utilizing the same scale.

Nematode soil samples were pulled from plots on 24 March (prior to planting and soil treatment) and again on 19 August (at final harvest). Eight to 10 cores of soil, 2.5-cm-diameter x 25-cm-deep, were collected from each plot randomly. Nematodes were extracted from 200-cm^3 soil sub-samples using a centrifugal sugar flotation technique.

Summary

Vigor ratings were low most likely due to chemical fumigant/soil moisture interaction that occurred early in the year. Height measurements were uniform across treatments and indicated that no stunting occurred from the chemical treatments.

Yields were high and all treatments except treatment #5 were significantly higher than the non-treated control.

Root gall ratings were low to moderate at mid-season and at harvest with little difference among treatments. Root knot larval numbers were low at plant and increased in the non-treated and chloropicrin plus treated plots by harvest time.

2009 Evaluation of Soil Fumigants for Control of Southern Root Knot Nematode on Tobacco
UGA-CPES-Black Shank Farm - Tifton, Ga.
Table 1. Plant Vigor, Plant Height and Dry Weight Yield of Tobacco Variety K394

Treatment	Rate/Application Schedule	Vigor Ratings [2]	Height Measurements[3]	Dry Weight Yield [4]
1. Non-treated control	N/A	3.4b	56.16ab	1814.8bc
2. Telone II	6 gal/A-chisel	4.0b	54.84ab	2250.1abc
3. Chloropicrin Plus	4 gal/A- chisel	6.1a	51.62b	1788.4c
4. Vapam	25 gal/A- chisel, rototill, seal	3.5b	57.82a	2308.4a
5. Vapam + Chloropicrin Plus	25 gal/A- chisel, rototill, seal 1.87 gal/A	4.0b	57.54a	2285.6ab
6. Vapam + Chloropicrin Plus	25 gal/A- chisel, rototill, seal 2.27 gal/A	4.0b	57.48a	2522.7a
7. Vapam + Chloropicrin Plus	25 gal/A- pre plant incorporate 3 gal/A	4.1b	54.16ab	2302.4a
8. Vapam	37.5 gal/A Chisel, rotoill, seal	3.3b	52.7ab	2514.0a
9. Vapam + Chloropicrin Plus	37.5 gal/A- pre plant incorporate 1.87 gal/A	3.8b	56.18ab	2463.6a
10. Vapam + Chloropicrin Plus	37.5 gal/A- pre plant incorporate 2.27 gal/A	3.4b	57.94a	2326.1a

1 Data are means of five replications. Means in the same column followed by the same letter are not different (P=0.05) according to Fisher's LSD. No letters indicates non-significant difference.
2 Vigor was done on a scale of 1-10, with 10 = live and healthy plants and 1 = dead plants, and an average was taken of vigor. Ratings were conducted on 11 and 26 May.
3 Height measurements were conducted by measuring each plant from the base of the plant to the tip of the longest leaf. Measurements were taken in centimeters on 15 June.
4 Dry weight yield was calculated by multiplying green weight totals of tobacco by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 7,260 divided by the base stand count.

2009 Evaluation of Soil Fumigants for Control of Southern Root Knot Nematode on Tobacco
UGA-CPES-Black Shank Farm - Tifton, Ga.
Table 2. Root gall ratings of tobacco

Treatment	Rate/Application Schedule	Root Gall Ratings (Zeck's Scale 0-10)	
		Mid-season (02 June)	At Harvest (17 August)
1. Non-treated control	N/A	3.0a	3.5b
2. Telone II	6 gal/A-chisel	2.9a	4.0b
3. Chloropicrin Plus	4 gal/A- chisel	3.1a	6.1a
4. Vapam	25 gal/A- chisel, rototill, seal	1.6a	3.5b
5. Vapam + Chloropicrin Plus	25 gal/A- chisel, rototill, seal 1.87 gal/A	2.7a	3.7b
6. Vapam + Chloropicrin Plus	25 gal/A- chisel, rototill, seal 2.27 gal/A	1.5a	4.0b
7. Vapam + Chloropicrin Plus	25 gal/A- pre plant incorporate 3 gal/A	1.2a	4.1b
8. Vapam	37.5 gal/A Chisel, rotoill, seal	2.2a	3.3b
9. Vapam + Chloropicrin Plus	37.5 gal/A- pre plant incorporate 1.87 gal/A	1.5a	3.8b
10. Vapam + Chloropicrin Plus	37.5 gal/A- pre plant incorporate 2.27 gal/AN/A	2.5a	3.4b

[1] Data are means of five replications. Means in the same column followed by the same letter are not different (P=0.05) according to Fisher's LSD.
[2] Gall ratings were done on a scale of 0-10, with 10 = dead plants and roots and 0 = no galls and a healthy plant. An average was taken of the gall ratings on five plants per plot and again on 09 July rating 10 plants per plot.

2009 Evaluation of Soil Fumigants for Control of Southern Root Knot Nematode on Tobacco
UGA-CPES-Black Shank Farm - Tifton, Ga.
Table 3. Soil population of parasitic nematodes

Treatment		Rate/Application Schedule	Number of *Meloidogyne incognita* larvae per 200 cc soil	
			Pre-Plant (24 March)	At Harvest (19 August)
1.	Non-treated control	N/A	9.8ab	148.0a
2.	Telone II	6 gal/A-chisel	14ab	41.2b
3.	Chloropicrin Plus	4 gal/A- chisel	28ab	124.0a
4.	Vapam	25 gal/A- chisel, rototill, seal	36ab	48.0b
5.	Vapam +Chloropicrin Plus	25 gal/A- chisel, rototill, seal 1.87 gal/A	8b	36.0b
6.	Vapam + Chloropicrin Plus	25 gal/A- chisel, rototill, seal 2.27 gal/A	48a	52.0b
7.	Vapam + Chloropicrin Plus	25 gal/A- pre plant incorporate 3 gal/A	22ab	44.0b
8.	Vapam	37.5 gal/A Chisel, rotoill, seal	46ab	40.0b
9.	Vapam + Chloropicrin Plus	37.5 gal/A- pre plant incorporate 1.87 gal/A	19.6ab	46.0b
10.	Vapam + Chloropicrin Plus	37.5 gal/A- pre plant incorporate 2.27 gal/A	8b	36.0b

[1] Data are means of five replications. Means in the same column followed by the same letter are not different (P=0.05) according to Fisher's LSD.
[2] At planting soil samples were taken on 24 March. Root Knot Nematode (*Meloidogyne sp.*)

Impact of Nitrogen Fertility Level on Thrips Population Densities and Suppression of Tomato Spotted Wilt Virus in Flue-cured Tobacco

R. McPherson, W. Stephens, S.S. LaHue, and E. Troxell

Introduction

Nitrogen fertility level directly impacts the growth and development of flue-cured tobacco, which can also influence the incidence of certain insect pests and pathogens. Thrips continue to increase in importance as economic insect pests of flue-cured tobacco because of their ability to vector Tomato spotted wilt virus (TSWV). This thrips-borne disease costs Georgia tobacco producers millions of dollars in lost revenue annually. The most common thrips vector on tobacco foliage is the tobacco thrips, Frankliniella fusca, but other, less abundant, species are also confirmed as vectors of TSWV, including the western flower thrips, F. occidentalis. This study was conducted to examine the impact of the nitrogen fertility level on the seasonal abundance of thrips and the incidence of TSWV symptomatic plants in flue-cured tobacco. Weekly insect counts and incidence of TSWV were compared between five nitrogen fertility levels throughout the season.

Materials and Methods

Flue-cured tobacco, variety K-326, was transplanted on 9 April on the Bowen Research Farm in Tift County, Ga. Production practices were used according to University of Georgia Cooperative Extension guidelines for weed control, disease control, nematode suppression and fertilization.

Nitrogen fertility level included rates of 0, 45, 60, 75 or 90 lbs/acre. At transplanting, 20 field plots, two rows wide (44-inch row spacing) by 58.5 feet long were arranged in an RCBD with four replications. The 45 lbs of N/acre rate was applied in 500 lbs of 6-6-18 in late April and 94 lbs/acre of 16-0-0 was applied in mid-May; the 60 lbs of N/acre rate was applied in 500 lbs/acre of 6-6-18 in late April and 250 lbs/acre of 6-6-18 plus 94 lbs/acre of 16-0-0 were applied in mid-May; the 75 lbs of N/acre rate was applied as the 60 lbs rate plus an additional 94 lbs/acre of 16-0-0 was applied in late May; and the 90 lbs of N/acre rate was applied as the 60 lbs rate plus 190 lbs of 16-0-0 was applied in late May.

The number of live thrips and tobacco aphids on plants 2, 4, 6 and 8 on the second row of each plot was counted weekly from late April to mid-June. All plants in each plot were visually examined weekly for symptoms of TSWV from April through June. Symptomatic plants were flagged and dated, and the cumulative percentage of symptomatic plants was determined. All thrips and aphid counts plus TSWV data were subjected to analysis of variance with P=0.05. Treatment means were separated using Duncan's multiple range test.

Results and Discussion

Nitrogen fertility level had very little effect on thrips population densities. Thrips populations were low in all plots until the late May sampling date. Then, populations were between 25 and 40 thrips per four plants, and these densities were not different between N fertility rates. Thrips populations declined rapidly in all plots in early June. Tobacco thrips (F. fusca) comprised more than 80% of the thrips species on tobacco foliage at this test site. Tobacco aphid populations were low in all plots until mid-June, when some plants in the 75 lbs and 90 lbs N rates had around 50-100 aphids per plant, but these infestations were sporadic. Mean aphid densities were not different between the N fertility rates on any sampling date. TSWV symptomatic plants were lower in the 0 lbs N rate than in the 90 lbs/acre N rate on all sampling dates from 27 May to 1 July (Table 1). On 1 July, the percent of TSWV approached 18% in the 90 lbs N rate compared to only 9% in the 0 lbs N rate.

In conclusion, the N fertility rates examined in this flue-cured tobacco trial had little impact on thrips and aphid infestation levels in 2009. However, the incidence of TSWV symptomatic plants was higher in the 90 lbs/acre rate of N compared to the 0 lbs rate of N. Additional studies on N rates are needed under different naturally occurring infection rates of TSWV and population densities of thrips vectors to effectively evaluate the interactions of N fertility and TSWV infection.

Acknowledgments

The authors thank Charlie Hill for technical support, and the Georgia Agricultural Commodity Commission for Tobacco and the Georgia Agricultural Experiment Stations for financial assistance.

Table1. Effects of nitrogen fertility rate on the seasonal incidence of Tomato spotted wilt virus in flue-cured tobacco, Tift County, Ga., 2009.

	Percent of TSWV symptomatic plants					
Nitrogen Rate	**20 May**	**27 May**	**3 June**	**10 June**	**17 June**	**1 July**
0 lbs/a	1.4a	2.1b	4.0b	6.8b	9.0b	9.0b
45 lbs/a	1.4a	7.8ab	9.2ab	12.0ab	14.1ab	14.8ab
60 lbs/a	1.7a	9.7a	13.1a	15.6a	16.0ab	16.3ab
75 lbs/a	2.4a	8.7a	11.8ab	13.9ab	15.4ab	16.1ab
90 lbs/a	1.8a	10.8a	13.7a	15.8a	17.6a	17.9a

K-326 flue-cured tobacco transplanted on 9 April. Plots were twp rows by 58.5 feet (32 plants per row), planted in an RCB design with four replications. Column means with the same letter are not significantly different, Duncan's multiple range test, P>0.05.

Modeling of Field Applications of Actigard and Admire Pro for Management of Tomato Spotted Wilt Virus in Tobacco
Bowen Farm, Tifton, Ga.

A.S. Csinos, L.L. Hickman, S. Lahue and S.W. Mullis

Introduction
Tomato spotted wilt virus continues to be of great concern to Georgia tobacco producers. This study was initiated to determine the effects of Actigard and Admire Pro applications in the field for Tomato spotted wilt virus management. In addition, different timing scenarios were evaluated to determine if the time of application was relative to the initiation of the epidemic and whether there was an influence on disease control and yield.

Methods and Materials
The study was located at the Bowen Farm CPES, Tifton, Ga., in a field with a history of crops such as corn, soybeans, peanuts, tobacco and assorted vegetables. The area was prepared using all current University of Georgia Cooperative Extension recommendations.

The plot design was a randomized complete block design (RCBD) consisting of single row plots replicated five times. Each plot was 37 feet long with 10-foot alleys between repetitions.

On 20 January, variety NC-71 was seeded into 242-cell flats. On 20 March, the pre-plant treatments of Admire Pro and Actigard 50WG were sprayed on in 200 ml of water per flat. Treatments that called for both Admire Pro and Actigard 50WG were tank mixed, then washed in with 0.25 inch of water. Actigard 50WG greenhouse treatments were applied at 2 g ai/7,000 plants. Admire Pro greenhouse treatments were applied at 1 oz/1,000 plants. The plants were transplanted on 26 March in plots on 44-inch rows with a 22-inch plant spacing. An average of 20 plants per test plot were planted.

Crop maintenance was achieved by using University of Georgia Cooperative Extension recommendations for the control of weeds, suckers and insects. Chemicals used for maintenance of the crop were Orthene 97 at 0.5 lbs/A for insect control, Prowl 3.3 EC at 2 pts/A for weed control and Royal MH-30 Extra at 1.5 gal/A for sucker control.

Field Treatments
Field treatments were applied using a CO_2 sprayer with one TX-12 tip/row with a 50-mesh ball check screen. Tips were angled at plants and sprayed in a 12-inch band at the rate of 40 PSI for 10.0 gal H_2O per acre. All treatments were mixed in three liters of water unless otherwise noted. Field Treatments 3 through 8 were originally scheduled to be applied beginning 14 days post transplant and continued every seven days thereafter to 49 days post transplant. Due to inclement weather, including several days of heavy rainfall, flooding, and a hail storm that occurred on 05 April, treatments were delayed until tobacco plants had a chance to recover from damage. Treatments 9-12 were applied on schedule since the first symptom of TSWV did not occur until 30 April. All field applications of Actigard 50WG were made at ½ oz/A (1.1g Actigard 50WG in 3 L/H_2O). A field treatment schedule and dates that treatments were applied is listed in the following table (Table 1).

Tobacco plots were scouted weekly to determine TSWV disease incidence and percentage of infection in non-treated as compared to treated plots. Stand counts were conducted beginning 15 April with a final stand count being done on 18 June.

Three harvests were conducted on 01, 16 and 30 July. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot separately in pounds.

Following the final harvest, root samples were collected from 10 plants per plot and an ELISA test was performed to determine TSWV incidence. The screen for TSWV was accomplished by the use of double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphase antisera kits (Agdia, Inc. Elkhart,IN). Samples of 1.0 gram were subjected to DAS-ELISA, and any sample eliciting an absorbance reading (A405) of three times the average plus two standard deviations of a healthy negative control were considered positive results.

Summary
2009 was a very difficult year for tobacco, with high rainfall (23 inches in two weeks), hail, frost, high TSWV and winds. However, even with all of the adversity, the test produced a better than average crop.

TSWV ranged from a high of 39% in the non-treated to 7% in the best treatment. The standards (Actigard and Admire float house) plots had 36% TSWV, suggesting that in some years the float house treatment may not be sufficient to control TSWV.

The treatments with the lowest TSWV were plots that received Actigard and Admire in the float house plus Actigard in the field applied at first symptom on non-treated plots.

Yields ranged from 1,350 lbs/acre to a high of 2,260 lbs/acre. All of the treatments with Actigard and Admire in the float house plus field sprays at first symptom had higher yields than the standard.

Acknowledgments

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Modeling Field Application of Actigard for Control of Tomato Spotted Wilt Virus (TSWV) Bowen Farm, Tifton, Ga., 2009

Table 1. Application Schedule and Dates of Actigard and Admire Pro Field Treatments

Treatment[1] (Greenhouse)	**Field Treatment[2]**	**Original Scheduled Application Date**	**Actual Application Date**
1. Non treated Control	No field treatment	N/A	N/A
2. Actigard & Admire Pro	No field treatment	N/A	N/A
3. Actigard & Admire Pro	+ 14 days post transplant (DPT)	09 April	01 May
4. Actigard & Admire Pro	+ 21 DPT	16 April	07 May
5. Actigard & Admire Pro	+ 27 DPT	23 April	14 May
6. Actigard & Admire Pro	+ 35 DPT	30 April	21 May
7. Actigard & Admire Pro	+ 42 DPT	07 May	27 May
8. Actigard & Admire Pro	+ 49 DPT	14 May	04 June
9. Actigard & Admire Pro	+ at 1st symptom	No Change in application Schedule	01 May
10. Actigard & Admire Pro	+ at 1st symptom + 1 week	No Change in application Schedule	01 May + 07 May
11. Actigard & Admire Pro	+ at 1st symptom + 1 week + 1 week	No Change in application Schedule	01 May + 07 May + 14 May
12. Admire Pro	+ at 1st symptom + 2 weeks + 2 weeks	No Change in application Schedule	01 May + 14 May + 27 May

Modeling Field Application of Actigard for Control of Tomato Spotted Wilt Virus (TSWV) Bowen Farm, Tifton, Ga., 2009

Table 2. Plant Height in Centimeters, Plant Vigor, and Dry Weight Yield of Tobacco Leaf Harvests.

Treatment[1] (Greenhouse)	Field Treatment[2]	Plant Height[3]	Vigor Ratings[4]	Dry Weight Yield[5]
1. Non treated Control	No field treatment	28.78 a	4.10 h	1449.7 c
2. Actigard & Admire Pro	No field treatment	29.84 a	4.35 gh	1320.0 c
3. Actigard & Admire Pro	+ 14 days post transplant (DPT)	28.58 a	4.75 fg	1972.3 ab
4. Actigard & Admire Pro	+ 21 DPT	31.40 a	5.10 ef	1697.7 bc
5. Actigard & Admire Pro	+ 27 DPT	33.94 a	5.25 ef	1743.9 bc
6. Actigard & Admire Pro	+ 35 DPT	28.84 a	5.30 e	2002.2 ab
7. Actigard & Admire Pro	+ 42 DPT	28.38 a	5.60 de	1482.3 c
8. Actigard & Admire Pro	+ 49 DPT	34.46 a	6.10 cd	1670.0 bc
9. Actigard & Admire Pro	+ at 1st symptom	28.22 a	6.20 bc	1932.7 ab
10. Actigard & Admire Pro	+ at 1st symptom + 1 week	28.24 a	6.40 bc	2266.0 a
11. Actigard & Admire Pro	+ at 1st symptom + 1 week + 1 week	30.64 a	6.65 ab	2027.3 ab
12. Admire Pro	+ at 1st symptom + 2 weeks + 2 weeks	32.16 a	7.0 a	2197.9 a

1 Data are means of six replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test.

2 Treatments consisted of field applications applied weekly beginning at seven days post transplant and continuing every seven days thereafter up to 49 days post plant. Other treatments were applied when the first symptom of TSWV was identified through scouting control plots, with some receiving an additional application one week, two weeks and four weeks afterwards, according to the treatment list. All Actigard and Admire Pro treatments were applied as pre-plant treatments in the greenhouse at a rate of 2 g ai/7,000 plants-Actigard and 1 oz/1,000 plants-Admire Pro.

3 Height measurements were done in inches from the soil level to the tip of the longest leaf. A height measurement was conducted on 21 May and 17 June.

4 Vigor ratings were done on a 1-10 scale, with 10 = live and healthy plants and 1 = dead plants, on 15 and 26 May.

5 Dry weight yield was calculated by multiplying green weight totals by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 6,491 divided by the base stand count. Tobacco was planted in 44-inch rows, with 22 inches between plants, which equals 6,491 plants/A.

Modeling Field Application of Actigard for Control of Tomato Spotted Wilt Virus (TSWV) Bowen Farm, Tifton, Ga., 2009

Table 3. Incidence of TSWV infection, and % TSWV positive plants as identified through ELISA testing of root samples

Treatment[1] (Greenhouse)	Field Treatment[2]	% TSWV[3]	% ELISA (+)Plants[6]
1. Non treated Control	No field treatment	38.96 a	32.0 a
2. Actigard & Admire Pro	No field treatment	36.16 a	36.0 a
3. Actigard & Admire Pro	+ 14 days post transplant (DPT)	23.54 abc	24.0 ab
4. Actigard & Admire Pro	+ 21 DPT	30.7 ab	28.0 ab
5. Actigard & Admire Pro	+ 27 DPT	39.15 a	24.0 ab
6. Actigard & Admire Pro	+ 35 DPT	17.93 bcd	16.0 ab
7. Actigard & Admire Pro	+ 42 DPT	32.77 ab	20.0 ab
8. Actigard & Admire Pro	+ 49 DPT	36.95 a	28.0 ab
9. Actigard & Admire Pro	+ at 1st symptom	10.61 cd	20.0 ab
10. Actigard & Admire Pro	+ at 1st symptom + 1 week	6.93 d	8.0 b
11. Actigard & Admire Pro	+ at 1st symptom + 1 week + 1 week	10.36 cd	16.0 ab
12. Admire Pro	+ at 1st symptom + 2 weeks +2 weeks	17.05 bcd	28.0 ab

[1] Data are means of six replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test.

[2] Treatments consisted of field applications applied weekly beginning at seven days post transplant and continuing every seven days thereafter up to 49 days post plant. Other treatments were applied when the first symptom of TSWV was identified through scouting control plots, with some receiving an additional application 1 week, 2 weeks and 4 weeks afterwards, according to the treatment list.

[3] Percent TSWV was calculated by using stand counts that were made from 15 April through 18 June, with TSWV being recorded and flagged every seven days.

[4] Cumulative number of TSWV-infected plants that were flagged during weekly stand counts.

[5] Plants that were flagged as TSWV infected were inspected to determine whether they had harvestable leaves. Those with no harvestable leaves were counted and recorded.

[6] Final harvest testing was completed on 30 July. Ten root samples were collected per plot. ELISA testing was performed in the lab using double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphatase antisera kits. ELISA test results are percent positive plants.

Nematicides for Control of Southern Root Knot on Tobacco
Black Shank Farm, Tifton, Ga., 2009

A.S. Csinos, L.L. Hickman, L. Mullis, and Unessee Hargett

Introduction
Nematicides for tobacco production are very limited. With the shortage and increase in cost of Telone II, other nematicides for tobacco must be evaluated.

Methods and Materials
This trial was conducted at the Black Shank Farm, CPES, Tifton, Ga., in a field with a history of assorted vegetable production. The trial was set up in Block 4 of an area that has been maintained as a nematode nursery with a strong population of *Meloidogyne sp.* nematodes. Field plot areas were turned on 12 March. A fertilizer application of 04-08-12 was broadcast over the plot area and incorporated into the soil after application on 25 March.

Vapam (metham sodium) was injected approximately 10-12 inches into soil using a fumigation rig with four shanks spaced 12 inches apart. The soil was sealed using ring roller. Telone II and Chloropicrin Plus were injected approximately 12-14 inches into the soil using a subsoil bedder with two shanks spaced 12 inches apart. Beds were immediately tilled and sealed using a concrete drag. All plots received 0.4 inch of irrigation after fumigant applications to provide a water seal.

On 09 April, applications of Devrinol 50DF at 4 lbs/A and Lorsban 4E at 3 qt/A were incorporated into the plot area. Plots were sub-soiled and bedded on [INFORMATION MISSING] April. The trial was set up in a randomized complete block design (RCBD) with five replications. Each plot was 30 feet long, with 48-inch-wide beds with 10-foot alleys.

Tobacco transplants were treated in the greenhouse on 14 April with Admire Pro at 1 fl.oz./1,000 plants and Actigard 50WG at 4 grams/7,000 plants. Both materials were tank mixed. Plants were pre-wet with materials being washed in after spraying.

Tobacco variety K394 was transplanted on 17 April on 48-inch-wide rows with an 18-inch plant spacing. Cultivation and side-dress fertilizer were as follows: 90 lbs/A of 15.5-0-0 calcium nitrate on 23 April and 28 May; 500 lbs/A of 4-8-12 on 08 May and 28 May. Layby was done on 28 May.

Additional pesticide applications on tobacco were applied as follows: 17 April and 07 May applied Ridomil Gold 4 SL at 1 pt/A, and 11 June at .25 pt/A; 07 May and 03 June applied Actigard 50 WG at 0.5 oz/A in a 12-inch band, one nozzle over row in 10.35 GPA H_2O. Orthene 97 was applied for insect control on 03 and 11 June.

Tobacco was topped on 18 June and topped and suckered on 24 June. Royal MH 4% solution at 55 gal/A was applied on 23 June. Fair 30 (MH-30) at 2 gal/A and Butralin at 2 qt/A were applied in 55 gal/A on 26 June.

Total rainfall recorded at the Black Shank Farm during this period (March through August, 2009) was 39.8 inches.

Field Trial Data
A stand count was conducted on 24 April to establish a base count. Stand counts were conducted thereafter every two weeks beginning 01 May and ending 09 July to monitor any loss of plants.
Vigor ratings were conducted on 11 May (four week post-plant) and 25 May (six weeks post-plant). Plant vigor was rated on a scale of 1-10, with 10 representing live and healthy plants and 1 representing dead plants.

Height measurements were conducted on 15 June. Plants were measured individually from the soil level to the tip of the longest leaf and recorded in centimeters.

Three harvests were conducted on 08 and 22 July and 06 August. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot in pounds.

A mid-season root gall rating was conducted on 02 June on three plants per plot using the Zeck's scale of 0-10, whereby 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some large galls, 5 = 25% of roots severely galled, 6 = 50% of roots severely galled, 7 = 75% of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plants dying, and 10 = plants and roots dead. A second root gall rating was conducted following the final harvest on 17 August, rating 10 plants per plot utilizing the same scale.

Nematode soil samples were pulled from plots on 18 March (prior to planting and soil treatment) and again on 19 August (at final harvest). Eight to 10 cores of soil, 2.5-cm-diam x 25-cm-deep, were collected from each plot randomly. Nematodes were extracted from 200-cm^3 soil sub-sample using a centrifugal sugar flotation technique.

Summary
Vigor ratings were high for all treatments except Devgen-treated plots and the non-treated controls.

Telone II plots were the lowest in height, and were significantly lower than the non-treated controls. The year 2009 was very wet at time of treatment and we suspect some phytotoxicty with Telone II.

Yields were relatively high for all plots and no significant differences were evident when compared to Telone II or non-treated controls. Root gall ratings were low to moderate with little differences among treatments.

2009 Nematicides for the Control of Southern Root Knot Nematode UGA-CPES-Black Shank Farm - Tifton, Ga.
Table 1. Plant Vigor, Plant Height and Dry Weight Yield of Tobacco Variety K394

Treatment[1]		Rate/Application Schedule	Vigor Ratings[2]	Height Measurements[3]	Dry Weight Yield[4]
1.	Telone II	6gal/A-chisel bed	8.5a	60.2d	2547.7ab
2.	Chloropicrin Plus	4gal/A-chisel bed	6.6b	83.7a	1952.8ab
3.	Metam sodium	25gal/A- chisel (seal)	6.9b	66.5dc	1923.4ab
4.	Metam sodium	37.5gal/A- chisel (seal)	7.7ab	74.3abcd	2681.8a
5.	Metam sodium	25gal/A- chisel, rototill, seal	6.3b	71.6bcd	1842.1b
6.	Metam sodium	37.5gal/A- chisel, rototill, seal	7.1ab	81.5ab	2523ab
7.	Temik	20lb/A- pre plant incorporate	7.4ab	81.9ab	2400.3ab
8.	Devgen 20	1oz/A/1000 plants - tray drench 1qt/A- 2 wks post plant 1qt/A- 4 wks post plant	6.8b	78.2abc	2257.6ab
9.	Devgen 20	2qt/A- pre plant incorporated 1qt/A- 2 weeks post plant	6.7b	87.9a	2098.3ab
10.	Non-treated Control	N/A	6.3b	79.5abc	2232ab

[1] Data are means of five replications. Means in the same column followed by the same letter are not different (P=0.05) according to Fishers LSD. No letters indicates non-significant difference.
[2] Vigor was done on a scale of 1-10, with 10 = live and healthy plants and 1 = dead plants, and an average was taken of vigor. Ratings were conducted on 11 and 25 May.
[3] Height measurements were conducted by measuring each plant from the base of the plant to the tip of the longest leaf. Measurements were taken in centimeters on 17 and 24 April and 02 May.
[4] Dry weight yield was calculated by multiplying green weight totals of tobacco by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 7,260 divided by the base stand count.

2009 Nematicides for the Control of Southern Root Knot Nematode UGA-CPES-Black Shank Farm - Tifton, Ga.
Table 2. Root gall ratings of tobacco

Treatment[1]		Rate/Application Schedule	Root Gall Ratings[2] (Zecks Scale 0-10)	
			02 June	17 August
1.	Telone II	6gal/A-chisel bed	3.0a	3.46b
2.	Chloropicrin Plus	4gal/A-chisel bed	2.87a	3.96b
3.	Metam sodium	25gal/A- chisel (seal)	3.07a	6.14a
4.	Metam sodium	37.5gal/A- chisel (seal)	1.60a	3.46b
5.	Metam sodium	25gal/A- chisel, rototill, seal	2.67a	3.74b
6.	Metam sodium	37.5gal/A- chisel, rototill, seal	1.47a	4.02b
7.	Temik	20lb/A- pre plant incorporate	1.20a	3.26b
8.	Devgen 20	1oz/A/1000 plants - tray drench 1qt/A- 2 wks post plant 1qt/A- 4 wks post plant	2.20a	3.84b
9.	Devgen 20	2qt/A- pre plant incorporated 1qt/A- 2 weeks post plant	1.53a	3.84b
10.	Non-treated Control	N/A	2.47a	3.42b

[1] Data are means of five replications. Means in the same column followed by the same letter are not different (P=0.05) according to Fisher's LSD.
[2] Gall ratings were done on a scale of 0-10, with 10 = dead plants and roots and 0 = no galls and a healthy plant. An average was taken of the gall ratings on five plants per plot and again on 09 July rating 10 plants per plot.

2009 Nematicides for the Control of Southern Root Knot Nematode UGA-CPES-Black Shank Farm - Tifton, Ga.
Table 3. Population of plant parasitic nematodes

Treatment[1]		Rate/Application Schedule	Number of *Melodogyne incognita* per 200cc soil[2]	
			March18 (Pre-Plant)	August 19 (At Harvest)
1.	Telone II	6gal/A-chisel bed	18bcd	36a
2.	Chloropicrin Plus	4gal/A-chisel bed	18bcd	72a
3.	Metam sodium	25gal/A- chisel (seal)	18bcd	53.8a
4.	Metam sodium	37.5gal/A- chisel (seal)	16cd	76a
5.	Metam sodium	25gal/A- chisel, rototill, seal	14cd	88a
6.	Metam sodium	37.5gal/A- chisel, rototill, seal	8d	24a
7.	Temik	20lb/A- pre plant incorporate	38a	62a
8.	Devgen 20	1oz/A/1000 plants - tray drench 1qt/A- 2 wks post plant 1qt/A- 4 wks post plant	36ab	84a
9.	Devgen 20	2qt/A- pre plant incorporated 1qt/A- 2 weeks post plant	16cd	25.4a
10.	Non-treated Control	N/A	30abc	88a

[1] Data are means of five replications. Means in the same column followed by the same letter are not different (P=0.05) according to Fisher's LSD.
[2] At-planting soil samples were taken on 07 May. Root Knot Nematode (*Meloidogyne sp.*)

Evaluation of Tobacco Lines for Resistance to TSWV in Georgia
Johnson Selected Variety Tobacco Trial
Bowen Farm, Tifton, Ga., 2009

A.S. Csinos, L.L. Hickman, S. Lahue and S.W. Mullis

Introduction
Tomato spotted wilt virus continues to be of great concern to Georgia tobacco producers. This study evaluates tobacco cultivars that have been selected for insect resistance and have demonstrated resistance to TSWV in the greenhouse. Entries that indicated low levels of TSWV were harvested for comparison with standards.

Methods and Materials
The study was located at the Bowen Farm CPES, Tifton, Ga., in a field with a history of crops such as corn, soybeans, peanuts, tobacco and assorted vegetables. The area was prepared using all current University of Georgia Cooperative Extension recommendations.

The plot design was a randomized split block design replicated five times. Each plot consisted of one row of transplants that had been treated in the greenhouse with Actigard and Admire Pro; one row was planted with transplants that received no greenhouse treatments. Each plot was 37 feet long with 10-foot alleys between repetitions.

On 16 January, 14 selected tobacco varieties were seeded into 242-cell trays. Tobacco varieties that were evaluated are listed in Table 1.

Table 1. Selected tobacco varieties

1.	CU9	8.	CU106
2.	CU22	9.	CU110
3.	CU61	10.	CU113
4.	CU75	11.	CU128
5.	CU94	12.	NC 71
6.	CU95	13.	NC72
7.	CU100	14.	K326

The test was transplanted on 25 March on 44-inch row spacing with 20 inches in row space. An average of 22 plants per row was planted.

Crop maintenance was achieved by using University of Georgia Cooperative Extension recommendations for the control of weeds, suckers and insects. Chemicals used for maintenance of the crop were Orthene 97 at 0.5 lbs/A for insect control, Prowl 3.3 EC at 2 pts/A for weed control and Royal MH-30 Extra at 1.5 gal/A for sucker control.

Tobacco plots were scouted weekly to determine TSWV disease incidence and percentage of infection in non-treated as compared to treated plots. Stand counts were conducted beginning 15 April with a final stand count being done on 18 June.

Three harvests were conducted on 01, 16 and 30 July. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot separately in pounds. Following the final harvest, root samples were collected from 10 plants per plot and an ELISA test was performed to determine TSWV incidence. The screen for TSWV was accomplished by the use of double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphatase antisera kits (Agdia, Inc. Elkhart, IN). Samples of ~1.0 gram were subjected to DAS-ELISA, and any sample eliciting an absorbance reading (A405) of three times the average plus two standard deviations of a healthy negative control were considered positive results.

Summary
Tomato spotted wilt virus levels were very high in this trial, with the standard varieties, NC72 and NC71, having 70% and 73% disease, respectively, in the non-treated plots. Entries 3, 4, 5, 6, 7, 8 and 9 had levels of TSWV lower than NC71 and NC72 in the non-treated plots. Entries 4, 5, 6, 7, 8 and 9 were lower than the standards in the Actigard and Admire Pro treated plots. ELISA positives ranged from a high of 72% to a low of 16% in the non-treated plots, and from a high of 61% to a low of 12% in the treated plots. Generally, the treated plots were lower than the non-treated in ELISA positives.

Yields were higher for most of the experimental entries when compared to the standards in the non-treated plots. Yields were increased 40% to 100% when cultivars were treated with Actigard and Admire Pro. Only CU95 had significantly higher yields than NC72 in the treated plots.

Acknowledgments
The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco and Altria Services (Philip Morris) for their support of this work. Thanks are also extended to Alana Heath, Brice Crawford, Holly Hickey, Seth Dale and Travis Brown for their assistance.

Table 2. Johnson Variety Trial 2009 Percent TSWV, Percent ELISA TSWV Results and Dry Weight Yield						
	% TSWV Symptomatic[2]		**% ELISA TSWV[3]**		**Dry Weight Yield[4] (lbs/A)**	
Variety[1]	**A Non-treated**	**B Treated**	**A Non-treated**	**Treated**	**A Non-treated**	**B Treated**
1. CU 9	53.3 bcd	34.2 cde	48.0 abc	24.0 bcd	1212.9 abc	1694.5 b
2. CU22	53.6 bcd	43.0 a-d	72. 0a	32.0 bcd	1173.8 abc	1707.8 b
3. CU61	48.3 cde	43.0 a-d	41.7 bcd	4.0 abc	1220.0 abc	1694.7 b
4. CU75	42.2 de	28.4 def	24.0 cd	12.0 d	1445.0 a	1833.6 ab
5. CU94	43.0 de	30.1 def	28.0 cd	32.0 bcd	1208.8 abc	1958.4 ab
6. CU95	35.0 e	12.6 g	28.0 cd	12.0 d	1385.8 a	2483.3 a
7. CU100	52.1 cde	29.2 def	32.0 cd	28.0 bcd	1485.0 a	1895.9 ab
8. CU106	42.0 de	24.7 efg	16.0 d	36.0 a-d	1295.1 ab	2006.1 ab
9. CU110	44.4 de	24.7 efg	36.0 cd	32.0 bcd	1315.4 ab	2075.6 ab
10. CU113	53.7 bcd	37.7 b-e	4.0 bcd	2.0 cd	870.0 dc	1671.9 b
11. CU128	51.4 cde	15.8 fg	4.0 bcd	30.4 bcd	1278.7 ab	2121.2 ab
12. NC72	69.7 ab	49.5 ab	63.6 ab	48.0 ab	870.7 dc	1718.5 b
13. NC71	72.6 a	46.1 abc	72.0 a	60.9 a	773.8 d	1503.2 b
14. K-326	63.3 abc	56.6 a	64.0 ab	6.0 a	946.8 bcd	1556.4 b

[1] Data are means of five replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher's LSD test. Twenty-one treatments consisted of selected varieties of tobacco. Each plot was two rows: one row treated with Actigard and Admire and one row non-treated.

[2] Percent TSWV was calculated by using stand counts that were made from 15 April through 18 June, with TSWV being recorded and flagged every seven days.

[3] Dry weight yield was calculated by multiplying green weight totals by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 6,491 divided by the base stand count. Tobacco was planted in 44-inch rows, with 22 inches between plants, which equals 6,491 plants/A. Fourteen varieties were selected out of the treatment list to collect yield on. These are highlighted in Table 1.

[4] Final harvest testing was completed on 30 July. Ten root samples were collected per plot. ELISA testing was performed in the lab using double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphatase antisera kits. ELISA test results are percent positive plants.

Relationship of Plant Size and Tomato Spotted Wilt Susceptibility in Tobacco
Bowen Farm, Tifton, Ga., 2009

A.S. Csinos,L.L. Hickman, S. Lahue and S.W. Mullis

Introduction
Tomato spotted wilt virus continues to be of great concern to Georgia tobacco producers. Previous field studies have shown that transplant age and size coupled with different field application timing scenarios of Actigard and Admire Pro have some influence on disease control and yield. This study was initiated to determine the best combination of transplant size and Actigard and Admire Pro applications in the field for Tomato spotted wilt virus management.

Methods and Materials
The study was located at the Bowen Farm CPES, Tifton, Ga., in a field with a history of crops such as corn, soybeans, peanuts, tobacco and assorted vegetables. The area was prepared using all current University of Georgia Cooperative Extension recommendations.

The plot design was a randomized complete block design (RCBD) consisting of single row plots replicated five times. Each plot was 37 feet long with 10-foot alleys between repetitions.
On 20 January, variety NC-71 was seeded into 242-cell flats. To obtain plants of different sizes, transplants were clipped in the greenhouse to produce 10-inch transplants, 7- to 9-inch transplants and 6-inch transplants. Plants were clipped beginning 25 February and then again on 02, 05, 10, 17 and 20 March to maintain plant heights. On 24 March, the pre-plant treatments of Admire Pro and Actigard 50WG were sprayed on in 200 ml of water per flat. Treatments that called for both Admire Pro and Actigard 50WG were tank mixed, then washed in with 0.25 inch of water. Actigard 50WG greenhouse treatments were applied at 2 g ai/7,000 plants. Admire Pro greenhouse treatments were applied at 1 oz/1,000 plants.

The plants were transplanted 26 March in plots on 44-inch rows with a 22-inch plant spacing. An average of 20 plants per test plot were planted.

Crop maintenance was achieved by using University of Georgia Cooperative Extension recommendations for the control of weeds, suckers and insects. Chemicals used for maintenance of the crop were Orthene 97 at 0.5 lbs/A for insect control, Prowl 3.3 EC at 2 pts/A for weed control and Royal MH-30 Extra at 1.5 gal/A for sucker control.

Field Treatments
Field treatments were applied using a CO_2 sprayer with one TX-12 tip/row with a 50-mesh ball check screen. Tips were angled at plants and sprayed in a 12-inch band at the rate of 40 PSI for 10.0 gal H_2O per acre. All treatments were mixed in 3 liters of water unless otherwise noted.
Field Treatments 7 through 9 were applied at the first symptom of TSWV (30 April). All field applications of Actigard 50WG were made at ½ oz/A (1.1 g Actigard 50WG in 3 L/ H_2O).

Tobacco plots were scouted weekly to determine TSWV disease incidence and percentage of infection in non-treated as compared to treated plots. Stand counts were conducted beginning 15 April with a final stand count being done on 18 June.

Three harvests were conducted on 01, 16 and 30 July. Harvests were done by collecting 1/3 of the plant's leaves at one time and weighing each plot separately in pounds.

Following the final harvest, root samples were collected from 10 plants per plot and an ELISA test was performed to determine TSWV incidence. The screen for TSWV was accomplished by the use of double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphase antisera kits (Agdia, Inc. Elkhart,IN). Samples of 1.0 gram were subjected to DAS-ELISA, and any sample eliciting an absorbance reading (A405) of three times the average plus two standard deviations of a healthy negative control were considered positive results.

Summary
TSWV ranged from a high of 57% to a low of 4.5%. Disease levels were similar for non-treated plants and greenhouse-treated plants. However, those plants that received both greenhouse treatments of Actigard and Admire plus field applications were significantly lower in TSWV. Similar trends were evident for ELISA-positive plants at harvest.

Plant heights and vigor tended to be higher in the non-treated and greenhouse-treated plants. Yields for non-treated and float house-treated plants were similar, ranging form 1,188 to 1,628 lbs/acre.

Plots receiving float house and field treatments tended to be higher in yield, with a range of 1,948 to 2,075 lbs/acre. ELISA data is presented in figure 1.

Acknowledgments

The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco and Altria Services (Philip Morris) for their support of this work. Thanks are also extended to Alana Heath, Brice Crawford, Holly Hickey, Seth Dale and Travis Brown for their assistance.

Relationship of Plant Size to Tomato Spotted Wilt Virus Susceptibility, Bowen Farm, Tifton, Ga., 2009

Table 1. Plant height in centimeters, Plant vigor, and Dry Weight Yield of tobacco leaf harvests.

Treatment[1] (Greenhouse)	Approximate Height	Greenhouse Treatment	Field Treatment[2]	Plant Height[3]	Vigor Ratings[4]	Dry Weight Yield[5]
1. Small Plants	6”	None	No field treatment	96.78 a	7.8 a	1188.5 c
2. Medium Plants	7”-9”	None	No field treatment	89.04 ab	7.1 ab	1439.7 bc
3. Large Plants	10”	None	No field treatment	89.69 ab	7.0 ab	1495.9 bc
4. Small Plants	6”	Actigard & Admire Pro	No field treatment	87.98 ab	7.0 ab	1224.7 c
5. Medium Plants	7”-9”	Actigard & Admire Pro	No field treatment	95.47 ab	7.0 ab	1628.0 abc
6. Large Plants	10”	Actigard & Admire Pro	No field treatment	76.8 b	6.5 b	1400.8 bc
7. Small Plants	6”	Actigard & Admire Pro	1st symptom Actigard spray + 1week + 1 week	79.16 ab	6.7 b	1849.3 ab
8. Medium Plants	7”-9”	Actigard & Admire Pro	1st symptom Actigard spray + 1week + 1 week	77.18 b	6.3 b	1748.2 abc
9. Large Plants	10”	Actigard & Admire Pro	1st symptom Actigard spray + 1week + 1 week	78.02 ab	6.5 b	2075.0 a

[1] Data are means of six replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher’s LSD test.

[2] Treatments were applied when the first symptom of TSWV was identified through scouting control plots. All Actigard and Admire Pro treatments were applied as pre-plant treatments in the greenhouse at a rate of 2 g ai/7,000 plants-Actigard and 1 oz/1,000 plants-Admire Pro.

[3] Height measurements were done in inches from the soil level to the tip of the longest leaf. A height measurement was conducted on 22 May and 17 June.

[4] Vigor ratings were done on a 1-10 scale, with 10 = live and healthy plants and 1 = dead plants, on 15 and 26 May.

[5] Dry weight yield was calculated by multiplying green weight totals by 0.15. Pounds per acre was calculated by multiplying dry weight conversion per plot by 6,491 divided by the base stand count. Tobacco was planted in 44-inch rows, with 22 inches between plants, which equals 6,491 plants/A.

Relationship of Plant Size to Tomato Spotted Wilt Virus Susceptibility, Bowen Farm, Tifton, Ga., 2009

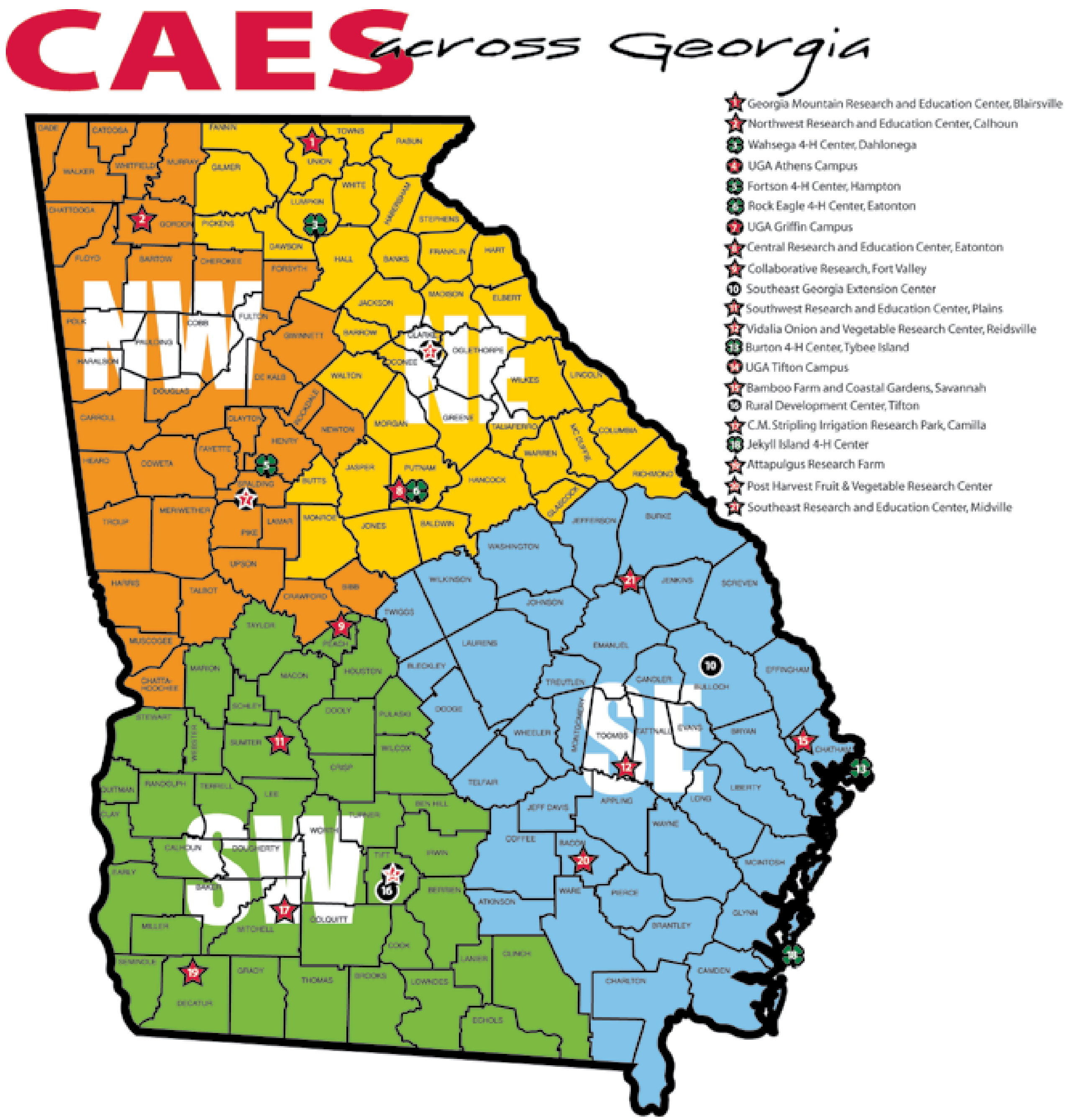
Table 2. Incidence of TSWV infection and % TSWV positive plants as identified through ELISA testing of root samples

Treatment[1] (Greenhouse)	**Approximate Height**	**Treatment[1] (Greenhouse)**	**Field Treatment[2]**	**% TSWV[3]**	**% ELISA (+) Plants[6]**
1. Small Plants	6”	None	No field treatment	56.7 a	40.0 a
2. Medium Plants	7”-9”	None	No field treatment	44.9 ab	20.0 abc
3. Large Plants	10”	None	No field treatment	40.3 ab	12.0 c
4. Small Plants	6”	Actigard & Admire Pro	No field treatment	49.7 ab	36.0 ab
5. Medium Plants	7”-9”	Actigard & Admire Pro	No field treatment	37.5 b	40.0 a
6. Large Plants	10”	Actigard & Admire Pro	No field treatment	41.6 ab	40.0 a
7. Small Plants	6”	Actigard & Admire Pro	1st symptom Actigard spray + 1week + 1 week	10.8 c	8.0 c
8. Medium Plants	7”-9”	Actigard & Admire Pro	1st symptom Actigard spray + 1week + 1 week	11.9 c	16.0 bc
9. Large Plants	10”	Actigard & Admire Pro	1st symptom Actigard spray + 1week + 1 week	4.5 c	8.0 c

1 Data are means of six replications. Means in the same column followed by the same letter are not significantly different (P=0.05) according to Fisher’s LSD test.
2 Treatments were applied when the first symptom of TSWV was identified through scouting control plots. All Actigard and Admire Pro treatments were applied as pre-plant treatments in the greenhouse at a rate of 2 g ai/7,000 plants-Actigard and 1 oz/1,000 plants-Admire Pro.
3 Percent TSWV was calculated by using stand counts that were made from 15 April through 18 June, with TSWV being recorded and flagged every seven days.
4 Cumulative number of TSWV-infected plants that were flagged during weekly stand counts.
5 Plants that were flagged as TSWV-infected were inspected to determine whether they had harvestable leaves. Those with no harvestable leaves were counted and recorded.
6 Final harvest testing was completed on 24 July. Ten root samples were collected per plot. ELISA testing was performed in the lab using double antibody sandwich-enzyme linked immunosorbent assay (DAS-ELISA) alkaline phosphatase antisera kits. ELISA test results are percent positive plants.

Conversion Table

U.S. Abbr.	Unit	Approximate Metric Equivalent
	Length	
mi	mile	1.609 kilometers
yd	yard	0.9144 meters
ft or ‘	foot	30.48 centimeters
in or “	inch	2.54 centimeters
	Area	
sq mi or mi^2	square mile	2.59 square kilometers
acre	acre	0.405 hectares or 4047 square meters
sq ft or ft^2	square foot	0.093 square meters
	Volume / Capacity	
gal	gallon	3.785 liters
qt	quart	0.946 liter
pt	pint	0.473 liter
fl oz	fluid ounce	29.473 milliliters or 28.416 cubic centimeters
bu	bushel	35.238 liters
cu ft or ft^3	cubit feet	0.028 cubic meter
	Mass / Weight	
ton	ton	0.907 metric ton
lb	pound	0.453 kilogram
oz	ounce	28.349 grams
Metric Abbr.	**Unit**	**Approximate U.S. Equivalent**
	Length	
km	kilometer	0.62 mile
m	meter	39.37 inches or 1.09 yards
cm	centimeter	0.39 inch
mm	millimeter	0.04 inch
	Area	
ha	hectare	2.47 acres
	Volume / Capacity	
liter	liter	61.02 cubic inches or 1.057 quarts
ml	milliliter	0.06 cubic inch or 0.034 fluid ounce
cc	cubic centimeter	0.061 cubic inch or 0.035 fluid ounce
	Mass / Weight	
MT	metric ton	1.1 tons
kg	kilogram	2.205 pounds
g	gram	0.035 ounce
mg	milligram	3.5×10^{-5} ounce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14 UGA Tifton Campus
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