2018 Tobacco Disease Management Trials

Tobacco and Field Crops Pathology Lab, North Carolina State University

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Evaluation of fungicides for control of black shank on tobacco, Wilson County 2018

Yara Rosado-Rivera, Norman Harrell, and Lindsey Thiessen

Fungicide rotations were assessed in Wilson County, North Carolina. Flue-cured tobacco 'K 326' was transplanted on April 19. Treatments were planted in 50-ft long plots with 10-ft alleys by 4 rows, were arranged in a randomized complete block design with 4 replicates to evaluate 10 different fungicide rotation treatments. Treatments were applied in transplant water drench applications or using a CO_2 pressurized backpack sprayer equipped with XR110025 nozzle at 20 gal/A at 20 psi, then later mechanically incorporated during cultivation. Treatment application dates were April 19, May 11, and June 31, for transplant water, first cultivation and layby applications, respectively. Disease incidence was assessed every two weeks beginning four weeks after transplant. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence, and data were analyzed using a general linear model and means separations determined using Tukey's test (R Studio, 2018).

Black shank was first detected at week six, and no phytotoxicity was observed in any treatment plots. Treatments 1, 2, 3, 5, and 6 had the least final disease incidence compared to the non-treated control. Season-long disease control (AUDPC) was most improved compared to other the non-treated control by treatments 1, 2, 3, and 4. This trial is consistent with previous assessments in 2017, with Orondis Gold treatments in transplant water applications reducing black shank in sandy soils.

Table 1. Fungicides rotation treatments

	Treatments	Rate	Application Timing
1	Orondis Gold	10 fl oz/A	TPW[y]
	Presidio	4 fl oz/A	1st cult[x]
	Ridomil Gold	16 fl oz/A	Layby[w]
2	Orondis Gold	10 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st cult
	Presidio	4 fl oz/A	Layby
3	Orondis Gold	10 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st Cult
4	Orondis Gold	10 fl oz/A	TPW
	Presidio Gold	4 fl oz/A	1st Cult
5	Orondis Gold	10 fl oz/A	TPW
6	Ridomil Gold	16 fl oz/A	TPW
7	Ridomil Gold	16 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st Cult
8	Ridomil Gold	16 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st Cult
	Ridomil Gold	16 fl oz/A	Layby
9	Orondis Gold	10 fl oz/A	1st Cult
	Presido	4 fl oz/A	Layby
10	Non-Treated Control	--	--

[y]Transplant water application.
[x]First cultivation application.
[w]Last cultivation application.

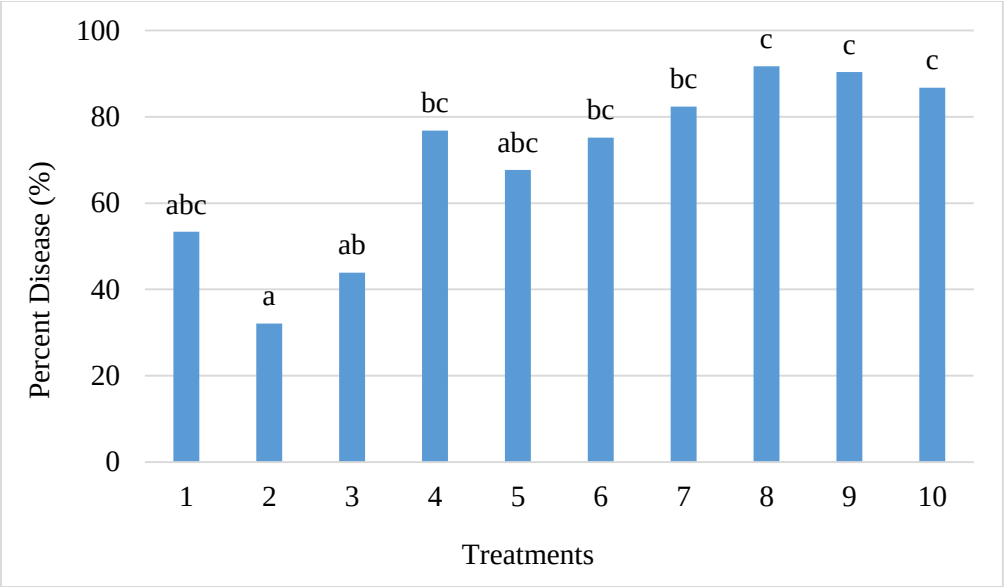


Figure 1. Percent disease incidence (%) of black shank assed in the fungicide rotation trial in Wilson Co. Higher the number (%) means more disease, in this case treatment 2 compound by Orondis Gold at transplant water (10 fl oz/A), Ridomil Gold at first cultivation (16 fl oz/A) and Presidio at layby (4 fl oz/A).

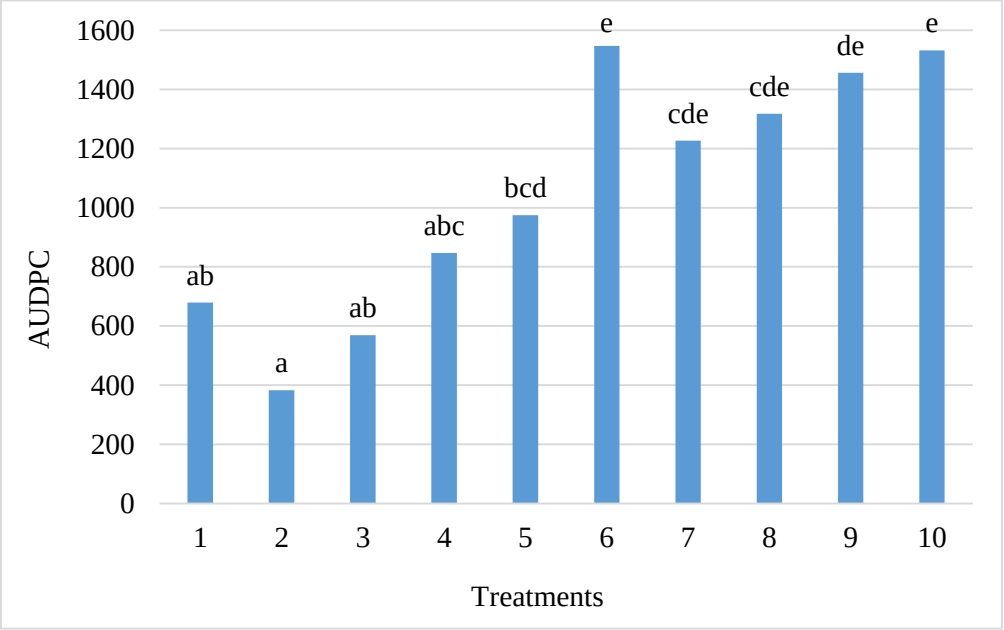


Figure 2. Area under disease progress curve values of season-long disease black shank incidence in Wilson Co. assessed by different fungicide rotations for manage black shank. Results showing treatment 2 (Orondis Gold at transplant water (10 fl oz/A), Ridomil Gold at first cultivation (16 fl oz/A) and Presidio (4 fl oz/A) at layby) being the most effective in managing the disease in the whole season.

Figure 3. Levels of black shank disease in the field in Wilson Co. (A and B).

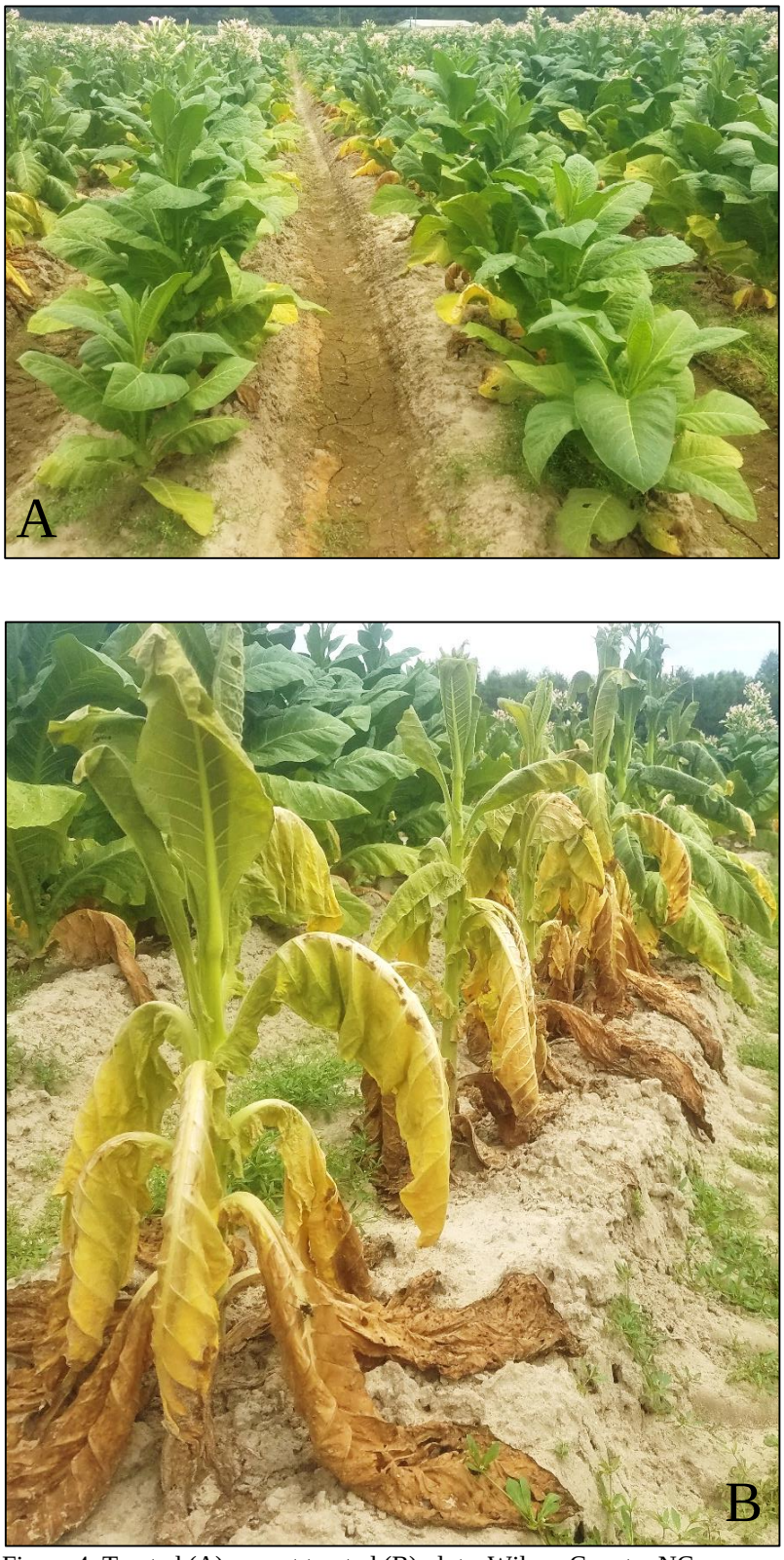


Figure 4. Treated (A) vs. not treated (B) plots. Wilson County, NC.

Chemical controls for the management of *Meloidogyne enterolobii* in flue-cured tobacco, Johnston County 2018

Yara Rosado-Rivera, Bryant Spivey, and Lindsey Thiessen

Nematode control treatments were assessed on-farm in Middlesex, NC. The field was naturally-infested with high populations of *Meloidogyne enterolobii*. Treatments were applied to 50-ft long with 15-ft alleys by four row paired plots. Fumigant treatments were applied on April 6. Pre-plant Nimitz applications (both broadcast and 15 in. band) were applied April 20. Flue-cured tobacco 'NC 196' was transplanted on April 30. Velum Prime treatments were applied on April 30. Nimitz applications and the second Velum Prime application were applied over the center of plant beds using a CO_2-pressurized backpack sprayer equipped with four XR110025 nozzles at 20 gal/A at 20 psi, then mechanically incorporated two to three hours later during cultivation on Jun 8. Plant stand, phytotoxicity, vigor incidence was observed on a biweekly basis from planting until August. Plant height were assessed at week 6 and at flowering stage, percent galls were collected at mid-season and at harvesting. Nematode soil populations were assessed on April 6, June 27, and October 4. Data were analyzed with a linear mixed effects model with the 'nlme' package using the R statistical software (version 3.5.0), and means were compared using the 'emmeans' package.

No phytotoxicity was observed from any treatments. Yield could not be obtained in this field due to the impact of Hurricane Florence. This trial will be repeated in 2019 to incorporate another year with yield data comparable to the 2017 trial.

Table 2. Chemicals used to manage *M. enterolobii* in Johnston County, NC.

	Chemical	Rate Per Acre	Application
1	Non-treated Control	--	
2	Telone II	6 gal	Pre-plant
4	Chloropicrin	3 gal	Pre-plant
6	Telone II	6 gal	Pre-plant
	Chloropicrin	2 gal	
8	Velum Prime	6.5 fl oz	Transplant Water
10	Velum Prime	6.5 fl oz	Transplant Water
	Velum Prime	6.5 fl oz	2nd Cultivation
12	Telone II	6 gal	Pre-plant
	Velum Prime	6.5 fl oz	Transplant Water
14	Nimitz Broadcast	5 pt	14 days before transplant
16	Nimitz 12 in. Band	3.5 pt	14 days before transplant
18	Nimitz 12 in. Band	5 pt	14 days before transplant

Figure 5. Fumigation system setup for one row applications of fumigant on bedded rows.

Figure 6. Tobacco nematode trial 6 weeks after transplant.

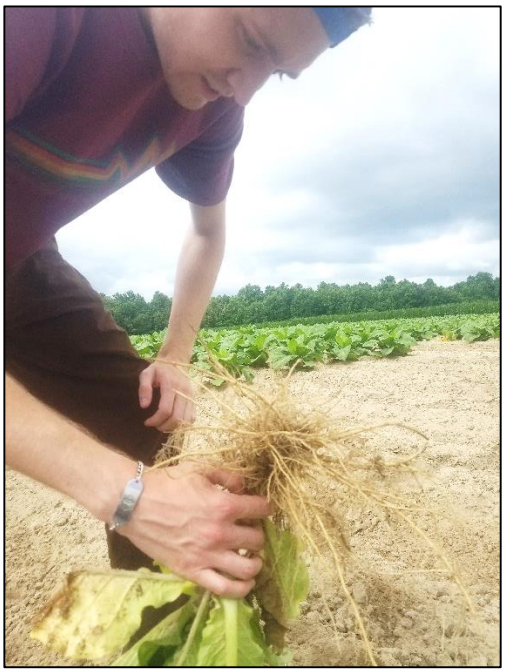


Figure 7. Tanner Schwarz (graduate student) assessing root galls in tobacco plants 30 days after transplant.

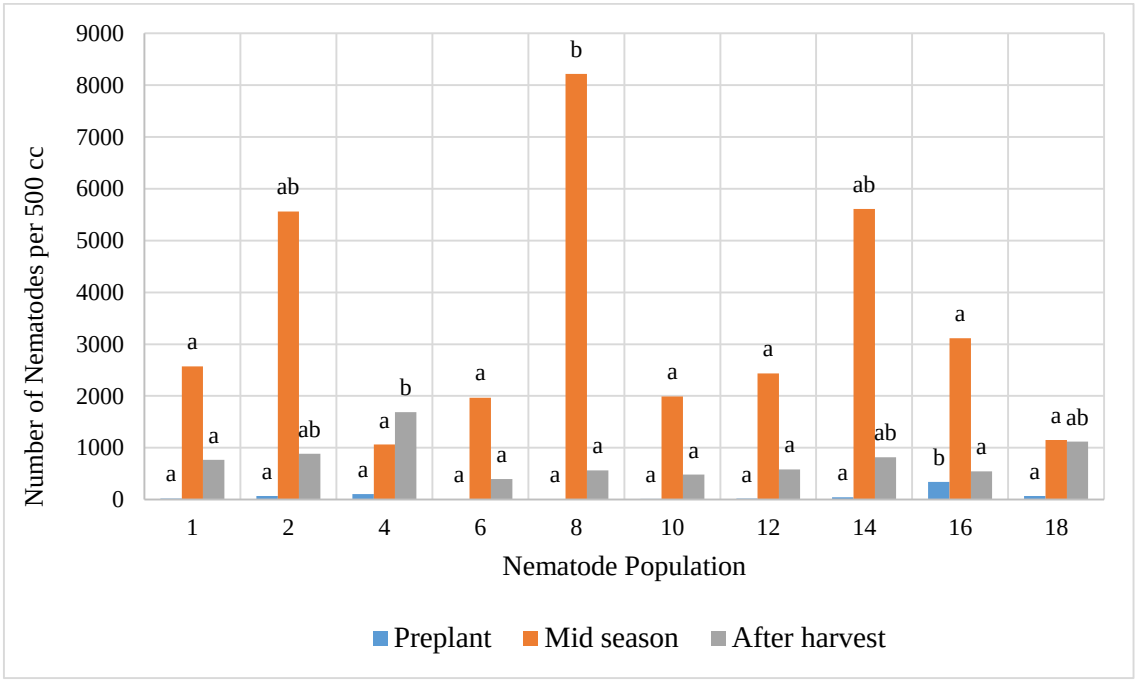


Figure 8. Development of nematode populations in the field. Population of nematodes changed drastically after transplant. At harvest, all the treatments were significantly lower than the highest count in plots with treatment 4.

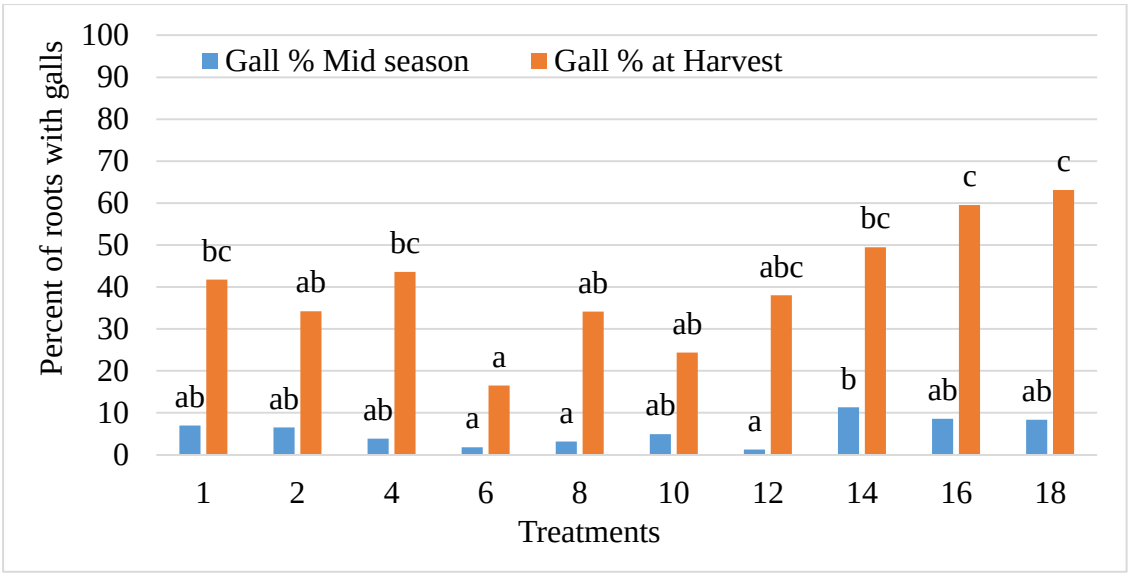


Figure 9. Development of galls caused by *M. enterolobii* in tobacco roots. At midseason rate the treatment 14 was higher than the other treatments but not significantly different than the non-treated control. In the other hand, at harvest the treatment 6 had the lowest percentage on galls significantly different than the non-treated control.

Evaluation of fungicides in rotation for control of black shank on tobacco, Edgecombe County 2018

Yara Rosado-Rivera and Lindsey Thiessen

Fungicide rotations were assessed at the Upper Coastal Plain Research Station in Edgecombe County, North Carolina. Flue-cured tobacco 'K326' was transplanted on May 3. Treatments were planted in 50-ft long plots with 5-ft alleys by 4 rows, were arranged in a randomized complete block design with 4 replicates to evaluate 10 different fungicide rotation treatments. Treatments were applied in transplant water drench applications or using a CO_2 pressurized backpack sprayer equipped with XR110025 nozzle at 20 gal/A at 20 psi, then later mechanically incorporated during cultivation. Treatment application dates were May 3, June 7 and June 29 for transplant water, first cultivation and layby, respectively. Disease incidence was assessed every two weeks beginning four weeks after transplant. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence, and data were analyzed using a general linear model and mean separations were obtained using Tukey's test (R Studio, 2018).

Black shank was first detected at week eight, and no phytotoxicity was observed in any treatment plots. Treatments 1, 2, 3, 8, and 9 had the least final disease incidence compared to the non-treated control. Season-long disease control (AUDPC) was most improved compared to other the non-treated control by treatments 1, 2, 8, and 9. This trial is consistent with previous assessments in 2017, with Orondis Gold treatments in transplant water applications reducing black shank in sandy soils.

Table 3. Chemicals programs used to manage black shank in Edgecombe County, NC.

	Treatments	Rate	Application Timing
1	Orondis Gold	10 fl oz/A	TPW[y]
	Presidio	4 fl oz/A	1st cult[x]
	Ridomil Gold	16 fl oz/A	Layby[w]
2	Orondis Gold	10 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st cult
	Presidio	4 fl oz/A	Layby
3	Orondis Gold	10 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st Cult
4	Orondis Gold	10 fl oz/A	TPW
	Presidio Gold	4 fl oz/A	1st Cult
5	Orondis Gold	10 fl oz/A	TPW
6	Ridomil Gold	16 fl oz/A	TPW
7	Ridomil Gold	16 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st Cult
8	Ridomil Gold	16 fl oz/A	TPW
	Ridomil Gold	16 fl oz/A	1st Cult
	Ridomil Gold	16 fl oz/A	Layby
9	Orondis Gold	10 fl oz/A	1st Cult
	Presido	4 fl oz/A	Layby
10	Non-Treated Control	--	--

[y]Transplant water application.
[x]First cultivation application.
[w]Last cultivation application.

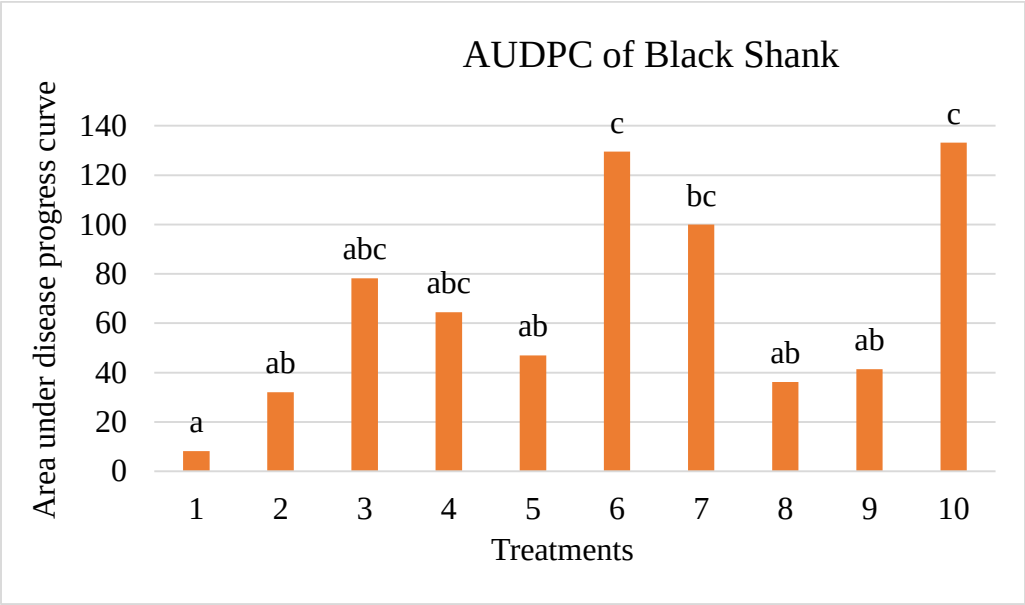


Figure 8. Area under disease progress curve for black shank in Edgecombe County. Being the treatment 1 significantly different than the non-treated control.

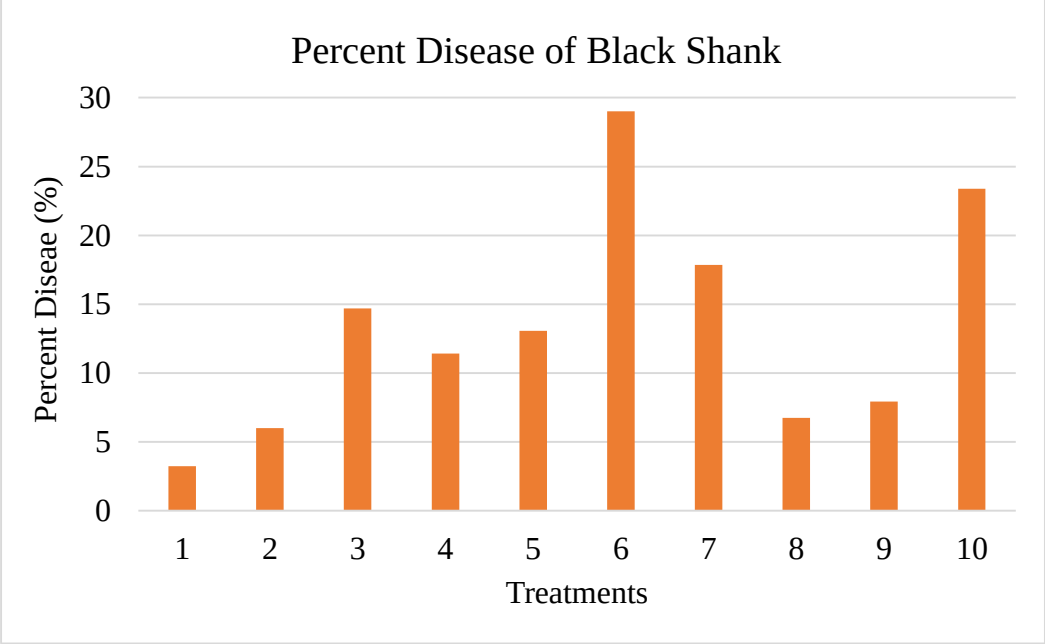


Figure 9. Percent disease of black shank, treatment 1 with significantly lower disease development than the non-treated control.

Figure 10. Flue-cured tobacco ‘K326’ in the black shank nursery at the Lower Coastal Plain Research Station in Edgecombe County, NC. Treatments were applied at transplant, 1st cultivation, layby, and any combination of the three (Table 3).

Figure 13. Plant with black shank in a non-treated plot (A) and asymptomatic plant in a treated (B) plants in Edgecombe County, NC.

Evaluation of varieties and fungicides rotation for control of black shank on tobacco, Edgecombe County 2018.

Yara Rosado-Rivera, Art Bradley and Lindsey Thiessen

Varieties and fungicide programs were assessed in Edgecombe County, North Carolina, which was transplanted on May 10. Treatments were planted in 50-ft long plots with 10-ft alleys by 4 rows, were arranged in a randomize complete block design with a factorial of 3 different fungicide rotation on 3 different varieties in a total of 12 treatments and 4 replicates. Treatments were applied in transplant water drench applications or using a CO_2 pressurized backpack sprayer equipped with XR110025 nozzle at 20 gal/A at 20 psi, then later mechanically incorporated during cultivation. Treatment application dates were May 10, June 7, and June 14, for transplant water, first cultivation and layby, respectively. Disease incidence was assessed every two weeks beginning four weeks after transplant. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence, and data were analyzed using ANOVA and Fisher test (R Studio, 2018). AUDPC values with smaller numbers indicate lower disease across the growing season, whereas a higher AUDPC values are indicative of earlier disease incidence.

Black shank pressure was not high this year due to intense rains throughout the growing season. Disease symptoms were first detected at week six, and no phytotoxicity was observed with any treatment. AUDPC and percent disease incidence for treatment 11 (non-treated: NC196 variety) were significantly greater than other treatments. 'K326' had significantly greater dead plants than other treatments.

Table 4. Chemical programs and varieties used to manage black shank in Edgecombe County, NC.

	Variety	Fungicide(s)	Rate	Application Timing
1	K326	Orondis Gold	10 fl oz/A	TPW[y]
2	K326	Orondis Gold Presidio	10 fl oz/A 4 fl oz/A	TPW 1st cult
3	K326	Orondis Gold Presidio	10 fl oz/A 4 fl oz/A	TPW Layby
4	NC196	Orondis Gold	10 fl oz/A	TPW[y]
5	NC196	Orondis Gold Presidio	10 fl oz/A 4 fl oz/A	TPW 1st cult
6	NC196	Orondis Gold Presidio	10 fl oz/A 4 fl oz/A	TPW Layby
7	NC938	Orondis Gold	10 fl oz/A	TPW[y]
8	NC938	Orondis Gold Presidio	10 fl oz/A 4 fl oz/A	TPW 1st cult
9	NC938	Orondis Gold Presidio	10 fl oz/A 4 fl oz/A	TPW Layby
10	K326	--	--	--
11	NC196	--	--	--
12	NC938	--	--	--

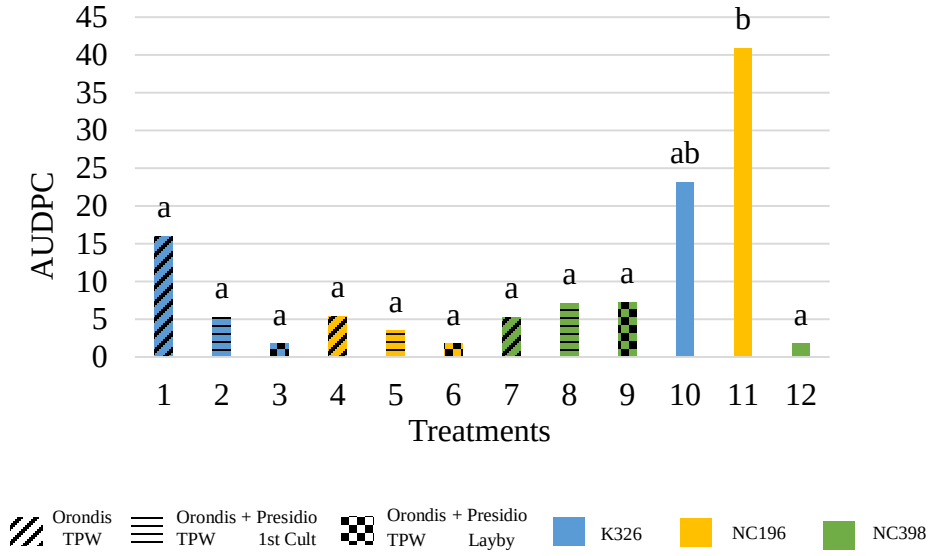


Figure 11. Area under disease progress curve (season-long disease pressure) of black shank in Edgecombe County, NC.

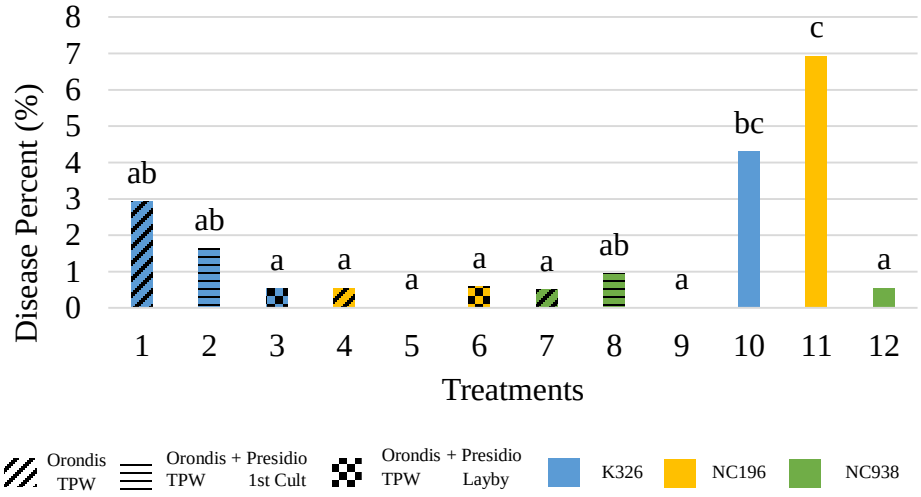


Figure 12. Final percent disease of black shank in Edgecombe County, NC.

Figure 13. Disease pressure in different fungicide and variety programs.

Evaluation of chemical programs to manage Tomato Spotted Wilt Virus in Flue-cured Tobacco, Sampson County, 2018.

Yara Rosado-Rivera, Della King and Lindsey Thiessen

Chemical programs were assessed in Sampson County, NC in 2018. Flue-cured tobacco 'NC196' were transplanted on April 30. Treatments were planted in 50-ft long plots with 10-ft alleys by 4 rows, and were arranged in a randomized complete block design with 4 replicates to evaluate 10 different treatments. Treatments were applied in greenhouse float bed, in transplant water drench applications or using a CO_2 pressurized backpack sprayer equipped with a flat fan nozzle at 20 gal/A at 20 psi. Treatment application dates were April 24, April 26 and April 27 for the greenhouse bed treatments, May 7, May 14 and June 1 for the 7 days, 14 days and 28 days after transplant application, and on June 15 at layby. The TSWV and Thrips Risk Forecasting Tool was used for model predicted thrips flights applications made on May 18. Disease incidence was assessed every week beginning at second weeks after transplant. Green yield data was harvested on two different dates following grower standards (August 9 and 30). Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence. Data were analyzed using a general linear model and lsdmeans Fisher's test (R Studio, 2018).

Treatment 5,6 and 9 significantly reduced disease progress across the growing season and significantly reduced disease incidence compared with the non-treated control. These treatments also had significantly higher green yields.

Table 5. Chemicals programs used to manage TSWV in Sampson County, NC.

Treatments		Rate	Application Timing
1	Admire Pro Actigard	0.8 fl oz/1000 plants 10 ppm float water	3 Days pre-transplant 2 Days pre-transplant
2	Admire Pro + Ninja	0.8 fl oz/1000 plants + 25 fl oz/100gal drench	3 Days pre-transplant
3	Ninja + Admire Pro Ninja Ninja Ninja	25 fl oz/100gal, drench + 0.8 fl oz/1000 plants 18 fl oz/A, foliar spray 36 fl oz/A, foliar spray 36 fl oz/A, foliar spray	3 Days pre-transplant 7 DPTA* 28 DPTA 49 DPTA
4	Ninja + Admire Pro Ninja Ninja Ninja	12.5 fl oz/100gal drench 12 fl oz/A, foliar spray 27 fl oz/A, foliar spray 27 fl oz/A, foliar spray	3 Days pre-transplant 7 DPTA 28 DPTA 49 DPTA
5	Ninja Ninja Ninja + Admire Pro	25 fl oz/100gal, foliar spray 18 fl oz /A, foliar spray 36 fl oz/A, foliar spray	7 Days pre-transplant 7 DPTA 28 DPTA
6	Admire Pro Actigard	0.8 fl oz/1000 plants 0.5 oz wt/a	3 Days pre-transplant 3 Days before thrips model
7	Admire Pro Ninja	0.8 fl oz/1000 plants 18 fl oz/a	3 Days pre-transplant 3 Days before thrips model
8	LifeGard LifeGard LifeGard LifeGard Actigard	4.5 oz/100gal 4.5 oz/100gal 4.5 oz/100 gal 4.5 oz/100 gal 0.13 oz wt/100 gal	14 DPTA 28 DPTA 42 DPTA 56 DPTA 3 Days pre-transplant
9	Actigard	0.5 oz/a	Layby
10	Non-treated Control	--	

*Days post-transplant application

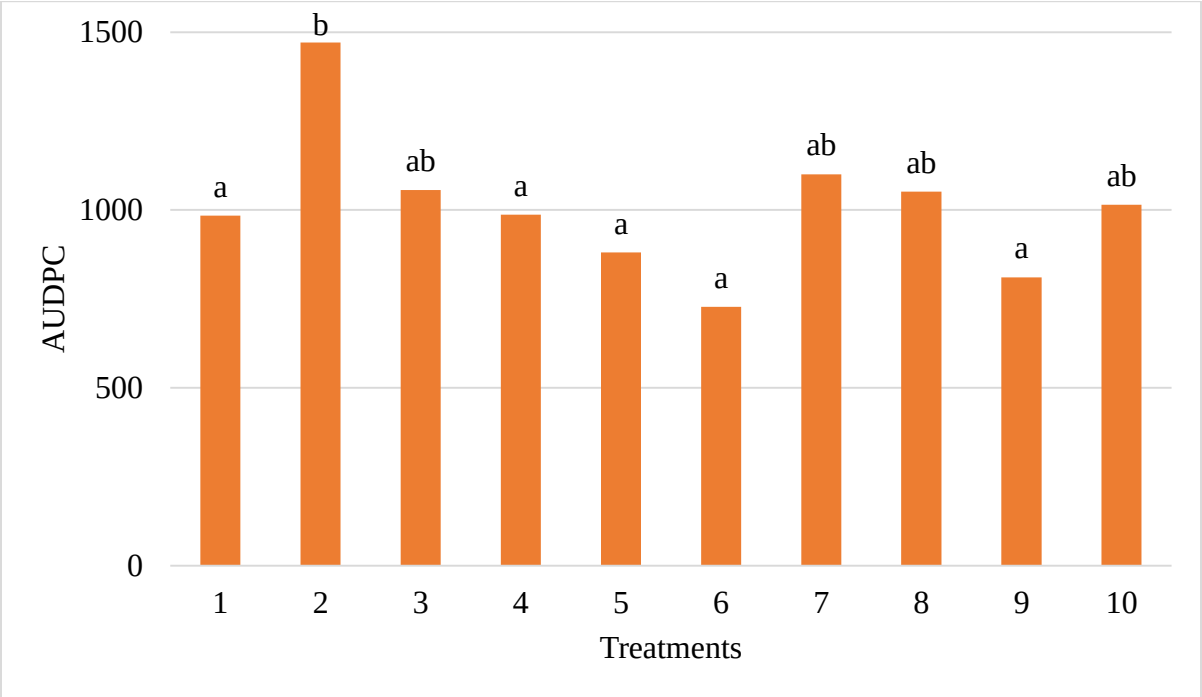


Figure 14. Area under disease progress curve of TSWV in Sampson County, NC. Treatments with the lower number were better managing the disease in the whole season than the other (Treatments 1, 4-6 and 9).

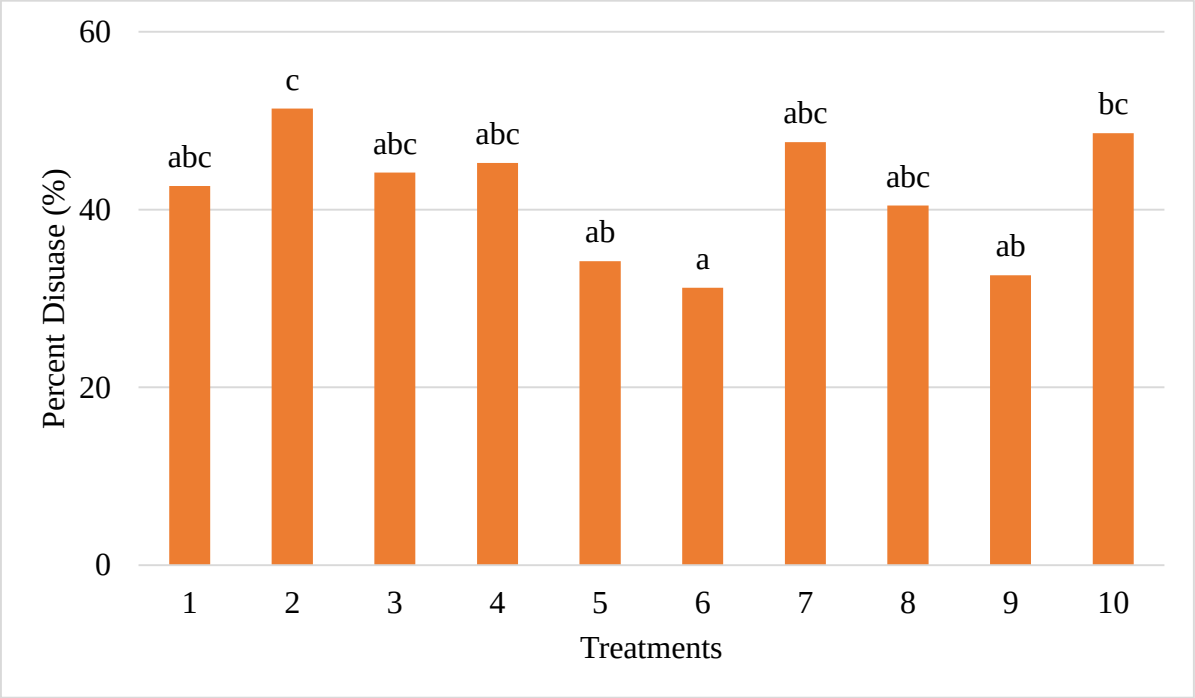


Figure 15. Percent of TSWV in flue-cured tobacco. Higher percentage shows less disease control that the other ones. Treatment 6 has the lowest disease index.

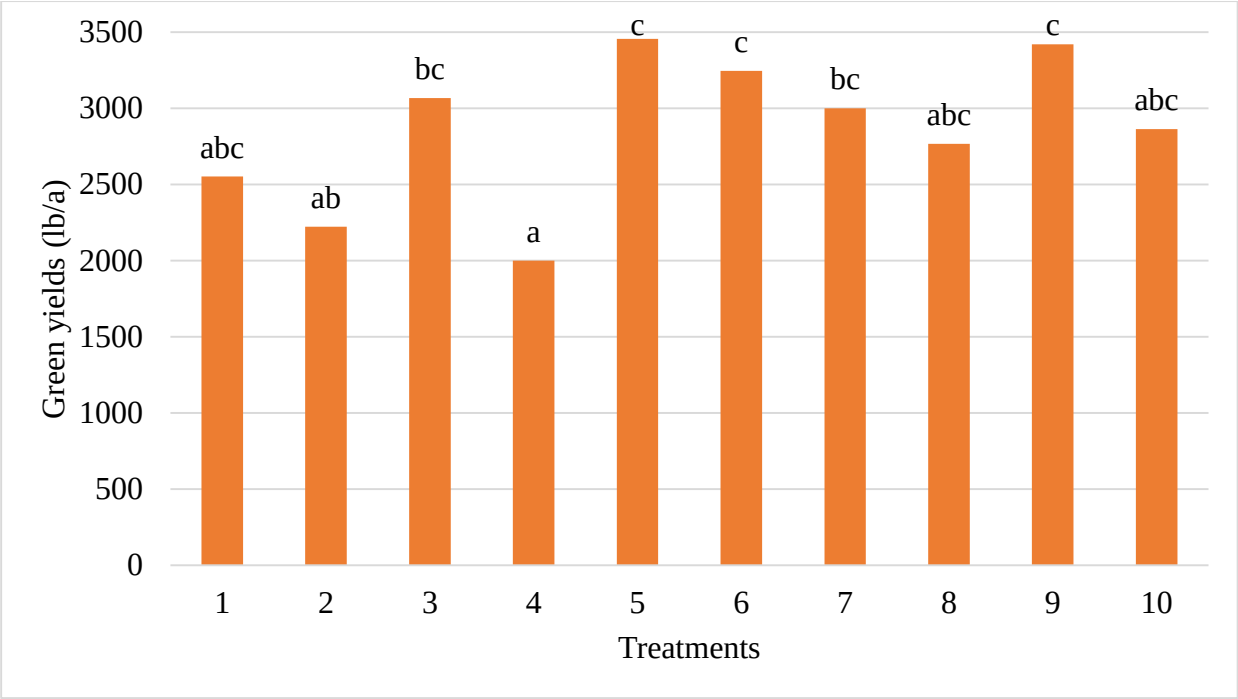


Figure 16. Green yields of tobacco (NC196) were assessed in two different times (lbs/a). Higher yields treatments were 5, 6 and 9.

Figure 17. Different bins used for applying the greenhouse float trays treatments. Tobacco variety 'NC196' seeded on February and treated 2, 3 or 7 days before transplanted.

Figure 18. Difference in growth and development of tobacco plant affected with TSWV.

Figure 19. Tomato spotted wilt virus symptom in a tobacco leaf. Sampson County, NC.

Granville Wilt Official Variety Test, Granville County, North Carolina, 2018

Yara Rosado-Rivera and Lindsey Thiessen

Official variety test was performed in the Oxford Tobacco Research Station in Granville County, NC. Tobacco plants were transplant on July 9. Artificial inoculation was assessed on June 22 using a CO_2 pressurized backpack sprayer at 20 gal/A at 4 psi. Disease incidence was assessed every week beginning at four weeks after transplant. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence, and data were analyzed using ANOVA and Fisher lsdmeans (R Studio, 2018).

Table 6. Granville wilt official varieties test of tobacco, 2018.

Varieties	AUDPC	Disease Percent
CC 143	38.5 a	17.86 a
CC 144	17.5 a	8.93 a
GF 318	35.0 a	18.20 a
GL 395	87.5 b	29.20 a
PVH 2343	24.5 a	11.11 a
NC 987	24.5 a	10.82 a
NC 72	24.5 a	11.06 a
CC 37	59.5 a	25.76 a
NC 980	38.5 a	18.08 a
CC 27	45.5 a	17.99 a
PVH 2408	45.5 a	17.01 a
CC 67	28.0 a	13.18 a
PVH 2275	56.0 a	25.13 a
K 326	17.5 a	8.89 a
NC 972	24.5 a	10.12 a
NC 606	63.0 a	22.90 a
NC 986	38.5 a	19.20 a
GL 26H	31.5 a	13.35 a
PVH 1600	28.0 a	13.41 a
PVH 2110	38.5 a	16.98 a
CC 145	35.0 a	15.03 a
GL 976	42.0 a	14.42 a
PVH 1920	35.0 a	9.23 a
PVH 1610	35.0 a	16.99 a
NC 925	24.5 a	11.45 a
CC 700	38.5 a	16.05 a
PVH 2254	38.5 a	14.17 a
NC 970	31.5 a	11.06 a
PVH 2360	21.0 a	12.17 a
CC 1063	42.0 a	20.31 a
K 346	24.5 a	10.82 a
NC 938	42.0 a	21.11 a
PVH 1452	38.5 a	17.60 a
PVH 2310	28.0 a	12.18 a
CC 13	49.0 a	19.45 a
NC 299	70.0 a	16.83 a
NC 1226	17.5 a	8.25 a
CC 33	21.0 a	7.31 a
NC 71	38.5 a	15.92 a
NC 297	38.5 a	18.33 a
NC 196	52.5 a	24.68 a
CC 35	38.5 a	12.84 a

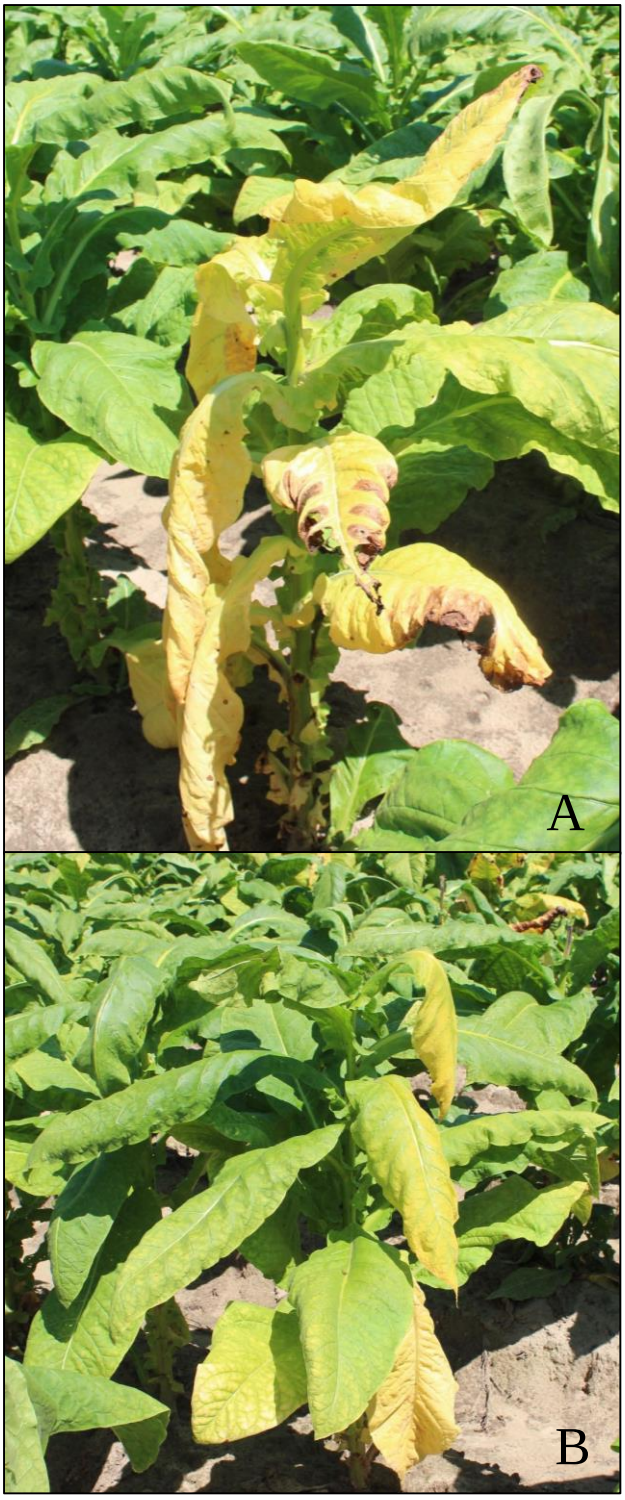


Figure 20. Granville wilt symptoms in the tobacco OVT in Granville County, NC (A and B).

Black Shank Official Variety Test, Edgecombe County, North Carolina, 2018

Yara Rosado-Rivera and Lindsey Thiessen

Black Shank official variety test was conducted at the Upper Coastal Palin Research Station in Rocky Mount, Edgecombe County, NC. Tobacco plants were transplant on April 23. Disease incidence was assessed every week beginning at four weeks after transplant. Black shank was first detected at week six after transplanting. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence, and data were analyzed using ANOVA and Fisher lsdmeans (R Studio, 2018).

Table 7. Black shank official varieties test of tobacco, 2018.

Varieties	AUDPC	Disease Percent
CC 143	22.17 a	10.61 abcde
CC 144	53.17 a	11.43 abcde
GF 318	31.17 a	10.94 abcde
GL 395	23.00 a	5.50 abcd
PVH 2343	95.17 abc	26.24 bcdef
NC 987	15.33 a	3.85 abcd
NC 72	41.17 a	17.70 abcdef
CC 37	3.17 a	1.33 abc
NC 980	0.00 a	0.00 a
CC 27	61.83 ab	19.13 abcdef
PVH 2408	83.50 abc	28.64 abcdef
CC 67	27.00 a	2.67 abc
PVH 2275	148.67 abc	30.98 ef
K 326	57.33 ab	20.37 abcdef
NC 972	16.67 a	2.56 abc
NC 606	211.50 c	25.71 bcdef
NC 986	46.50 a	14.21 abcdef
GL 26H	87.83 abc	17.67 abcdef
PVH 1600	33.33 a	6.72 abcde
PVH 2110	15.83 a	6.37 abcde
CC 145	3.17 a	1.28 abc
GL 976	10.33 a	0.00 a
PVH 1920	21.67 a	6.78 abcde
PVH 1610	18.00 a	2.96 abc
NC 925	12.17 a	3.03 abc
CC 700	31.17 a	10.87 abcde
PVH 2254	3.17 a	1.23 ab
NC 970	65.83 abc	16.45 abcdef
PVH 2360	27.50 a	7.13 abcde
CC 1063	52.33 a	15.54 abcdef
K 346	20.67 a	0.00 a
NC 938	33.83 a	8.33 abcde
PVH 1452	40.17 a	11.33 abcde
PVH 2310	108.67 abc	25.00 abcdef
CC 13	21.67 a	6.67 abcde
NC 299	41.00 a	8.06 abcde
NC 1226	5.83 a	0.00 a
CC 33	76.67 abc	20.67 abcdef
NC 71	202.33 bc	15.55 abcdef
NC 297	63.67 abc	22.91 abcdef
NC 196	18.00 a	2.67 abc
CC 35	202.67 bc	37.39 f

Figure 21. OVT trial in Upper Coastal Plain Research Station in Rocky Mount, NC (A). Black shank disking symptom in tobacco stem (B).

Black Shank Small Plot Trial, Edgecombe County, North Carolina, 2018

Yara Rosado-Rivera and Lindsey Thiessen

Black Shank small plot trial was assessed in the Upper Coastal Palin Research Station in Rocky Mount, Edgecombe County, NC. Tobacco plants were transplant on April 23. Disease incidence was assessed every week beginning at four weeks after transplant. Black shank was first detected at week six after transplanting. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence, and data were analyzed using ANOVA and Fisher lsdmeans (R Studio, 2018).

Table 8. Black shank small plot trial of flue-cured tobacco, 2018.

Varieties	AUDPC	Disease Percent
NC 95	78.83 d	13.69 c
K326	18.00 abc	2.67 ab
NCEX95	0.00 a	0.00 a
GF 315	51.33 cd	9.90 bc
NCEX96	6.33 ab	2.78 ab
PXH38	47.67 bcd	11.67 bc
NCEX97	12.17 abc	2.84 ab
PXH39	0.00 a	0.00 a
NCEX98	38.33 abcd	9.83 bc
PXH40	21.67 abc	6.92 abc
NCEX100	0.00 a	0.00 a
PXH19	74.50 d	12.18 c

Figure 22. SPT test assessed in Rocky Mount Research Station, Edgecombe County, NC.

Black Shank on Farm Test, Edgecombe County, North Carolina, 2018

Yara Rosado-Rivera and Lindsey Thiessen

Black Shank on farm test was evaluated in the Upper Coastal Palin Research Station in Rocky Mount, Edgecombe County, NC. Tobacco plants were transplant on April 23. Disease incidence was assessed every week beginning at four weeks after transplant. Black shank was first detected at week six after transplanting. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence, and data were analyzed using ANOVA and Fisher lsdmeans (R Studio, 2018).

Table 9. Black shank on farm test of flue-cured tobacco, 2018.

Varieties	AUDPC	Disease Percent
NC 95	58.67 a	17.61 c
K326	18.50 a	5.44 ab
NCEX94	10.33 a	0.00 a
NCEX89	31.50 a	4.25 ab
ULT116	37.00 a	10.67 bc
NCEX93	10.33 a	0.00 a

Figure 23. OFT trial evaluated in the Upper Coastal Plain Research Station in Rocky Mount, NC.

Evaluation of fungicides to manage foliar diseases in Flue-cured Tobacco, Oxford NC, 2018.

Yara Rosado-Rivera and Lindsey Thiessen

Tobacco foliar disease trial was assessed in the Oxford Tobacco Research Station in Granville County, NC. Experimental treatments were planted in 40-ft long plots with 5-ft alleys by 4 rows, were arranged in a randomized complete block design with 4 replicates to evaluate 8 different foliar treatments. Application was performed using a CO_2 pressurized backpack sprayer equipped with a flat fan nozzle at 20 gal/A at 20 psi. Treatment application dates were July 12 and August 10. Disease incidence of target sport, brown spot and frogeye was assessed every week beginning first application. Data were summarized as area under disease progress curve (AUDPC) and final percent disease incidence per disease, and data were analyzed using ANOVA and lsd mean Fisher test (R Studio, 2018). Green yields were assessed on October 2and percent of good quality harvestability of the leaves.

No significantly difference were found in the target spot and frogeye leaf spot diseases compared with the non-treated control. Significant difference was found in brown spot disease and in green yields, also the quality of the tobacco leaf was significantly different than the non-treated control (Figures 28-30).

Table 10. Fungicides treatments for manage foliar diseases in Flue-Cured Tobacco.

	Treatments	Rate	Application
1	LifeGard	4.5 oz/100 gal	Layby
	LifeGard	4.5 oz/100 gal	1 week after Layby
2	LifeGard	4.5 oz/100 gal	Layby
	Quadris	8.0 oz/a	1 week after Layby
3	Double Nickel LC + Cueva	1.0 qt/a + 2.0 qt/a	Layby
	Double Nickel LC + Cueva	1.0 qt/a + 2.0 qt/a	1 week after Layby
4	Double Nickel LC + Cueva	1.0 qt/a + 2.0 qt/a	Layby
	Quadris + Double Nickel LC + Cueva	8.0 oz/a +1.0 qt/a + 2.0 qt/a	1 week after Layby
5	Quadris	8.0 oz/a	Layby
	Quadris	8.0 oz/a	1 week after Layby
6	Serifel + Leaf life Widespread Organic	4.0 oz/a	Layby
	Serfiel + Leaf life Widespread Organic	4.0 fl oz/100 gal	1 week after Layby
7	Serifel + Leaf life Widespread Organic	8.0 oz/a	Layby
	Serifel + Leaf life Widespread Organic	4.0 fl oz/100 gal	1 week after Layby
8	Non-treated Control	--	--

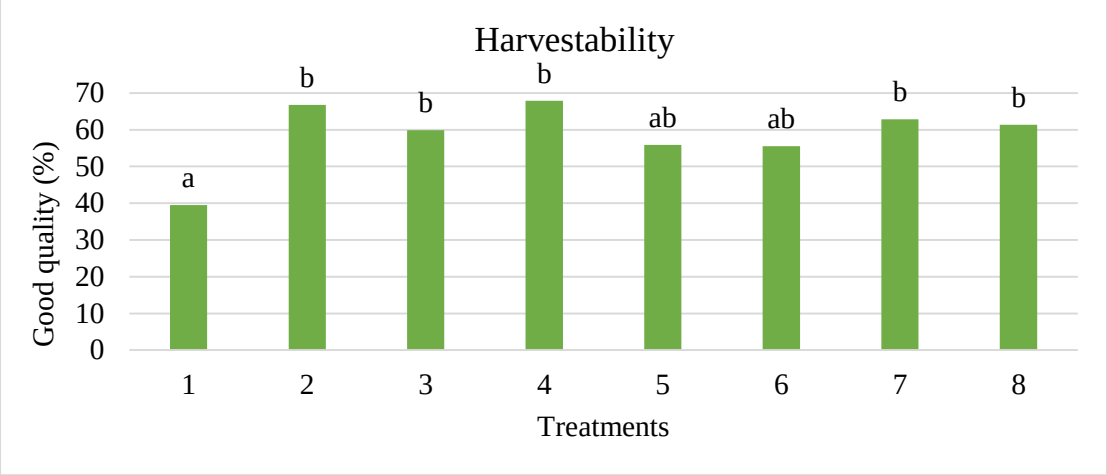


Figure 24. Good quality harvestability percent of the tobacco was significantly better for the treatment 1 than the non-treated control.

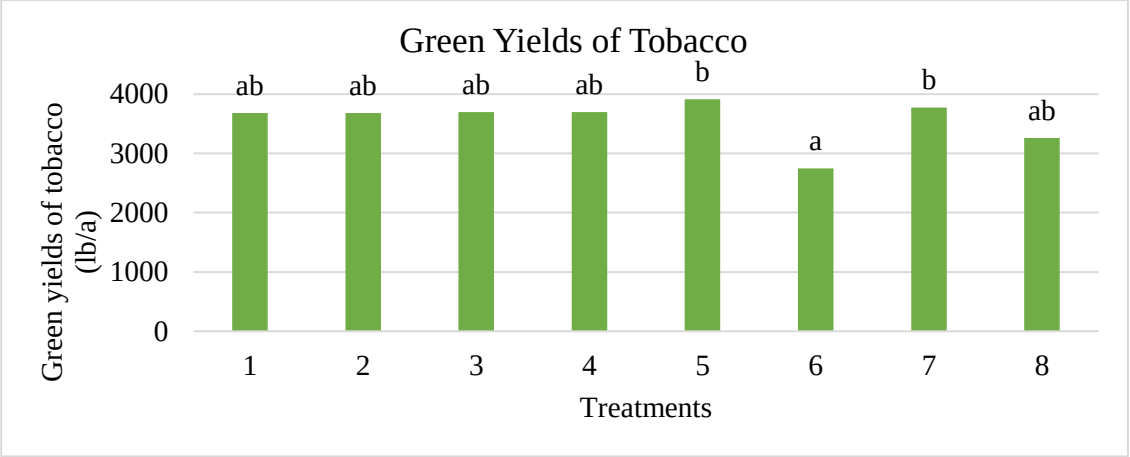


Figure 25. Green yields (lb/a) of tobacco. Treatment 6 had the lowest green weight in compared with the other treatments.

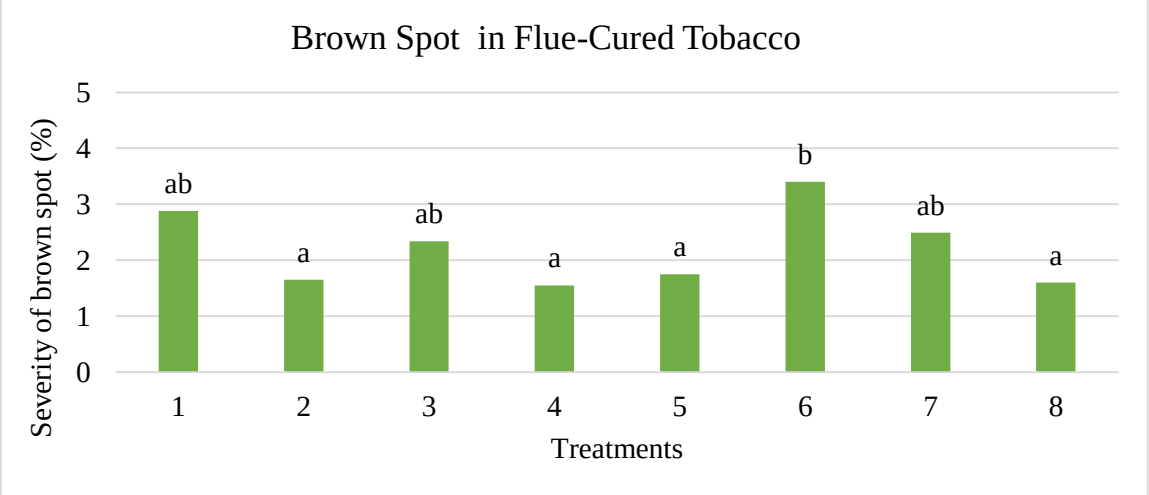


Figure 26. Brown spot disease severity (%) of tobacco in Oxford Tobacco Research Station, Granville County, NC.

Evaluation of Chemicals to Manage Root Knot Nematode in Nash County, NC. 2018

Yara Rosado-Rivera, Maryanna Bennett and Lindsey Thiessen

Root knot nematode control treatments were assessed on-farm in Bailey, NC with a Dothan loamy sand soil. The field chosen was naturally-infested with high populations of *Meloidogyne* spp. Treatments were applied to 50-ft long with 10-ft alleys by four rows in a randomize complete block design. Fumigant treatments were applied on April 11. Pre-plant Nimitz applications (both broadcast and 15 in. band) were applied May 1. Flue-cured tobacco (NC 196) was transplanted on May 10. Velum Prime treatments were applied on May 10. Nimitz applications and the Velum Prime applications were applied over the center of plant beds using a CO_2 pressurized backpack sprayer equipped with four XR110025 nozzles at 20 gal/A at 20 psi, then mechanically incorporated two to three hours later during cultivation. Plant stand, phytotoxicity, vigor incidence was observed on a biweekly basis from planting until August. Percent galls were collected at mid-season and at harvesting. Nematode soil populations were assessed on April 11, July 5, and September 26. Data were analyzed with ANOVA and lsdmean Fisher test using the R statistical software (version 3.5.0).

No phytotoxicity was observed from any treatments made.

Table 11. Chemicals treatments to manage root knot nematode on tobacco in Nash County, NC.

	Treatments	Rate	Application Timing	Application Description
1	Non-treated Control	--	--	--
2	Nimitz	7 – 10 DBT[1]	3.5 pt/a	Broadcast
3	Nimitz	7 – 10 DBT	7 pt/a	Broadcast
4	Nimitz	7 – 10 DBT	3.5 pt/a	Band 15”
5	Nimitz	7 – 10 DBT	5 pt/a	Band 15”
6	Nimitz	7 – 10 DBT	7 pt/a	Band 15”
7	Telone II	21 DBT	6.0 gal/a	Injected soil
8	Velum	TPW[2]	6.5 oz/a	75 gpa1[4]
9	Velum	TPW	6.5 oz/a	150 gpa
10	Velum	TPW	6.5 oz/a	300 gpa
11	Nimitz	7 – 10 DBT	5 oz/a	Band 15”
12	Velum	7 – 10 DBT	6.5 oz/a	Band 15”
13	Velum	1st Cultivation[3]	6.5 oz/a	--

[1]Days before transplant
[2]Transplant water application
[3]First cultivation application
[4]Gallons per acre

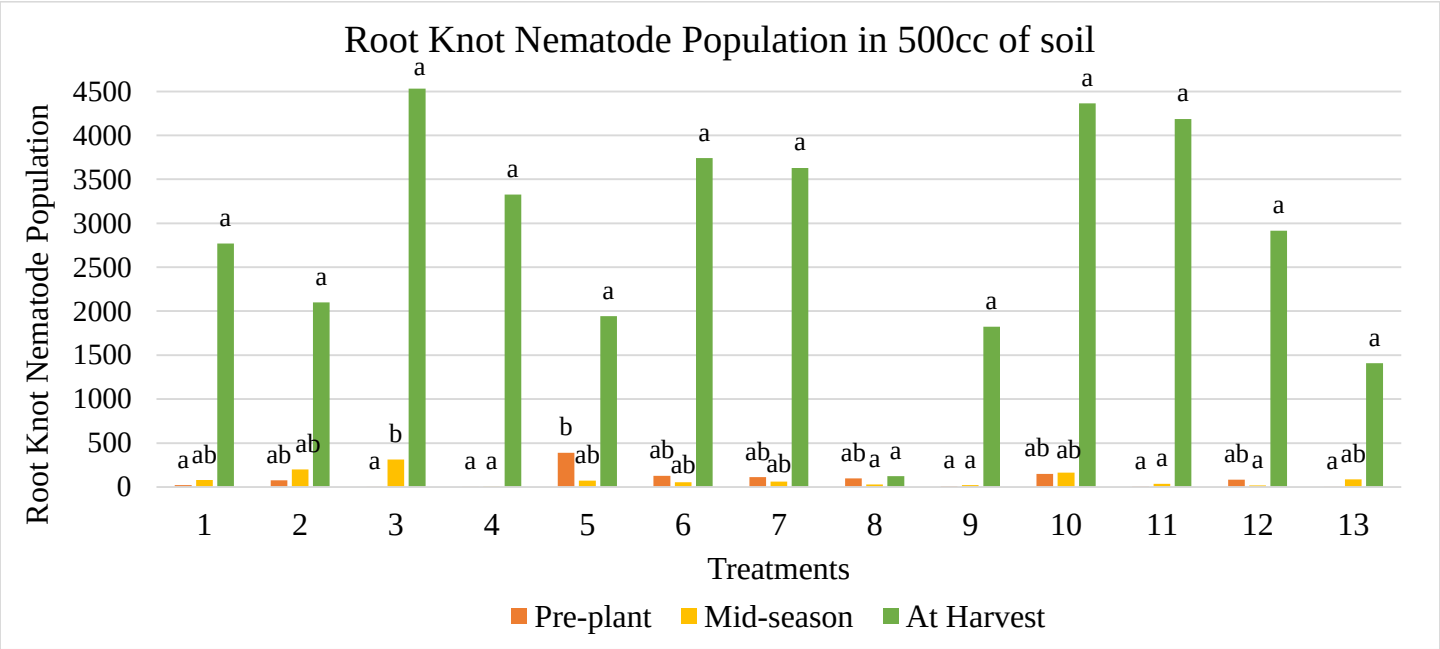


Figure 27. Nematode population pre-plant, midseason and at harvest. No significant difference was found at the end of the season.

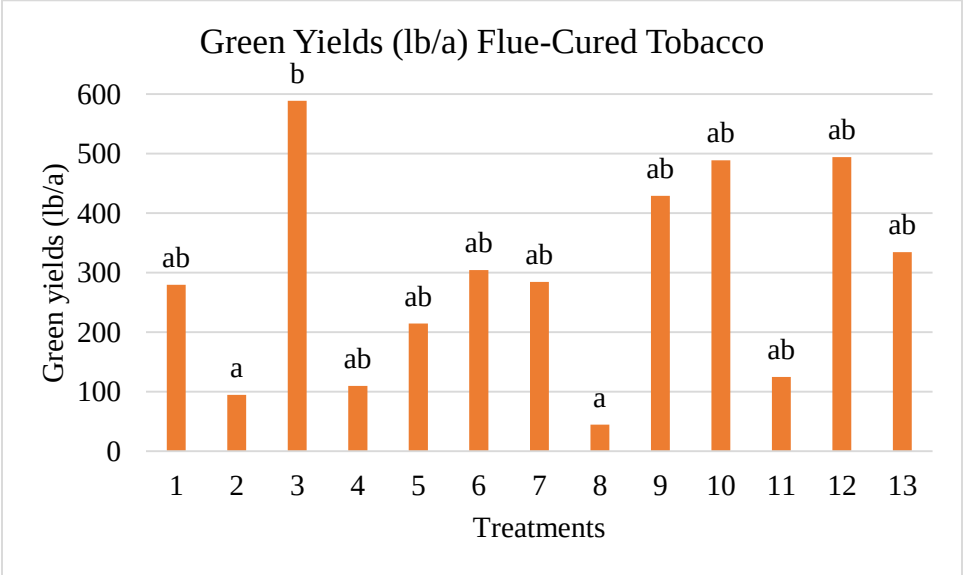
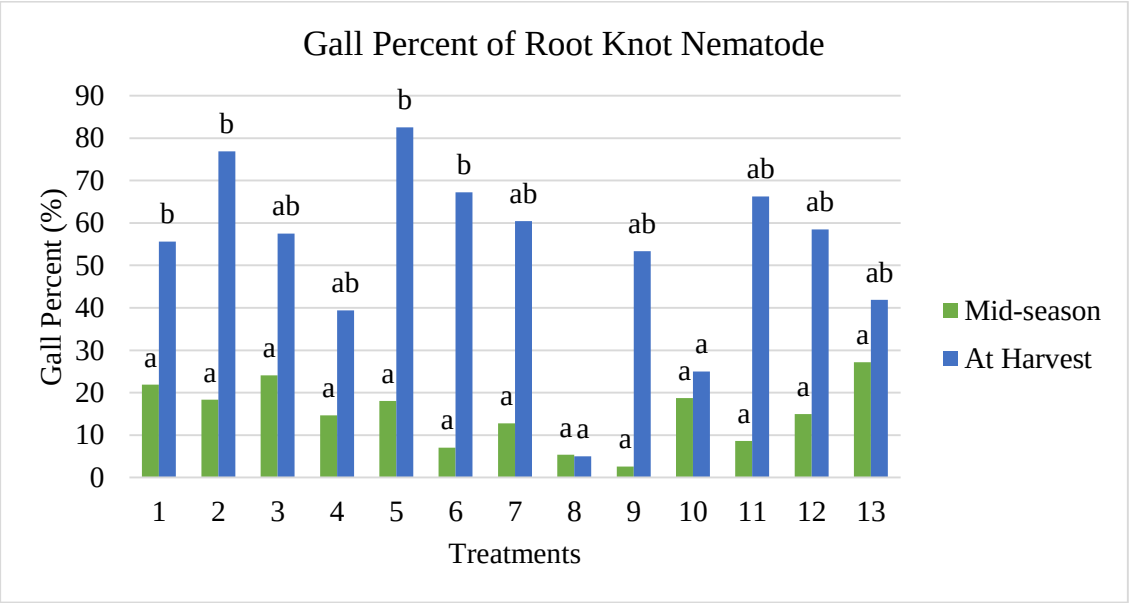


Figure 28. Green yields (lb/a) base in just one crop or half of the plant. Significant difference between treatment 3 and other treatments.


Gall Percent of Root Knot Nematode
Gall Percent (%)
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13
Treatments
a b
a b
a ab
a ab
a b
a b
a ab
a a
a ab
a a
a ab
a ab
a ab
Mid-season
At Harvest

Evaluation of biological products to manage Granville wilt in flue-cured tobacco, Johnston County 2018.

Raymond O. García, Bryant Spivey and Lindsey Thiessen

An on farm trial was implemented in Johnston County, North Carolina with a natural presence of Granville wilt bacteria. Treatments were arranged in a randomized complete block design with a 2 x 5 factorial (2 tobacco cultivars × 5 biocontrol treatments) with four replicates. The tobacco cultivars 'NC196' and 'NC471', with low and medium resistance against Granville wilt respectively, were used as part of the integrated pest management strategy. Seeds were planted in the greenhouse on a 288 cell CGP float strays containing tobacco mix, using a plug tray precision seeder machine in early March and transplanted on early May. Admire Pro was also applied in the transplant water to reduce the impact of tomato spotted wilt virus and 12-6-18 fertilizer was broadcast-applied at 800 lbs. per acre seven days after transplanting. Treatments were done after transplant with a CO_2 pressurized backpack sprayer at 4 PSI. The compost treatment was incorporated into the beds prior to transplanting at a rate of 5 tons per acre then mechanically incorporated. Stand count and disease incidence were measured weekly starting 27 days after transplanting. The assessing was based on visible symptoms of bacterial wilt on the tobacco plants which included, wilting and yellowing of leaves, unilateral wilting and yellowing, and total collapse of the plant on the later stages of the disease. The season-long disease incidence was used to calculate the Area Under Disease Progress Curve (AUDPC). Data was analyzed with a linear model using the 'nlme' package in the R statistical software (version 3.5.1). Means were compared using the "multcompView" software package in the R statistical software and a Tukey post hoc correction was utilized to account for multiple comparisons.

Ralstonia solanacearum was confirmed in a subset of plants from each plot by using *R. solanacearum* specific ImmunoStrip®. We were unable to collect yield data due to severe damage to the field trial caused by Hurricane Florence. The treatment combinations 'NC471'-McGill Compost and 'NC196'-Serifel had the lowest final disease incidence percentage, respectively. However, the final disease incidence percentage between these two treatments and seven others was not significantly different. Bio-Save had significantly higher final disease incidence percentage when combined with either cultivars. Additionally, there was not a significant main or interaction effect, either for the cultivars nor biocontrol. No phytotoxicity was observed.

Table 12. Organics treatments and varieties asses in Johnston County.

Cultivar	Biocontrol
NC196	Serifel
NC196	McGill Compost
NC196	Serenade ASO
NC196	Bio-Save
NC196	Non-treated
NC471	McGill Compost
NC471	Serifel
NC471	Serenade ASO
NC471	Bio-Save
NC471	Non-treated

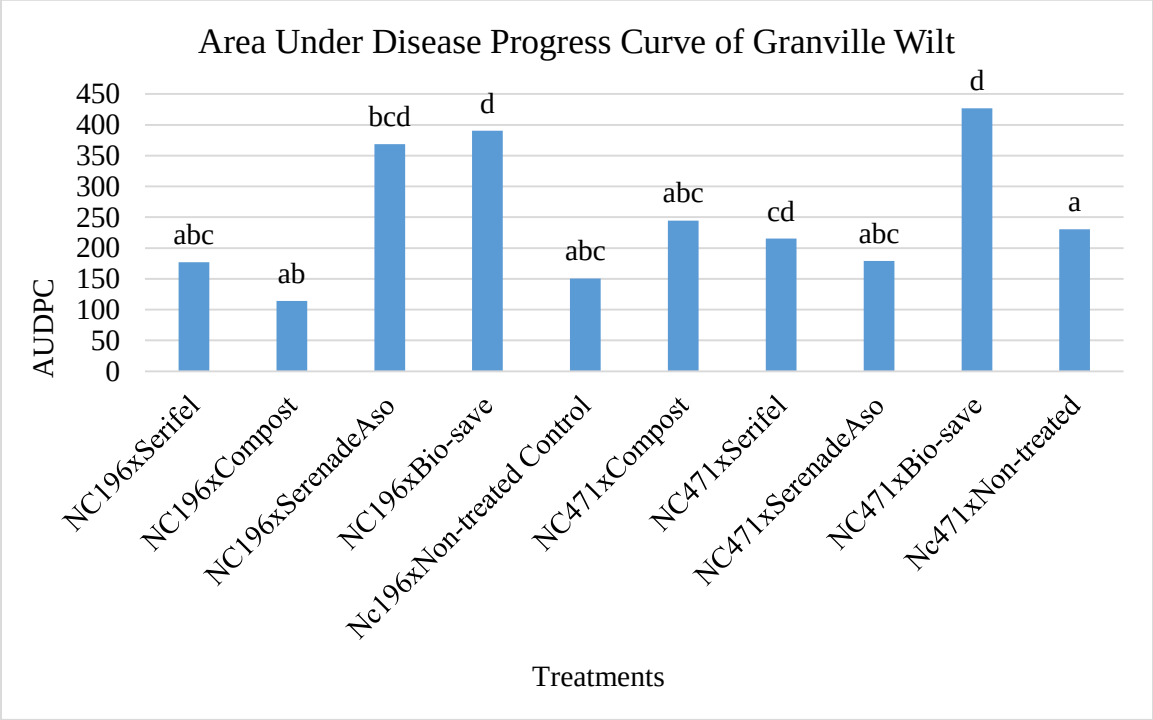


Figure 29. Area under disease progress curve of granville wilt in flue-cured tobacco. Variety NC 196 in combination with the compost was the one with the lowest disease development in the season, but no significantly different.

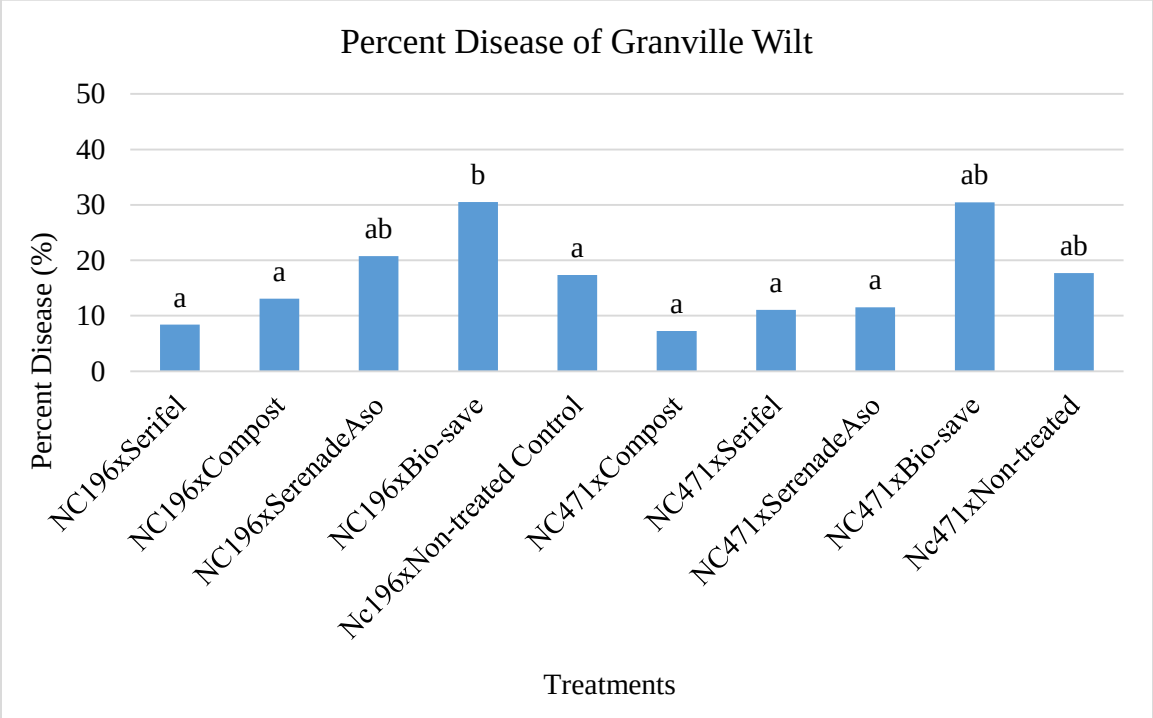


Figure 30. Percent disease of granville wilt on tobacco. The variety NC471 in combination with the compost had the lowest disease pressure than the other ones but no significantly different than the non-treated one.

Figure 31. Granville wilt symptoms, yellow wilting in one side of the plant. Johnston County, 2018.

Figure 32. Severe disease pressure of granville wilt in Johnston County, NC 2018.