

# The Evaluation of Breeding Lines Possessing an Introgressed *Nicotiana rustica* Genomic Region for *Phytophthora nicotianae* Resistance in Georgia

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## Abstract:

In 2013, 24 tobacco entries from North Carolina State University were evaluated in Pierce and Irwin Counties to determine their black shank resistance in Georgia. Sites with a known history of black shank (*P. parasitica* race1) were selected for this experiment. Taken together the results of these trials suggest the efforts of the NCSU breeding program to develop tobacco cultivars with resistance to race1 of *P. nicotianae* have been successful.

## Introduction:

Black shank, caused by *Phytophthora nicotianae*, is a major disease of flue-cured and burley tobacco. The black shank fungus affects the roots, basal stem and the leaves of the tobacco plant. Characteristics of the disease include the rapid wilting of leaves (Fig.1.) and a black lesion that extends from the soil level upward on the stalk (Fig.2.). When stalks of affected plants are split, the pith may be notably discolored and arranged in cylindrical discs. However, other influences can also result in pith discing.

Knowledge of field history and crop rotation are important in the management of black shank. Three or more years rotation will provide a consistent moderate to high level of benefit. The use of fungicide (Ridomil Gold or Ultra-Flourish) is suggested in fields with a history of black shank. The use of resistant cultivars in combination with rotation and fungicide applications has been effective in reducing losses to black shank. However, the continual use of Php gene based race 0 resistant cultivars has resulted in shifts to race 1 of the black shank pathogen. The purpose of this study was to evaluate breeding lines and new cultivars developed at North Carolina State University for resistance to race 1 of *P. nicotianae*.



Figure 1. Early Signs of Black Shank.

**Table 1. Results of the 2013 Georgia trial evaluating North Carolina State University germ plasma for resistance to black shank.**

Entry Number	Variety	Final % Black Shank	
		Irwin County	Pierce County
1.	K326 + WzWz;BC5F3 Line 1	8.9e	0.0c
2.	K326+ WzWz;BC5F3 Line 2	0.8c	0.8c
3.	K326+ WzWz;BC5F3 Line 3	5.5e	0.0c
4.	K326 null segregant Line 1	94.6ab	1.7c
5.	K326 null segregant Line 2	99.4a	2.8c
6.	NC1071	99.3a	41.5a
7.	K326+ Wz--;Hybrid 1	3.2e	10.9bc
8.	K326+ Wz--;Hybrid 2	29.2d	7.7bc
9.	K326+ Wz--;Hybrid 3	5.4e	0.0c
10.	Cms K326+ Wz--;Hybrid 1	3.6e	3.7c
11.	Cms K326-Wz--;Hybrid 2	2.9e	0.9c
12.	Cms K326+ Wz--;Hybrid 3	9.6e	2.0c
13.	K326 + Wz--+Php--;Hybrid 1	8.1e	6.6bc
14.	K326 + Wz--+Php--;Hybrid 2	4.6e	5.4bc
15.	K326 + Wz--+Php--;Hybrid 3	2.5e	4.6c
16.	K326 (certified)	99.3a	21.0b
17.	K346 (certified)	37.2d	2.3c
18.	NC 196 (certified)	88.0b	9.1bc
19.	NC71 (certified)	88.8b	11.8bc
20.	NC 95	100a	4.6c
21.	NC2326	95.0ab	7.1bc
22.	Beinhart 1000	4.8e	0.0c
23.	KT 209	35.3d	0.0c
24.	KT 206	70.2c	0.0c

Numbers in the same column followed by same letter do not differ statistically. (p=0.05)



Figure 2. Characteristic above ground symptoms of black shank.

## Materials & Methods:

The experiment design was a randomized complete block with 4 replications in Pierce County and 6 replications in Irwin County (Fig.3.). Production practices were per normal UGA Extension recommendations. Mefanoxam (Ridomil Gold) or Metalaxyl was not applied within the test area. Plots were evaluated visually from 2 weeks through 14 weeks post-transplant for the presence of black shank infected plants.



Figure 3. Irwin Co. plot. Each rep. is 1 row x 24-32 plants.

## Results:

Black shank incidence on entry no. 6 (NC1071) indicated the predominance of race 1 of *P. nicotianae* at both locations. At Irwin Co. the incidence of black shank was high with seven entries developing greater than 80% disease. Twelve entries at this location developed less than 10% disease indicating that new gene combinations can be effective against race 1 of *P. nicotianae*. The incidence of black shank was lower and more variable in Pierce but results generally support the Irwin Co. findings..