SP 277-Q

BLACK SHANK OF TOBACCO

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OVERVIEW

Black shank is the most widespread and destructive disease of tobacco in Tennessee. The disease is present in all tobacco-producing counties in the state. Burley, dark air-cured and dark fire-cured types of tobacco are all susceptible to black shank. Black shank disease is caused by a soil-borne oomycete, or water mold, called *Phytophthora nicotianae*. The pathogen can survive in the soil for many years, even in the absence of tobacco.

SYMPTOMS

This disease is often initially noticed in low areas or along the edges of a field. The first symptoms of black shank are usually the yellowing and wilting of a few scattered plants (Figure 1). Black shank can be mistaken for drowning, especially if the first plants affected are in a low area. Black shank-infected plants do not recover and soon the leaves on the entire plant wilt and turn a golden yellow (Figure 2). The lower stalk and root system of infected plants are usually black. The blackened area on the stalk is often sunken and extends from several inches above the soil line to the root system (Figure 3). Splitting the stalks of larger plants will often reveal a brown pith that is segmented into layers, often called pith disking (Figure 4). The pith is the innermost portion of the stalk and in healthy plants is off-white, soft and not layered. However, segmenting of the stalk pith alone should not be relied on for positive identification of black shank, since this symptom does not always occur. Also, segmenting of the pith can be caused by other factors, such as lightening. If there is doubt about the cause of symptoms,

Figure 1. *Black shank symptoms initially appear as leaf yellowing and wilting.*

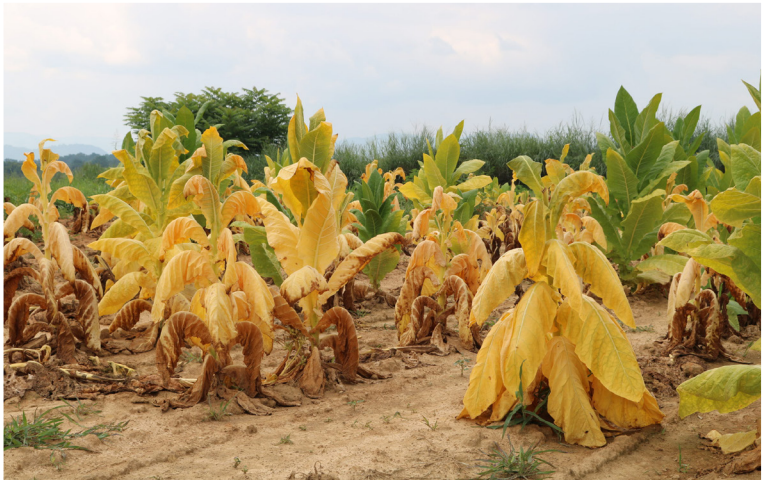

Figure 2. *As disease progresses, more plants may become infected and entire plants turn golden yellow and display permanent wilting.*

Figure 3. *A black, sunken lesion can usually be seen on the stalk of black shank-infected plants. The lesion may extend a few to several inches above the soil line, and into the root system.*

black shank can be easily and rapidly confirmed using an immunostrip assay (agdia ImmunoStrip for Phytophthora, https://orders.agdia.com/agdia-immunostrip-for-phyt-isk-92601). Contact your state plant diagnostic laboratory to inquire about testing.

SPREAD

The black shank pathogen can be spread in water, soil, transplants, and crop residue. Rivers, creeks, ditches, and ponds that receive drainage water from black shank-infested fields will become contaminated. Extensive damage from black shank can occur in fields receiving irrigation water from contaminated water supplies. The movement of soil is an important means of spread for this disease. Soil is commonly moved between field on worker's boots, farm equipment, and the movement of animals. Stalks and stripping trash from infested crops can serve as a source of the black shank pathogen and can infest new areas.

RACES OF THE BLACK SHANK PATHOGEN

Two races of the black shank pathogen occur in Tennessee and throughout the southeastern US. These races, called race 0 and race 1, are distinguished by differences in their abilities to infect certain varieties of tobacco. A study conducted in 2021 and 2022 by University of Tennessee researchers showed that 92 percent (101 out of 110 samples tested) of black shank in Tennessee was race 1. Additionally, all of the race 0 samples came from one research field in Greene County, which means all commercial production fields sampled contained race 1 only. Samples came from the following TN counties; Greene, Cheatham, Robertson, and Montgomery. Although race 0 is still found in Tennessee and may be present in commercial tobacco fields, race 1 is the predominant race. This finding underscores the importance of selecting varieties with race 1 black shank resistance in fields with a known history of disease.

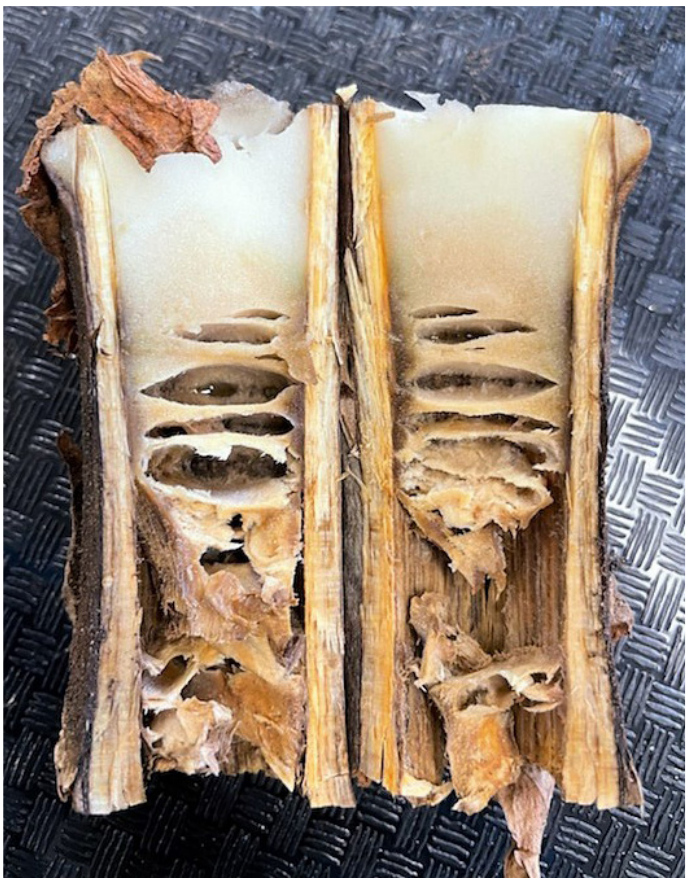

Figure 4. *Splitting the stalks of larger plants infected with black shank will often reveal a brown pith that is segmented into layers, often called pith disking.*

PREVENTION IN NON-INFESTED FIELDS

Disease prevention is crucial in fields that do not have black shank. Once the disease it introduced, it can be very difficult to manage and persists in the soil for many years.

1. Thoroughly clean all equipment, tires, boots, etc., after use in infested fields and before use in non-infested fields. Clean equipment with a pressure washer and disinfest with a 2 percent bleach solution or other disinfectant to ensure the pathogen will not be carried to clean fields. Work non-infested fields before moving to infested fields whenever possible. The time and effort spent on sanitation is worthwhile if black shank can be prevented from entering non-infested production fields.

2. Don't place stalks and sweepings from black shank-infested crops on non-infested tobacco fields. Stalks from infested fields can be returned to the fields from which they were cut.
3. Avoid unnecessary trips into fields in which plants are infected with black shank, especially during wet weather. Wear designated black shank boots that are not used elsewhere or disposable covers when entering fields where black shank is present.

MANAGEMENT IN INFESTED FIELDS

Crop rotation

Crop rotation is essential in managing black shank. The black shank pathogen can reproduce and reach high levels even when moderately resistant varieties are grown. Rotating black shank-infested fields with grass, hay and pasture, corn, and sorghum will help slow the buildup of *P. nicotianae* by depriving the pathogen of its host. Sod crops, such as fescue, will help prevent the movement of contaminated soil to non-infested fields on tillage equipment. The longer an infested field is planted to a crop other than tobacco, the lower the black shank disease pressure will become. A three-to-five-year rotation is recommended for fields infested with black shank. Rotation should be practiced even when resistant varieties are grown. It is best practice to assume a field has black shank if field history is unknown and is selected for tobacco production.

Field management

High soil pH has been associated with an increase in disease. Ideal soil pH for tobacco production is 5.8-6.5. Avoid water run-off from fields that have black shank and surface irrigation sources that may be contaminated with the pathogen. Black shank is favored by wet soil conditions, so improving soil drainage and minimizing soil saturation improves management.

RESISTANT VARIETIES

Burley tobacco

High levels of black shank resistance are available in burley tobacco. Resistance is rated on a scale from 0 to 10, where 0=no resistance and 10=high resistance (practically immune). Resistance ratings for each variety are based on field trials where percent survival of each variety is assessed in the presence of black shank. Several burley varieties have level 10 resistance to race 0. However, since race 1 is the predominant race in Tennessee, growers should select varieties with a high level of race 1 resistance if black shank is a known problem. There are currently no varieties with level 10 race 1 resistance. However, several varieties have a high level of resistance (level 8 or 9), which provides good protection against disease. Growers transplanting into fields with a history of black shank should choose a variety with at least level 4 resistance to race 1. In such cases, a variety with level 4 or higher race-1 resistance plus fungicides are usually required for acceptable disease management. Table 1, borrowed with permission from the 2023-2024 Burley and Dark Tobacco Production Guide, shows an updated list of burley varieties and their black shank resistance ratings.

Dark tobacco

Black shank is a major threat to dark tobacco due limited availability of high-level race 1 resistance. There are currently several dark varieties with level 10 resistance to race 0. However, since race 1 is the predominant race in Tennessee, growers should select varieties with a high level of race 1 resistance if black shank is a known problem. There are currently no dark varieties available with race 1 resistance higher than level 6, and most varieties are much less resistant than that. If dark tobacco is to be planted in a field with known black shank, growers should select a variety with at least level-4 resistance to race 1, and plan for two to three black shank fungicide applications. Currently, there are five dark varieties with at least level-4 race-1 resistance; KT D8LC, KT D14LC, KT D17LC, DT 538LC, and DT 558LC. Growers should also focus on the cultural practices outlined earlier in this article, such as crop rotation and field management, to minimize disease pressure. Table 2, borrowed with permission from the 2023-2024 Burley and Dark Tobacco Production Guide, shows an updated list of dark varieties and their black shank resistance ratings.

Cigar wrapper tobacco

Recently, CT Broadleaf (and other similar types) produced for cigar wrapper has been explored by Tennessee tobacco producers. There are no black shank-resistant varieties commercially available for producers. Therefore, an integrated approach for black shank management is important, including field selection, crop rotation, and use of fungicides.

CHEMICAL CONTROL

There are currently six fungicides recommended for black shank management (Table 3). Among these, there are only three active ingredients (a.i.). Those products are Orondis Gold Pre-Mix (a.i. oxathiapiprolin + mefenoxam), Orondis Gold 200 (a.i. oxathiapiprolin), Presidio (a.i. fluopicolide), Ridomil Gold SL (a.i. mefenoxam), Ultra Flourish (a.i. mefenoxam), and MetaStar 2E (a.i. metalaxyl). Metalaxyl and mefenoxam are closely related chemicals, both belonging to FRAC group 4. Oxathiapiprolin and fluopicolide belong to FRAC groups 49 and 43, respectively. If multiple fungicide applications are made during a season, rotate fungicides belonging to different FRAC groups to discourage the development of fungicide resistance. In a black shank-infested field, fungicides should be applied in transplant water at a minimum. Fungicides containing mefenoxam (Ridomil, Ultra Flourish) and/or oxathiapiprolin (Orondis Gold Pre-Mix, Orondis Gold 200) are the best options for transplant water applications. One to two additional applications at layby and/or first cultivation are often required for satisfactory control. Any of the previously mentioned products, except Orondis Gold Pre-Mix, may be used for post-plant applications. Refer to the product label and the most recent version of the Burley and Dark Tobacco Production Guide for updated fungicide recommendations.

ADDITIONAL RESOURCES

2023-2024 Burley and Dark Tobacco Production Guide.

http://www2.ca.uky.edu/agcomm/pubs/ID/ID160/ID160.pdf

University of Tennessee Specialty Crops Agronomy website

specialtycrops.tennessee.edu

University of Tennessee Specialty Crops Pathology website

www.utspecialtycrop.com

Table 1. New and Selected[$] Burley Tobacco Varieties - Relative Disease Resistance, Yield Scores, and Maturity. Borrowed with permission from the 2023-2024 Burley and Dark Tobacco Production Guide.

VARIETY	BLACK SHANK		VIRUS COMPLEX	BLACK ROOT ROT	TMV	FUSARIUM WILT	RELATIVE YIELD SCORE[x]	MATURITY
	RACE 0	RACE 1						
ms KY 14 X L8LC	**10**	**0**	**S**	**M**	**R**	**6**	**8**	**Early**
KT 200LC	6	6	R	H	R	0	8	Late
KT 204LC	7	7	R	H	R	1	8	Med-Late
KT 206LC[#]	10	6	R	H	R	1	8	Med-Late
KT 209LC	10	8	R	H	R	1	8	Med-Late
KT 210LC	10	8	S	H	R	5	8	Late
KT 212LC	10	4	S	H	R	5	6	Early
KT 215LC	10	9	S	H	S	8	8	Late
KT 219LC	10	8	S	H	R	4	7	Early
KT 222LC*	10	9	S	H	R	7	9	Late
NC BH 129LC	1	1	S	H	R	1	7	Med-Early
NC 7LC[**]	10	4	R	H	R	5	8	Late
TN 86LC	4	4	R	H	S	0	6	Late
TN 90LC[#]	4	4	R	H	R	0	5	Medium
TN 97LC	4	4	R	H	R	0	6	Med-Late
HYBRID 403LC	0	0	S	M	R	6	9	Medium
HYBRID 404LC	0	0	S[*]	H*	R*	4	9	Medium
N 126LC	0	0	S	S	R	3	8	Medium
N 777LC	2	2	S	M	S	0	3	Med-Late
N 7371LC	4	4	S	–	–	5	7	Late
NBH 98LC	2	2	S	M	R	3	5	Medium
HB04PLC	0	0	S	H	R	0	7	Med-Early
HB3307PLC	10	5	R	H	S	3	8	Late
HB4488PLC	10	4	R	H	–	3	8	Late

$ For an extensive list of varieties go to http://www.uky.edu/Ag/Tobacco

x Relative yield scores are based on growth under disease-free conditions.

[*] *Based on a limited number of field tests and subject to change.*

** Resistant to root knot nematode (Meloidogyne incognita, Races 1 and 3).

[#] *Low resistance to blue mold (Peronospora tabacina).*

– Resistance not rated for this disease

Table 2. Characteristics of dark tobacco varieties. Borrowed with permission from the 2023-2024 Burley and Dark Tobacco Production Guide.

Variety	Maturity	Black Shank (0-10)[a]		Use[b]	Relative Yield Score[c]	Relative Quality Score[c]	Black Root Rot[de]	TMV	Wildfire	Angular leaf spot[f]
		Race 0	Race 1							
NL Mad LC	Med-Late	0	0	F/A	7	9	S	S	S	S
TR Madole	Early-Med	0	0	F	6	6	S	S	S	S
Lit Crit	Med-Late	0	0	A/F	5	9	S	S	S	LS
KY 171[f]	Medium	0	0	A/F	7	7	R	R	S	S
VA 309	Early-Med	2	2	A/F	6	7	S	S	-	S
VA 359	Medium	1	1	A/F	6	7	S	S	-	-
TN D950	Early	3	3	F	8	6	R	R	R	HS
KT D6LC	Early-Med	3	3	F	8	7	R	R	R	S
KT D8LC	Medium	4	4	F/A	9	5	S	S	S	S
KT D14LC	Medium	10	5	F/A	8	6	R	R	R	S
KT D17LC	Medium	10	6	F/A	9	7	R	S	R	HS
DT 538 LC	Medium	4	4	F/A	8	6	M	-	-	LS
DT 558LC	Medium	4	4	F/A	8	7	M	S	-	S
PD 7302LC[g]	Medium	10	0	F/A	6	7	R	R	-	-
PD 7305LC	Early	10	3	F	8	6	R	R	R	S
PD 7309LC	Medium	10	0	F/A	7	8	S	S	-	LS
PD 7312LC[f]	Medium	0	0	A/F	7	8	R	R	S	S
PD 7318LC	Medium	10	0	F/A	8	7	R	R	-	LS
PD 7319LC	Medium	10	1	F/A	8	7	-	R	-	S

[a]Black shank resistance levels are based on a limited number of field tests and subject to change.
[b]F or A refers to use as a fire-cured or air-cured variety. F/A indicates either use with predominant use given first.
[c]Relative yield scores based on performance under disease-free conditions. Relative yield and quality scores given on a 0-10 scale, with 10 being best for the predominant use.
[d]R = highly resistant; M = medium resistance; S = susceptible.
[e]Dash (-) means that resistance level is unknown or not rated at present.
[f] LS = less susceptible; S = susceptible; HS = highly susceptible
[g]KY 171, PD 7302LC, and PD 7312LC have medium resistance to Fusarium wilt.

Table 3. Guide to fungicides available for control of black shank. Do not use for black shank control in Pennsylvania. Borrowed with permission from the 2023-2024 Burley and Dark Tobacco Production Guide.

		Pre-plant or at-planting applications			Post-plant applications	
Fungicide (FRAC Code)	Season Rate/A	Method	Rate/A*	Remarks	Rate/A*	Remarks
Orondis Gold Premix (49)	27.8 fl oz	Transplant water only	24-27.8 fl oz	Apply in no less than 200 gallons of transplant water per acre.	N/A	N/A
Orondis Gold 200 (49)	36.4 fl oz	Transplant water OR Post-plant	4.8 fl oz	Apply mixed with 6-8 fl oz Ridomil, at planting in-furrow or in transplant water. Rates up to 19.2 fl oz/A are labeled, such as in heavier soils. Apply in no less than 200 gallons of transplant water per acre.	4.8 fl oz	Apply mixed with 6-8 fl oz Ridomil, as a banded post-plant application to the soil at 1st cultivation or layby. Rates up to 19.2 fl oz/A are labeled, such as in heavier soils. Do not use if Orondis Gold has already been applied.
Presidio (43)	8 fl oz	NA	NA	NA	4 fl oz	Make banded application directed at soil beneath leaves at 1st cultivation or layby.
Ridomil Gold SL (4)	3 pt	Transplant water + Post-plant	¼-½ pt	Apply in no less than 200 gallons of transplant water per acre.	1 pt	Make subsequent application(s) at 1st cultivation and/or layby.
		Pre-plant + Post-plant	1 pt	Apply to soil within 1 week before planting and incorporate into the top 2-4 inches of soil.	1 pt	Make 1st application as near as possible to transplanting if no pre-plant application was made or if black shank is expected early in the season. Otherwise, make application(s) at layby or at 1st cultivation and layby.
		Pre-plant only	1-2 pt	Apply to soil within 1 week before planting and incorporate into the top 2-4 inches of soil.	----	----
Ultra Flourish (4)	6 pt	Pre-plant + post-plant	2 pt	Apply to soil within 1 week before planting and incorporate into the top 2-4 inches of soil.	2 pt	Make 1st application as near as possible to transplanting if no pre-plant application was made or if black shank is expected early in the season. Otherwise, make application(s) at layby or at 1st cultivation and layby.
		Pre-plant only	2-4 pt	Apply to soil within 1 week before planting and	--	--
MetaStar 2E (4)	12 pt	Pre-plant + post plant	4 pt	Apply to soil just prior to planting and incorporate into the top 2-4 inches of soil.	4 pt	Do not make a post-plant application of MetaStar if more than 4 pt was used pre-plant or if none was used pre-plant. Post-plant application(s) may be made at layby or at 1st cultivation and layby.
		Pre-plant only	8-12 pt	Apply to soil just prior to planting and incorporate into the top 2-4 inches of soil.	--	--

* Rate range of product. In general, use the highest labeled rates when disease pressure is high. Refer to product label for application information, restrictions, and warnings.

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Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

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