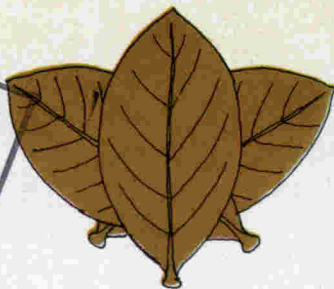


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DF-300

**A BLACK SHANK RESISTANT
DARK FIRE-CURED TOBACCO
AND OBSERVATIONS
ON TOBACCO BLACK SHANK
IN TENNESSEE**

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SUMMARY

DF-300 was developed through selective breeding and extensive testing on the Highland Rim Experiment Station and by many cooperating growers. The new variety is moderately resistant to black shank. It produces tobacco of good quality. It is capable of producing either snuff or wrapping tobacco.

COVER PHOTO: Performance of Madole and DF-300 in the presence of the black shank organism. For details, see page 7.

ACKNOWLEDGMENT

The writer wishes to express his gratitude to the many farmers who have helped in evaluating the new variety; to Mr. George A. Washington (now deceased), President of Wessyngton, Incorporated, and to his successors for making suitable land available as a black shank contaminated testing area; and to Mr. Lawson Safley, Superintendent of the Highland Rim Experiment Station for his assistance in conducting the experimental work.

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DF-300

A Black Shank Resistant Dark Fire-Cured Tobacco

Dennis H. Latham*

The University of Tennessee in cooperation with the U. S. Department of Agriculture initiated a breeding program some years ago to develop disease resistant dark fire-cured tobacco varieties. A new dark fire-cured tobacco variety—DF-300, with moderate resistance to black shank—was released in 1967. This variety produces tobacco of good quality, and in the absence of black shank the monetary value is not significantly different from that for Madole. Where black shank is a problem, DF-300 may be expected to have 75% or more survival, while under the same conditions Madole or Black Mammoth likely would show 90% or greater loss (Table 1).

Table 1. Five year average yield, value, and percent survival for Madole and DF-300, a black shank resistant dark fire-cured tobacco

Variety	Yield in pounds per acre*	Value in dollars per 100 pounds*	Value in dollars per acre*	Percent survival on black shank soil**
Madole	2324	41.20	957	1.8
DF-300	2149	41.78	898	81.0

*The yield and value data are averages for the 5 years 1962-1966 in variety tests conducted by the Agronomy Department.

**The survival data are for plants of the same lines grown on the naturally contaminated black shank experimental field. There were an equal number of Madole plots each year and they were always adjacent to the DF-300 plots.

DEVELOPMENT OF DF-300

DF-300 comes from a cross between two rather widely different types of tobacco; Florida shade-grown, variety 301, and dark fire-cured, variety Broadleaf Madole. There have been two backcrosses and numerous plant selections through several generations involved in the development of DF-300. The second generation from the last backcross, D57-353-A-2, was field planted in contaminated

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soil in 1958 (Figure 1). Five plant selections based on type and apparent disease resistance were made in this line in 1958.



Figure 1. Black shank resistance in dark tobacco breeding lines. The plant in the central foreground (arrow) is D57-353-A-2 and is the progenitor of DF-300.

Progeny from three selections were found to have a fair level of resistance to black shank (Figure 2), one had a rather low level of resistance, and the other appeared no better than the susceptible check. Repeated selections for both resistance and plant type in succeeding generations have resulted in a line with desirable agronomic characteristics and a moderate resistance to black shank.

DESCRIPTION OF DF-300

Under conditions favorable for growth of dark fire-cured tobacco, DF-300 plants will average about 74 inches tall and can be topped with 12 to 16 leaves for harvest. The plants have about the same general growth habit as Madole. Typically, DF-300 plants are lighter green in color than those of Madole. The shape and size of the leaves are essentially the same as on Madole. The midrib of the leaf is slightly smaller than that on Madole. The ruffles are no larger than those on Madole. On plants topped with 12 to 14 leaves for harvest, the top leaves, at maturity, will usually average about 16 inches wide by 32 inches long. Under average conditions, DF-300 tobacco cures with a lighter brown color than



Figure 2. Black shank killed all plants in the Madole row (center) by 8-21-59. DF-300 on left of the Madole had 51.1% survival on 10-21-59. The related line on the right had higher resistance but was of lower quality.

Madole that is produced and cured under the same conditions. Although DF-300 is capable of producing either snuff or wrapping tobacco, it appears best adapted to wrapping tobacco.

PERFORMANCE OF DF-300 AND MADOLE

DF-300 was grown as Tennex 300 in the variety tests on the Highland Rim Experiment Station in the absence of black shank for 5 years, 1962-1966. In these tests DF-300 did not produce as many pounds of tobacco per acre as did the Madole grown under the same conditions (Table 1). The quality of the DF-300 tobacco, as judged by value per 100 pounds, was slightly better than that of the Madole. The acre value of DF-300 was a little lower than that of Madole. In the same 5-year period, the same lines of tobacco were grown in the naturally contaminated black shank experimental field where the average survivals were 1.8% for Madole and 81.0% for DF-300 (Table 1).

DF-300 was grown on the Highland Rim Experiment Station for 3 years in half-acre plots in direct comparison with Madole for yield and quality. These tobaccos received similar treatment and were sold at auction as individual crops each year. DF-300 produced less tobacco per acre, had a higher value per 100 pounds (a

more usable product), and had a little less value per acre than Madole in the absence of black shank. In the same years on the heavily contaminated soil of the black shank experimental field, Madole had an average survival of 3.1% and DF-300 averaged 76.6% survival.

Plantings of more than 1 acre each of DF-300 were grown by a number of cooperating tobacco farmers in 1966. In 4 of 5 such plantings the quality of DF-300, as judged by value per 100 pounds, was equal to or better than that for the Madole or Black Mammoth with which it was compared. The value per acre in all five of the cooperative crops was greater for DF-300 than for the Madole or Black Mammoth with which it was compared. The results are summarized in Table 2.

Table 2. Performance of Madole, Black Mammoth, and DF-300 tobacco, average of five cooperative grower crops, 1966

Variety	Acres per grower	Yield in pounds per acre	Value in dollars per 100 pounds	Value in dollars per acre
Madole & Mammoth	1.87	2127	43.71	933
DF-300	1.22	2281	45.83	1,048

One of the cooperating growers, Carl Gilbert, planted Madole and DF-300 in alternate strips across a field that had not been used for tobacco in 10 years and was not known to have a black shank history. A field of tobacco upgrade from this field did have black shank in it in 1964. Drainage water from the higher field normally is diverted by a terrace. About 3 weeks before harvest time, there was an unusually heavy rain in the area; according to the grower, "We had a 3-inch rain in about 15 minutes." The excess water over-flowed the terrace and moved in a restricted area, about 125 feet wide, diagonally across the field of tobacco (see cover photograph). The first 18 rows on the upper side of the field were set with Madole. In the area where the water flowed across those Madole rows, 94.2% of the plants were killed by black shank. In the over-flow area of the adjacent 18 rows of DF-300, only 1.7% of the plants developed black shank. In the second strip of Madole, 86.3% of the plants in the overflow area died from black shank. In the second strip of DF-300 tobacco, there were no black shank symptoms visible on any of the plants in the overflow area. In the third strip of Madole, a total of 64.1% of the plants in the overflow area died from black shank. In the third strip of DF-300 tobacco, there was a single plant in the overflow area that died from black

shank (see cover photograph). The above data are summarized in Table 3. The Madole and the DF-300 tobaccos were harvested, cured, and sold at auction as separate crops (Table 4).

Table 3. Madole and DF-300 plants killed by black shank, Carl Gilbert farm, 1966 crop

Variety	Total plants counted*	Number plants killed by black shank	Percent of plants killed by black shank
Madole	649	547	84.3
DF-300	705	7	1.0

*Plant counts were made on an equal length of row in the over-flow area in each block or plot of tobacco (see cover photograph). There were 2 rows more of the DF-300 tobacco than there were of the Madole.

Table 4. Performance of Madole and DF-300 tobacco, Gilbert crop, 1966

Variety	Acres grown	Pounds per acre	Dollars per 100 pounds	Dollars per acre
Madole	1.10	1940*	41.30	801
DF-300	1.17	2569	42.53	1,093

*Black shank losses in the Madole tobacco, reported in Table 3, amounted to approximately 15% of the entire crop.

FIRST-KNOWN OCCURRENCE OF BLACK SHANK

*Black shank of tobacco was first reported from Java in the Dutch East Indies in 1895 (3). The disease is caused by the fungus now known as *Phytophthora parasitica* (Dast.) var. *nicotianae* (Breda de Haan) Tucker. Black shank was identified in the United States for the first time in Florida in 1915 (2). It is not known how the organism causing black shank arrived in Florida. It is entirely possible that a related species already present was able, under favorable conditions, to adapt itself to a new host. At any rate the organism became established and was identified as a parasite on tobacco in the United States in 1915. Since then, the black shank organism has been reported in most of the tobacco-producing areas of the United States.*

Black shank was first reported in Tennessee on dark fire-cured tobacco in Robertson County in 1935. The disease now occurs in practically every tobacco producing county in the State. Black shank was first identified on burley tobacco on the J. C. Anthony farm near Adams in Robertson County in 1942 (1).

Potentially, black shank is the most destructive disease affect-

ing tobacco. Under favorable conditions the disease may develop on a tobacco plant any time between the germination of the seed and the harvesting of the mature plant. The fungus which causes black shank is a member of a large group of fungi known as water molds. The organism grows best in a warm, moist situation and is easily spread by water.

DESCRIPTION OF THE DISEASE

Usually the first symptom of black shank will be a slight wilting. This will be followed in a short time by a more pronounced wilting and the death of the plant may occur within a few days. Typically a tobacco plant large enough to have a woody stem will remain erect after being killed by black shank. The root system of such a plant will be black and completely dead (Figure 3). The

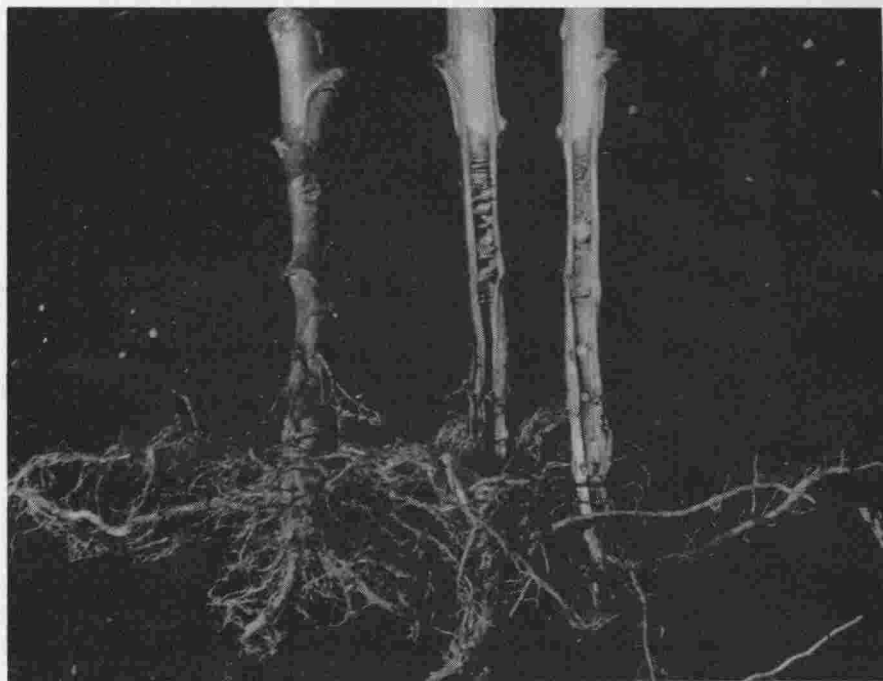


Figure 3. Dark tobacco plants killed by black shank, showing both external and internal symptoms. Both root systems are dead.

black discoloration will develop on and advance up the stalk several inches above the ground line. It is this discoloration of the lower portion of the stalk that gave the disease the name black shank (Figure 3). If the stalk is split open, usually the pith in the affected area will be found separated into disk-like formations

(Figure 3). The visibly affected pith tissue will be slightly in advance of the discoloration on the outside of the stalk.

The black shank organism may enter a plant not only thru the root but also thru the lower leaves that are in contact with contaminated soil. On leaves not in contact with the soil, leaf spotting (Figure 4) may occur in rainy weather, produced by spores



Figure 4. Leaf spot infection of blank shank on tobacco.

splashed onto the leaves by water. Under favorable conditions, such leaf spots develop very rapidly and may continue to grow until they reach a primary vein or the midrib and eventually the stalk. When such an infection occurs and the organism reaches the stalk, the portion of the plant above the lesion will be killed first. The fungus will spread downward more slowly but will eventually kill the entire plant. Such infections are much less common than root infections.

CONTROL MEASURES

Control of black shank can be obtained by sanitation coupled with a crop rotation of 5 years or more between tobacco crops, provided the fields are so located that there is no drainage water coming on the area from a previously contaminated area. Where

drainage water from contaminated areas flows over an otherwise clean field of tobacco, the chances are quite good that black shank will develop on at least a few of the plants, as described for the Gilbert farm and shown in the cover picture.

At the present time, chemical control of black shank is not economically practical. The use of resistant varieties offers the best means of controlling black shank in infested ground.

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