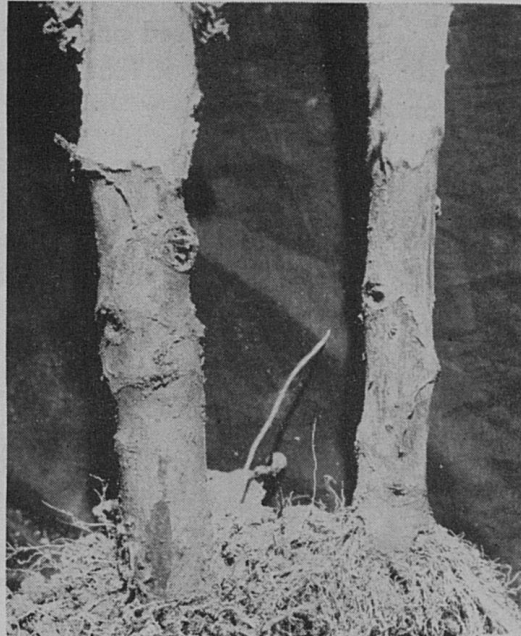


# PREVENT LOSS FROM BLACK SHANK of TOBACCO

By J. W. Irvine and W. D. Valleau



Plants wilt and die



Stalks turn black

Circular 520

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## SUMMARY

### To prevent loss from black shank

1. Place the plant bed on clean land that is not likely to be contaminated by road water, wash from infested land, or wash from the tobacco barn or barnlot.
2. Grow tobacco on land that has never had black shank on it, and that is not likely to become infested by running water from roads, infested fields, or any other source.
3. Prepare the bed and the tobacco field with tools that have been thoroughly cleaned, so that the black shank fungus will not be introduced on clods of dirt.
4. If you trade labor or tools with your neighbors, be sure that all tools are thoroughly clean before moving from one farm to another, and be sure no dirt is carried from one farm to another on men's shoes or on the hoofs of animals or in any other way.
5. For watering the beds and for setting tobacco, use water that has no chance of contamination with the black shank fungus. Water from creeks and rivers is not safe.
6. If any black shank plants do develop, remove them with all of the roots possible and drench the spot thoroughly with 1-400 nabam solution.
7. Do not allow a field to become heavily infested with the black shank fungus by growing tobacco in infested ground or by leaving infected plants and roots in the field. Remove them as completely as possible.
8. Manure, tobacco stalks, and the machinery used in spreading manure are all likely sources of black shank infection on a farm where black shank is already present. Therefore do not use manure or tools that have been used in the barnlot on land to be put in tobacco.

# Prevent Loss From Black Shank of Tobacco

By J. W. Irvine and W. D. Valleau

Results in the statewide efforts of Kentucky tobacco growers to stop losses from black shank have been spectacular and have demonstrated that a careful farmer who has enough land so that he can change the location of his tobacco from year to year if black shank develops, has little to fear from the disease. No satisfactory way has yet been found, however, to prevent losses on farms where there is only one plot of ground satisfactory for tobacco, and this infected with the black shank fungus. Drenching with nabam solution has proved effective in preventing carry-over when only a few diseased plants develop. The roots should be carefully removed, and the soil thoroughly drenched. This treatment cannot be recommended where there are many affected plants or in heavily infected fields.

## Clean Land and Clean Tools the Solution

Reports were gathered in 1952 on 1,183 farms that had black shank losses in 1951 but where tobacco was planted on clean land<sup>1</sup> in 1952. On 932 of these farms, or 79 of each 100, there was no loss whatever from black shank in 1952. Similar reports were received in 1953 from 959 farms that had losses from black shank previously but where tobacco was planted on clean land in 1953. On 84 percent, or 801, of these farms, there was no loss from black shank in 1953.

Where black shank did occur on clean land, usually only a few plants were affected. Where tobacco was grown in 1952 or 1953 on land where losses occurred the year before, losses were sometimes heavy in spite of the drouth that occurred in most of the state during those years.

<sup>1</sup>By clean land is meant land that has never had a black-shank-infected crop of tobacco on it. Reports from counties with a long history of black shank suggest that some of the growers moved from a recently infested field to one where there was a carry-over of the disease from an infected crop some years previously, and so failed to get control.

The effectiveness of using clean land and clean tools and of following other practices to prevent the spread of the disease has been clearly demonstrated.

**Occurrences and Losses from Black Shank in Kentucky, 1950-1953<sup>1</sup>**

	1950	1951	1952	1953
Number of counties reporting				
black shank .....	39	62	58	55
Number of farms reporting				
black shank .....	743	1725	1188	872
Estimated loss of income				
from black shank .....		\$452,740	\$187,385	\$118,235
Number of farmers moving from				
infected fields to clean land ....			1183	959
Percent of above farmers who effectively controlled black shank....			79%	84%

**How Long Does the Black Shank Fungus Remain in the Soil?**

Two years ago there was no definite information as to how long the black shank fungus would remain in the soil after a diseased crop. In 1952 and 1953, studies were made of carry-over in fields out of tobacco from 1 to 6 years following a severe outbreak of black shank.

One year without tobacco was not long enough to get rid of the disease on any one of 13 fields studied. Losses were recorded on these 13 fields where the loss previously in all but 2 was from 20 to 90 percent, with an average loss in the 13 fields of 37 percent. One year without tobacco reduced the loss to an average of 15 percent.

Two years without tobacco gave variable results. Losses were recorded on 11 fields where the loss previously ranged from 5 to 66 percent. In 4 of the fields there were 0, 1, 4, and 54 plants, respectively, that developed black shank after 2 years without tobacco. In another field the loss dropped from 50 to 1.6 percent; while in the other fields losses were 2, 6, 17.6, 21, 37, and 80 percent. In half of the fields a commercially satisfactory crop was grown, but the loss in the others was too great to warrant taking a chance on land only 2 years without tobacco.

<sup>1</sup> These figures are based on answers to a questionnaire sent to county agents and filled out by them. In some cases their answers were based on actual records; in others, on estimates. Enough accurate records were obtained to indicate that the estimates were conservative.

Three years without tobacco was studied on 19 fields that ranged in loss from 1 to 95 percent with an average loss of 47 percent. After three years without tobacco the losses ranged from a few plants in each of six fields (1, 1, 1, 2, 11, 22 plants lost) to 19 percent, with an average loss of 3.6 percent in the 19 fields. In 12 of the 19 fields the loss was 4 percent or less, which means that it is relatively safe to plant a field with tobacco that has been out of tobacco 3 years, particularly if one is willing to remove affected plants at the first sign of black shank and drench the spot thoroughly with nabam solution in order to prevent spread from that point and reduce carry-over. The field should again be sowed to grass for at least a three-year period.

Four years without tobacco was studied on 11 fields. Losses in 1948 had ranged from 1 percent in two fields to between 10 and 99 percent in the other 9 fields, with an average loss in the 9 fields of 31 percent. In 1953 the losses were as follows: none in 3 fields, 8 plants or less in 4 fields, and 1.7, 3.2, 5.5, and 5.7 percent loss in the other four fields. The average loss after the four years without tobacco on the 11 fields was 1.5 percent.

Five years without tobacco was studied on two fields, and 6 years without tobacco on one field. The losses after 5 and 6 years were 1 plant, 40 plants, and no loss respectively.<sup>1</sup>

It is evident from these studies that a rotation on infested soil with tobacco not oftener than once in 5 years should be relatively safe. On some soils tobacco once in 4 years, or even once in 3 years would be safe and should eventually result in the disappearance of the fungus from the farm. But a farmer would have to learn from experience the length of rotation safe for his soil.

### **Varieties of Burley Resistant to Black Shank**

For several years the Virginia Experiment Station has been attempting to develop burley varieties resistant to black shank. The Kentucky Experiment Station has cooperated in this work, particularly in testing the quality of the strains. These varieties, called W.B.R. series, have been tested by farmers in the black shank areas with variable results. Selections from the Virginia

<sup>1</sup> The studies on longevity were made by E. M. Johnson and will be reported in detail elsewhere.

varieties have been made by the Tennessee Station at Greeneville, and 2 of these, Burley 11A and 11B will be released in 1954 according to press announcements.

From studies on the W.B.R. series and Burley 11A and 11B it is evident that these moderately resistant varieties will not be satisfactory on heavily infested soils or where one wishes to grow tobacco continuously on the same land. The best of these resistant varieties sustained a loss of 60 percent in 1953 in heavily infested soil. They will be of value in a rotation which gives an opportunity for the fungus to largely disappear from the soil between crops.

According to the figures given in the preceding pages on length of time required for disappearance of the fungus, it is obvious that, in half the fields studied, two years out of tobacco would enable the resistant varieties to be grown satisfactorily, while they should be successful in most fields out of tobacco 3 or more years. The resistant varieties have not been satisfactory on infested soils high in lime.

In the Kentucky Experiment Station breeding program an attempt is being made to transfer what appears to be an immune factor from the wild species *Nicotiana longiflora* to burley and dark tobaccos. In 1953 the resistant segregates survived with no sign of black shank injury in a field where the best of the strains derived from the W.B.R. series died 60 percent. This highly resistant material will be tested in the black shank areas of the state as soon as satisfactory strains are available. From present information it appears probable that the *longiflora* type of resistance will allow varieties containing it to be grown continuously on heavily infested soils.

### **Don't Allow Land to Become Heavily Infested**

The more crops of tobacco grown on a piece of land infested with black shank, the more heavily the soil will become loaded with spores of the fungus and the longer it will take to get rid of them. Therefore, on the very first appearance of the disease, remove the diseased plants as soon as they can be recognized, taking up all roots possible, and then drench each spot thoroughly

with 1-400 nabam solution (3 tablespoons of nabam to 10 quarts of water). If a field has many diseased plants the nabam treatment may be too tedious and expensive, but it would still pay to remove every tobacco plant, with as many roots as possible, as soon as it is recognized that it has black shank. If this is done carefully, taking out all roots possible, it is certain to reduce the amount of fungus spores that can be carried over. The field should then be sown to grass and not used for tobacco until experiments show it is safe. If any other ground is available, don't risk planting a field to tobacco the year after black shank is found in it, even though there were only a few plants and these were removed and the ground drenched with nabam solution.

### **Tobacco on Flooded Land**

Several fields were found in 1952 that had had black shank in the past but had been flooded in winter or spring by high waters of a creek or river. These flooded fields, when put back to tobacco, usually had few or no black shank plants below the high-water line, but in several instances had black shank above the high-water mark. While there is no absolute proof that flooding will always get rid of the fungus, it now appears that flooded land will be safer to use after a couple of years without tobacco than land that has not been flooded. Flooding, if it introduces the fungus, does not contaminate a whole field with black shank; it may leave a few contaminated roots or stalks in the debris at the high-water mark, and these may result in a few affected plants in the next crop.

### **Limestone and Carryover of Black Shank in the Soil**

Studies on the reaction of the soil, whether acid or alkaline, as determined by pH, suggest that fields on which the pH concentration is high (that is, 6.5 or above) are more likely to develop the disease and carry the fungus from year to year than soil more distinctly acid (pH 5.6 or below). The most serious losses from black shank appear to be on parts of fields where much limestone rock, as small particles or large pieces are scattered through the soil.

Until more is known about the reaction between limestone particles and carry-over of black shank, it may be well to put spots in fields that are known to contain lime, such as drainage-ways from old limestone roads that pass across a field, in grass permanently, even though the remainder of the field is plowed for tobacco. Fields that have been heavily limed for alfalfa may be found to carry the black shank fungus for longer periods than more acid soils. There is no absolute proof of such a relation between limestone and black shank, but observations over two years make it seem probable, and it may be safer to use the more acid soils for tobacco. These observations also suggest that limed soils should be left out of tobacco longer than acid soils.

### **Selection of a New Field for Tobacco**

Any farmer who has had black shank should select a clean field (that is, one that has not had a black shank affected crop on it in the past) that does not receive any drainage water from a black shank field, or, if it does, the waterway across the field should be left in grass above the high-water mark. The new field should not be along a road if the field is lower than the road and receives drainage water from it, unless all of the road water can be carried across the field on a sod waterway. If the field is about level with the road, a strip of sod about 20 feet wide should be left between the road ditch and the tobacco. This will tend to filter out the fungus that may be in the ditch water when it overflows the sod. The field should not receive drainage water from a barnyard or the yard around a tobacco barn; and it should be so located that no one has to cross a contaminated field to reach it. It has been observed that when an old tobacco bed site is plowed, along with a clean piece of ground, black shank sometimes starts at the old bed site. It may, therefore, be safer not to plow old bed sites for cropping tobacco.

### **Precautions Against Contamination of the New Field**

The black shank fungus is carried in running water but also in clods of dirt on shoes or horses' hoofs, and in dirt clinging to all kinds of machinery including the manure spreader and ani-



mals' feet or tractor used to pull the spreader. Manure can also be a potent source of infection and so manure should not be used for tobacco on a farm where black shank is present. To prevent contamination of a new field, it is necessary that all tools that have been used in a black shank field or in a barnlot be cleaned of dirt as thoroughly as possible before preparing the new plant bed and the new field. Thorough soaking of tools with 1-400 nabam solution should be helpful, provided all soil masses on the tools are thoroughly wetted.

It is so important that the machinery be clean that a farmer can afford to give careful thought to the best methods to be used under his conditions. It is better to do the cleaning on a grass plot rather than in a tobacco barn or in a barnyard where the tools may be contaminated again by the dirt left on the ground, and it is also better to do the cleaning as near the old infested field as possible so as not to distribute dirt from the black shank field over the farm. It would be highly desirable for each farmer to make a practice of cleaning all of his machinery in the fall before storage for winter, so that this work need not be done when the weather is satisfactory for plowing and fixing the ground.

### **Selection of a Site for the Tobacco Bed**

There is danger, on a farm where black shank occurs, that infested soil may be carried to the plant bed site during the pulling season. It may, therefore, be safer to choose a new site each year. The tobacco bed should be placed where it will receive no drainage from a black shank field and where dirt from the barnyard or tobacco barn is not likely to be carried to it on the feet of animals or men. It should be located where it can be reached without walking across a black shank field. The bed should be prepared with clean tools. If watering is necessary, the water should be from a cistern, well, spring, a pond that does not receive drainage from a black shank field, or a city water supply; not stream or river water.

### **Grow Your Own Tobacco Plants**

Make your plant bed large enough and care for it well, so that you will not need to get plants from another farm. In case

of a plant bed failure in a black shank area in Kentucky, a grower would be much safer to go to a black-shank-free area for plants, but should take every precaution not to carry black shank to the farm from which he gets the plants.

### **Setting the Crop**

Make every effort to see that all tools used in setting are as clean as possible before beginning work, particularly if they are borrowed tools that have been used on a black shank farm. The grower should see that the shoes of the setters are free from clods of dirt before entering the field, particularly if the setters are hired labor from a farm where black shank was present the year before. Black shank can be introduced in setting water if it is taken from an infested creek or river. Pond water, if the pond receives no drainage from a black shank field, cistern water, spring water, and water from town or city water supplies should be safe to use.

### **Tobacco Stalks and Barn Sweepings**

Tobacco stalks and barn sweepings from a black shank crop should not be used as bedding and should not be put on the manure pile. They may be burned or put on grassland that does not drain onto land that is to be used for tobacco or into a creek or river, if such land is available; or they may be put back, during a dry period, on the field from which they came if it has been sown to permanent grass.

### **Black Shank and Irrigation**

Tobacco beds should not be watered from creeks or rivers, as at that time of the year the water is likely to be contaminated. It is also probably dangerous to irrigate tobacco fields soon after setting the crop, particularly if the water is high. However, at the low stage of rivers during a drouth, when irrigation is particularly valuable, it is probable that the water is free from contamination and safe to use for irrigation.

### **Visiting, Trading Labor and Tools, and Measuring Tobacco Acreage**

Black shank can be carried from one farm to another on shoes, automobile tires and fenders, on the floor of a car, and on all kinds of machinery. Visitors from black shank farms, when visiting other farms, should first be sure that their shoes are free from dirt and that clods of dirt are not on the floorboard ready to be kicked out when they get out of the car. As an added precaution, visitors should stay entirely away from the tobacco field.

In areas where labor and tools are traded, the greatest of care should be taken to see that all tools are clean before they leave a farm; and the farmer on whose farm the tools are to be used should assure himself that they *are* clean before he allows them to enter his farm.

There is danger that black shank can be carried from farm to farm by those who measure tobacco acreage for ASC (formerly PMA) although we have no evidence that this has occurred. The PMA has recognized this danger and has instructed those who do the measuring to make measurements of fields infested with black shank outside of the field to avoid carrying dirt from infested fields. Those who measure have also been warned to leave infested farms until the last and then to measure only when the ground is dry. Another suggestion is that the measurers wear overshoes or boots which may be removed and washed before leaving the farm.<sup>1</sup>

### **How to Recognize Black Shank**

Black shank causes tobacco plants to look as though they had been drowned; and many growers, in the wet season of 1950, mistook a few plants that were dying from black shank for drowned plants, only to put the field back in tobacco in 1951, with heavy loss. The fungus that causes black shank lives through the winter in the soil and attacks tobacco any time during the summer.

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<sup>1</sup>Letter 2241, August 9, 1951, State PMA Committee to chairman of county PMA committees.

The first signs of the disease are a slight wilting, followed by the lower leaves turning bright yellow and hanging down the stalk. At the early wilting stage it may be necessary to cut into the underground base of the stalk to find the blackened, diseased area; while later the roots usually will be found to be dead and a black rot may have spread up the stalk for several inches. If the stalk is split, the rot will usually be found to have entered the pith, which is dark and separated into disks.

Lexington, Kentucky

January, 1954