

Connecticut Agricultural Experiment Station
New Haven

Control of Tobacco Mildew
(Blue Mold) in Seedbeds

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DOWNY MILDEW of tobacco¹ has been in Connecticut now for two years. Although no one can predict that the disease will recur every year in serious proportions, it is certain that all growers should be prepared to combat it.

Various methods of control are under investigation at the Connecticut Tobacco Substation at Windsor and at experiment stations in other tobacco producing states. Certain of these have been found very effective and fairly easy of application.

The object of the present circular is to describe the two most successful methods we have found up to the present time. It includes such information as we have, with the realization that improvement or simpler means of control may result from continued study.

In the 1938 season, two general methods were tried extensively both by growers and by the Station at Windsor: (1) Spraying the plants with various forms of red copper oxide; and (2) gassing the growing seedlings with vapors of benzol. The red oxide spray gave only partial control. In most cases it merely retarded the mildew for about a week, after which the plants became diseased about as badly as in beds where no spray was used. Also in many instances, the leaves were injured by the copper oxide. Therefore the copper oxide spray is not recommended for 1939.

The benzol treatment gave much better results and looks promising. Another material, paradichlorobenzene, has also given good control at the station. Both methods are described below.

¹ Other reports on this disease in Connecticut are found in Downy Mildew of Tobacco, Bul. 405, and Tobacco Substation at Windsor, Report for 1937. Bul. 410.

Tight Beds

Success in either of the gassing methods depends first of all on making the sidewalls and sash, or cloth covers, as nearly air-tight as possible to prevent too much leakage of the gas. Both benzol and paradichlorobenzene vaporize when exposed to the air, and if this air is sufficiently confined, the percentage of vapor will soon "build up" to a concentration high enough to kill the mildew on the plants. But if the gas leaks out through holes in the glass, cloth, or sideboards too rapidly, it never becomes sufficiently concentrated to be lethal to the mildew fungus. Obviously it is not possible, nor is it necessary, to make the beds absolutely air tight, but, within practical limits, the tighter they are the more certain will be the control, and the smaller will be the quantity of chemical needed. The most common avenues of escape are: (1) Open cracks between boards where the sideboards are more than one board high; (2) loose fitting corners or end joints between boards; (3) openings under the boards where the soil has not been piled up against the bottom of the board; (4) uneven tops of the sideboards or warped sash so that sash do not lie snugly on the boards; (5) broken glass not replaced; (6) glass laid in the sash without putty or paint; (7) open slits where the panes overlap each other; (8) in cloth-covered beds, cloth with too loose a mesh or that is not drawn tightly over the edges of the sideboards.

The remedy for each of these conditions will be obvious to every practical grower and need not be discussed further here. If cloth cover is used, it should have over 50 threads to the inch, judging from our experience in 1938.¹ If such cloth is sprinkled with a hose at sun-down, the water fills the pores and makes a covering almost impervious to the passage of gas. In last year's experiments, when the gas concentration was measured every hour of the night, wetted cloth covers were found to be superior to glass sash in keeping up the concentration. Even wetting the glass sash made them more effective by swelling the wood and filling the crevices between glass with water. It is quite possible to obtain complete control under glass covers alone. Where there are too many leaks in the beds, however, some growers found it profitable to spread wet cloth over the sash and in this way got complete control with a surprisingly small quantity of benzol.

When to Start Gassing

Both of the gassing methods described here are curative, and not preventive measures. Therefore it is not necessary to apply them before the disease appears. In 1937, the first case of mildew was found in Connecticut on May 25, and in 1938 on May 11. Probably the second week in May is as early as we may expect the disease any year. As soon as it is found in one bed in a neighborhood, it is time to start control measures, because this is usually an indication that it will soon appear in the neighboring beds.

When the treatment is first started it is advisable to continue for two or three nights in succession if mildew has been seen in the beds. If not, every second or third night is sufficient.

¹ A grade of cloth known in the trade as 56-60 is the one most commonly used and was found to be very satisfactory.

Benzol Method

Shallow pans of benzol are distributed throughout the closed beds during the night and removed the first thing in the morning. Pie tins or the wash basin type of "firing pans"—used for charcoal curing—are used most commonly, but any type of shallow pan which will hold benzol is suitable. These pans should be supported above the plants up close under the glass for two reasons: First, so that drops of water falling from the sash will not splash the benzol on the leaves to injure them and, secondly, because benzol vapor is heavier than air and will distribute itself better if the pans are elevated. Some prefer to place a metal shield above the pans to prevent splashing. This is not necessary if the pans are close to the glass.

The number of pans required for a bed naturally depends on the area of the pan bottom. In tight glass beds with little gas leakage, or beds properly covered with wetted cloth as described in a previous section, a ratio of one square foot of evaporating surface of benzol to 100 square feet of bed area to be protected is adequate. In beds only fairly tight, a ratio of 1:72 was found to be necessary in 1938. For example, with an average pan of .5 square foot area, one pan to every third sash in a very tight bed, or one pan to every second sash in one only fairly tight, is required.

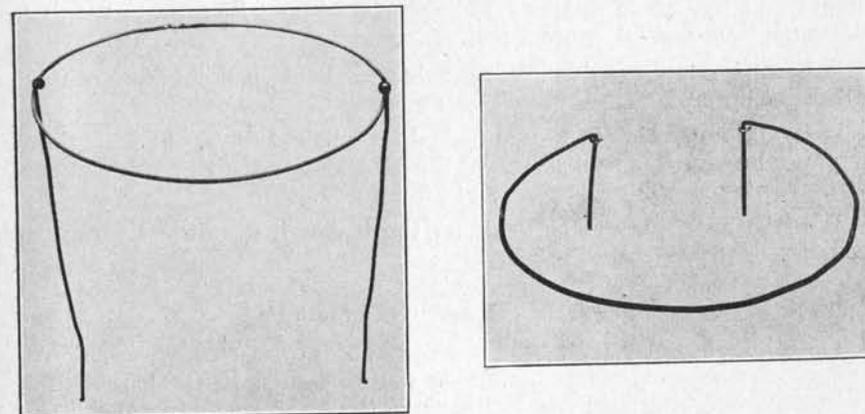


FIGURE 1. Wire supports for the benzol evaporating pans. A, hoop supported by legs pushed into the soil. B, type in which the ends of the hoop are bent down and supported by staples in the sideboards. Both are made of No. 8 pliable wire.

There should be enough benzol in each pan to last throughout the night. The rate of evaporation will vary some with the temperature and wind but, in general, if the bottom of the pan is covered a quarter of an inch deep with benzol, it will be sufficient and will be about all evaporated the next morning. If any benzol is left in the morning, it should be poured back into the container and may be used for the next application. If water has dripped into the pans, it may be separated by carefully pouring the lighter benzol off the top.

Benzol of the commercial grade known as 90 percent is suitable. Commercial benzine, motor benzol, or types containing impurities should not be used.

Various methods of supporting the pans over the plants have been devised. The type of support most popular with the growers in the past season was a simple standard constructed of heavy wire, which consists of a hoop of proper size to fit the pan, supported by two or three long wire legs which are pushed into the soil (Figure 1 A) or the hoop may be supported by staples in the sideboards (Figure 1 B). From the standpoint of the distribution of the vapor, the best position for the pans would seem to be in a line along the center of the bed. Since this arrangement is quite inconvenient to manipulate, and actual tests have not demonstrated the necessity of a central position, they are usually placed close to the higher and lower sides of the bed in alternating sequence.

Wick Evaporators: An effective, safe and time-saving apparatus for evaporating the benzol has recently been placed on the market. This consists of a series of compact closed cans spaced at regular intervals along the inner side of the headboard and connected by copper tubing. A long wick with one end immersed in the benzol in the can and the other end hanging free in the air permits the benzol to evaporate at a uniform rate. The entire line of cans is filled from a reservoir outside the end of the bed. In this way the whole bed can be "gassed" without disturbing the sash and much time and labor are saved.

Precautions: Benzol is inflammable and should be kept from contact with lighted matches.

It should not be left in closed beds during bright days. At such times the vapor becomes concentrated and the plants, with their breathing pores open, absorb the gas too rapidly and are injured.

When benzol splashes or drips on the leaves it kills the tissues and produces dead spots.

Paradichlorobenzene Method

The principles of this method are the same as those of benzol. Paradichlorobenzene is a white crystalline material, a derivative of benzol, which vaporizes when exposed to the air in the beds. In our tests of 1938, as well as in the tests in other states, this material gave as good results as the liquid benzol and in some ways is more convenient to handle. It is not inflammable.

In our first trials, the same pie tins were used which we had been using for benzol. In later tests, the crystals were distributed on narrow continuous shelves, 3 inches wide, nailed inside the upper and lower boards of the bed. Both of these methods were quite successful under conditions of severe bed infection in the spring of 1938, even when the treatment was started after the disease was found in the beds.

Another form of container for the crystals which may prove more convenient, economical of material, and as effective in control, is the wire basket shown in Figure 2. These baskets have been tried only in greenhouse tests up to the present. They are made of ordinary galvanized wire

screening, are very cheap, and easily made at home by any grower with a few simple tools. The one shown in the illustration is 1 inch deep, 2 inches wide, and 10 inches long. On one side are two "eyes", or grommets, by which the basket is hung on two finish nails driven into the sideboard of the bed.

The advantage in using these baskets is that enough paradichlorobenzene may be placed in the bottom to last through a week of treatments. An excess of this material is not harmful to the plants. The baskets, with the crystals that have not evaporated, are removed from the beds each morning. They may be stored as they are, in any large covered can that will not allow the paradichlorobenzene to evaporate, and are ready for use another evening.

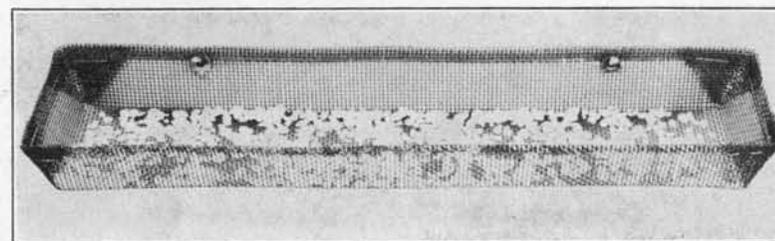


FIGURE 2. Wire basket containing crystals of paradichlorobenzene. Supported against the sideboard on nails passing through 2 grommets in the screen.

As low as an eighth of an ounce of paradichlorobenzene to the square yard of bed was found effective, but it is advisable to use a quarter of an ounce if beds are not very tight. If the removable baskets are used, a larger amount may be put in at the beginning to eliminate the work of renewal so often. The best spacing for the baskets in the beds has not been sufficiently tested to make definite recommendations, but it is suggested that there be at least one basket every second sash and on alternating sides of the bed.

Paradichlorobenzene may be purchased in different grades of crystal size. A medium size, of the commercial grades numbers 6 to 8 (one-eighth inch or less in diameter), has given good results. Larger crystals do not vaporize fast enough and those that are too fine have a tendency to "cake."

Warning: Paradichlorobenzene should not be left in the closed beds during bright days or the plants will fade and be checked in their growth.