## NURSERY CONTROL OF FUSIFORM RUST DEMANDS CAREFUL SPRAYING

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Fusiform rust in southern pine nurseries is caused by a highly specialized organism which demands a set of exact conditions before it can infect pines. In the absence of these conditions some nurseries escape serious infection every year and all nurseries may escape serious infection some years. Consequently, many nurserymen who spray carelessly appear to get satisfactory disease control much of the time. However, if they are in the range of potentially heavy rust occurrence, they are taking a gamble they are certain to lose with disastrous results in the occasional severe rust years.

The cycle of infection with fusiform rust begins in winter or early spring when the orange, powdery spore masses break through the bark of cankers on pine trees. These spores are carried by the wind to new leaves of oaks which they infect, causing yellowish, irregular spots. From these spots, brown, hair-like protuberances grow on the under side of the oak leaves The spores that cause new infections on the pines are produced on these protuberances. Periods of 18 hours or more of saturated atmosphere and temperatures between 60° and 79° Fahrenheit are necessary for these spores to ripen and be blown to and infect the pines. [1,2] Under such conditions, the only way to protect pine seedlings is to have them covered with a film of fungicide. Ferbam is currently in use, although ziram and zineb are also recommended.[3]

In experimental work which demonstrated the effectiveness of ferbam, Siggers [4] accomplished this protective coverage by drenching the plants with an excessive dose of fungicide (5. 5 pounds of ferbam in 270 gallons of water per acre).

1/ Siggers, P. V. 1947. Temperature requirements for germination of spores of Cronartium fusiforme. Phytopathology 37: 855-864.

2/Siggers, P. V. 1949. Weather and outbreaks of the fusiform rust of southern pines. Journal of Forestry 47: 802-806.

3/Siggers, P.V. 1955. Control of the fusiform rust of southern pines. Journal of Forestry 53: 442-446.

4/Siggers, P.V. .1951 . Spray control of the fusiform rust in forest-tree nurseries. Journal of Forestry 49: 350-352.

With the great expansion in nursery production, the need for mechanizing the spray program increases. It is possible with present equipment to cover an acre of pine seedlings with 2 pounds of ferbam in 75 gallons of water. To do this, however, it is necessary to reduce droplet size to a minimum, and to spread the fungicide film thinly and evenly.

A given amount of liquid dispersed in small droplets gives more effective coverage than in large droplets. Small droplets are produced in three ways. Nozzles may be revolved at high speeds as in some European sprayers. Large volumes of air may be moved at high velocity over a small stream of liquid as in concentrate sprayers and mist blowers. The third method of reducing droplet size is to pass a liquid at a minimum pressure of 300 pounds per square inch through a hole no more than 1/32 inch in diameter (#2 nozzle disc.). This latter is the method in common use in southern forest nurseries. It fails, however, when the holes in the nozzles become worn or when the spray-pump pressure falls below 300 pounds per square inch. Either of these conditions causes large droplets, and hence the fungicide covers only a small percentage of its potential area of protection.

The second essential for efficient application of the fungicide is to spread it in a thin layer over the plant. Pine tree shoots and needles are covered with a waxy "bloom" which prevents water droplets from flattening. If a surface-active agent is added to the spray, the droplets will flatten as they touch the tree. Although any detergent will do this, a more satisfactory job can be obtained by using commercial spreader-sticker which also contains an adhesive material.[5]

The third factor necessary for efficient coverage is uniform distribution. Number 2 nozzles spaced 10 inches apart, and 18 inches above the seedlings, moved over the beds at 3 miles per hour will apply 75 gallons per, acre uniformly. Sprayers may be calibrated from the information given in table 1.

About 1 hour after spraying by the method shown in table 1, on a sunny day, the film of ferbam is dry enough to stick to the plant. Heavy rains and irrigation will gradually wash it off, and as the plant grows it puts out unprotected tissue. Consequently, it is necessary under ordinary conditions to repeat spraying at weekly intervals. In some areas, sprays are applied twice a week for the first 3 weeks.

5/ Some commercial materials and rates in common use are: Dupont Spreader-Sticker (E.I. duPont ,de Nemours) 5 to 8 ounces per 100 gallons; B1956 (Rohm & Haas)--5 to 8 ounces per 100 gallons; and Santomerse S (Monsanto Chemical Company)-1 pint per 100 gallons.

Usually the spray program should begin when the spring-sown slash-or loblolly seeds begin to germinate and should be continued until mid-June.

Future research may find some material more effective than ferbam, or types of machinery more efficient than our high-pressure sprayers. Nevertheless, the present methods, if carefully practiced, will keep the .incidence of fusiform rust below one-half of one percent under most conditions.

**Table 1.--Calibration of sprayers to deliver 75 gallons per acre**

| Distance between nozzles | Tractor speeds of | | | |
|---|---|---|---|---|
| | 2 m.p.h. | 3 m.p.h. | 4 m.p.h. | 5 m.p.h. |
| (Inches) | (Quarts delivered per minute per nozzle) | | | |
| 6 | 0.6 | 0.9 | 1.2 | 1.5 |
| 8 | 0.8 | 1.2 | 1.6 | 2.0 |
| 10 | 1.0 | 1.5 | 2.0 | 2.5 |
| 12 | 1.2 | 1.8 | 2.4 | 3.0 |