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# Experiments for the Control of Pecan Scab Disease

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**SUMMARY**

Zineb fungicide applied as a spray at the rate of 2 pounds per 100 gallons of water was the most effective material tested for the control of scab disease in experiments conducted in Bastrop, Wharton and Parker counties during 1950-56.

The use of zineb, which is nonphytotoxic to pecan leaves, results in more luxuriant foliage, better leaf retention, greater nut weight and increased yields per tree.

Pecan scab disease, caused by the fungus *Cladosporium effusum* (Wint.) Demeree, is the most important disease affecting pecans in Texas. The control of this disease has been a difficult problem because the fungicides formerly used, particularly Bordeaux mixture, encouraged the development of damaging aphid and mite infestations in treated trees. In addition, applications of low lime Bordeaux mixture (6-2-100) during the summer frequently induced leaf brittleness as well as marginal necrosis. The disadvantages resulting from the application of Bordeaux mixture and other copper-containing fungicides prompted the search for materials of lesser phytotoxicity that would effectively control scab disease and not incite the development of damaging arthropod infestations.

Nine fungicides were tested in 1950 to determine their effectiveness in controlling scab disease. The treatments were applied as sprays to trees of the Delmas variety, which are highly susceptible to scab disease. Four applications were made with a hydraulic sprayer operated at 600 pounds pressure per square inch at intervals of 3 to 4 weeks beginning in mid-April. Each test tree received per application approximately 1 gallon of spray mixture per foot of height. Data from this experiment are presented in Table 1.

Of the fungicides used in the experiment, the dithiocarbamate compounds were the most effective in controlling scab disease. Trees sprayed with mercury and copper compounds exhibited marginal leaf burn which resulted in premature abscission of the more severely damaged leaves.

Inconclusive results were obtained in experiments in two locations because of the low incidence of scab disease during the 1951 and 1952 seasons, which were extremely dry.

The dithiocarbamate compounds were compared with two previously untested fungicides, Captan and EMMI in 1953. These compounds were applied as sprays on approximately the same dates as indicated for the 1950 season. Scab infection data were obtained by counting and recording the number of scab lesions on 20 nuts selected at random from each test tree, Table 2.

Most effective control of scab disease was obtained with EMMI. Zineb, Bordeaux mixture and Puratized Agricultural Spray were comparable in their effectiveness. However, the latter two compounds produced marginal leaf burning, while a damaging infestation of mites and aphids developed in the Bordeaux-sprayed trees. A mild phytotoxic effect expressed as slight chlorosis and brittleness of leaflets occurred in the trees sprayed with EMMI. In contrast, the leaves of the zineb-treated trees were dark green

TABLE 1. YIELD OF NUTS PER TREE FOLLOWING FOUR APPLICATIONS OF EACH TEST FUNGICIDE TO DELMAS VARIETY PECAN TREES, 1950

Fungicide materials	Rate per 100 gallons	Average yield of nuts per tree, pounds	Percent yield over control	Percent yield over Bordeaux	Number nuts per pound
Zineb <sup>1</sup>	2 pounds	121.8	815.8	123.0	68
Fermate	2 pounds	94.2	608.2	72.5	90
Zerlate	2 pounds	84.3	533.8	54.4	78
Puratized Agricultural Spray	1 quart	76.0	471.4	39.2	89
Copper 34	2 pounds	58.2	337.6	6.6	85
Yellow Cuprocide	2 pounds	56.6	325.5	3.7	84
Bordeaux mixture	6-2-100 <sup>2</sup>	54.6	308.2		77
Phygon XL	1 pound	25.3	90.2	-53.7	130
Spergon SL	2 pounds	23.1	73.6	-57.7	104
Control		13.3		-75.6	148

<sup>1</sup>Zineb = Zinc ethylene bis dithiocarbamate. Manufactured by Rohm & Haas Co., trade name Dithane Z-78, E. I. DuPont Co., trade name Parzate.

<sup>2</sup>6-2-100 = 6 pounds copper sulphate, 2 pounds hydrated lime in 100 gallons water.

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TABLE 2. FUNGICIDE, RATES OF APPLICATION AND PERCENTAGE OF SCAB-DISEASED NUTS, DELMAS VARIETY, 1953

Fungicide materials	Rate per 100 gallons	Percent infected nuts			
		June 18	July 8	August 3	Total <sup>1</sup>
Zineb	2 pounds	13.0	9.5	25.8	48.3
Puratized Agricultural Spray	1 quart	4.3	13.5	33.0	50.8
Bordeaux mixture	6-2-100	13.5	22.5	19.3	55.3
Captain 50W	2 pounds	13.5	23.0	31.5	68.0
EMMI <sup>2</sup>	2 ounces	0.5	2.5	9.0	12.0

<sup>1</sup>Minimum difference required for significance at .05 level = 13.4.

<sup>2</sup>Chlorinated organic mercury.

in color and phytotoxic effects were absent. Captan was the least effective of the materials tested. Further testing of Puratized Agricultural Spray was discontinued because of its apparent phytotoxicity.

Zineb at two concentrations was compared with four previously untried compounds in the 1954 experiments. The treatments were evaluated by counting the number of scab lesions per 20 nuts selected at random from each of the test trees, Table 3.

Table 3 shows that zineb at rates of 1½ and 2 pounds per 100 gallons of water was the most effective fungicide tested. Vancide 51ZW was next in effectiveness.

The 1955 experiments consisted of varied concentrations of zineb compared with standard Bordeaux mixture (6-2-100), EMMI and Bayer Experimental Compound 1, Table 4.

Lesion counts and yield records substantiate the findings of previous seasons' experiments. Zineb was consistently the most satisfactory fungicide tested from the standpoints of scab control, leaf retention and nut production. Although the 1½-pound rate provided effective control of scab disease when properly applied, the 2-pound rate probably would provide more consistent results in the hands of commercial pecan growers.

TABLE 3. FUNGICIDE RATES OF APPLICATION AND NUMBER OF LESIONS PER NUT, SCAB DISEASE EXPERIMENT, DELMAS VARIETY, 1954

Fungicide materials	Rate per 100 gallons	Percent scabby nuts per tree <sup>1</sup>	Average number
			scab lesions per 20 nuts <sup>2</sup>
Zineb	2 pounds	45.8	18.3
Zineb	1½ pounds	44.3	11.8
Cop-O-Zink	4 pounds	95.3	100.0
Phix	4 ounces	87.0	70.0
Vancide 51-ZW	2 pounds	65.5	39.0
Copper			
manganese	4 pounds	89.8	90.0
Control		92.8	86.3

<sup>1</sup>L.S.D. at 5 percent level = 18.7.

<sup>2</sup>L.S.D. at 5 percent level = 29.9.

TABLE 4. YIELD AND SIZE OF NUTS FROM SCAB-DISEASED PECAN TREES SPRAYED WITH FUNGICIDES, SUCCESS VARIETY, 1955

Fungicide materials	Rate per 100 gallons	Percent scabby nuts per tree	Average number	Nut yields, pounds per tree	Number nuts per pound
			scab lesions per 10 nuts		
Zineb	2 pounds	36.0	8.5 <sup>1</sup>	114	57
Zineb	1½ pounds	39.0	9.5	102	57.5
Zineb	1 pound	43.0	8.5	94	65.7
EMMI	2 ounces	60.0	22.0	44	74.7
Bordeaux mixture	6-2-100	53.0	20.0	53	64.7
Bayer					
No. 1	6 pounds	69.0	42.5	78	63.5
Control		86.0	69.0	33	74.5

<sup>1</sup>L.S.D. at 5 percent level = 43.25.

Studies also were conducted in 1954-55 to determine whether a fixed spray application schedule could be recommended. An experiment in which only zineb was applied to test trees was carried out in 1954. The effectiveness of each spray application was determined by omitting one treatment on each application date, Table 5.

The results of this experiment indicate that the prepollination spray was the most effective application in 1954. This probably was due to the reduction early in the spring of primary inoculum which arise from over-wintered mycelium in twig cankers and shucks and initiate early foliage and nut infection.

A similar spray scheduling experiment using zineb was undertaken in 1955 to ascertain whether the prepollination spray application of zineb would again be the most effective. Table 6 shows that the prepollination application was not effective, whereas later spray applications alone and in combination with even later sprays during the season produced the most satisfactory control of scab disease.

The contrasting results in the 2 years' experiments may be attributed to differences in

TABLE 5. SPRAY-SCHEDULING EXPERIMENT, SUCCESS VARIETY, 1954

Zineb treatments	Dates of application				Average number lesions per 10 leaves <sup>1</sup>
	April 2, leaves ½ grown	April 30, post-pollination	May 25	June 17	
1	x <sup>2</sup>	x	x	x	37
2	x	x	x	—	59
3	x	x	—	x	38
4	x	—	x	x	30
5	— <sup>3</sup>	x	x	x	120
6	—	—	—	—	127

<sup>1</sup>Minimum difference required for significance at 5 percent level = 53.1

<sup>2</sup>x = fungicide applied.

<sup>3</sup>— = fungicide not applied.

TABLE 6. SPRAY SCHEDULING EXPERIMENT, SUCCESS VARIETY, 1955

Zineb treatments	Average number scabby nuts, 60 nuts counted	Average yield, pounds nuts per tree
1. Prepollination only (April 15)	52	51
2. Postpollination (May 5)	33	36
3. 4 weeks after postpollination (June 2)	28	40
4. 4 weeks after 3 (July 5)	58	68
5. Applications 1 and 2	31	28
6. Applications 1 and 3	31	40
7. Applications 1 and 4	53	62
8. Applications 2 and 3	15	76
9. Applications 2 and 4	41	59
10. Applications 3 and 4	31	75
11. Control	57	22

seasonal distribution of rainfall. Early spring rains in the 1954 season were followed by a protracted period of dry weather, during which the scab inoculum potential was reduced. Frequent rains throughout the spray season in 1955 provided ideal conditions for spore dissemination and germination.

Rainfall is a primary consideration in determining when a spray application for effective control of pecan scab disease should be made. In dry years, one or two spray applications may provide satisfactory scab control, while during

SPRAY SCHEDULE FOR THE CONTROL OF PECAN SCAB DISEASE

Time of application	Spray material, per 100 gallons
Prepollination spray, when first leaves are one-third grown	Zineb, 2 pounds <sup>1</sup>
First cover spray, when tips of small nuts have turned brown	Zineb, 2 pounds
Second cover spray, 3 to 4 weeks after first cover spray	Zineb, 2 pounds
Third cover spray, 3 to 4 weeks after second cover spray	Zineb, 2 pounds
Fourth cover spray 3 to 4 weeks after third cover spray. (Optional, except in rainy seasons and varieties highly susceptible to scab, such as Burkett Delmas.)	Zineb, 2 pounds

<sup>1</sup>Zineb = Zinc ethylene bis dithiocarbamate. Manufactured by Rohm & Haas Co., trade name Dithane Z-78, E. I. DuPont Co., trade name Parzate.

seasons of frequent, though not necessarily heavy rainfall, several spray applications will be required. Therefore, since precipitation is the primary factor in determining when to apply sprays for the control of scab disease, it is improbable that fixed dates for spray applications could be established in a schedule which would be applicable in its entirety for all pecan production areas from 1 year to the next.

In consideration of these factors, a general spray schedule for the control of scab disease is recommended. (See above table.)