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### Studies on the Control of Powdery Mildew of Roses

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The critically short supply of sulfur in the United States has necessitated an extensive search for substitutes. This problem is as acute in the field of plant disease control as it is in other fields. During the summer of 1951 several new fungicides were tested against powdery mildew on roses.

A spray schedule was established at the Colorado A&M Research Greenhouses with 7 fungicides (Table 1) applied to moderately infected pink Delight roses at 10-day intervals for one month, starting July 20. All treatments, including untreated check, were tested on 3 rows of 4 plants each in 4 randomized replicates. Dreff was used as a spreader for the first application but was found to be unsatisfactory; consequently Triton B-1956 was added to subsequent sprays, providing adequate coverage.

Another test was made at the Pikeview Greenhouses in Colorado Springs incorporating 2 applications, 10 days apart, on Red Delight and Pink Delight varieties. Eight replications of 12 plants each were used including 7 fungicides (Table 2) and an unsprayed check in each variety. Triton B-1956 was used as a spreader with each material at the rate of 4 oz. per 100 gallons. The spray was applied at 100 to 150 pounds pressure. At the time of the first application mildew infection was slight. The Red Delight plants were producing new foliage after having been cut back; the Pink Delight plants were young plants recovering from a severe infestation of the mildew fungus. (See page 2)

Table 1. Results of spray tests for the control of powdery mildew of rose at Colorado A&M Research Greenhouses, 1951

Treatment	Rate of application (per 100 gallons)	Av. Incidence infection of pct.	Pct. control
DHA-A <sup>1/</sup> (50%)	2 lbs.	90.0	10.0
Crag 658 <sup>2/</sup>	2 lbs.	9.0	91.1
Manganese ethylene <sup>3/</sup> bisdithiocarbamate	2 lbs.	1.5	98.5
OS-377D <sup>4/</sup>	2 lbs.	100.0	0.0
Puratized Agricultural <sup>5/</sup> Spray	$\frac{1}{2}$ pt.	30.5	69.5
Check	untreated	100.0	0.0

<sup>1/</sup> Dehydroacetic Acid, sodium salt - provided by Dow Chemical Co.

<sup>2/</sup> Copper zinc chromate - provided by Carbide & Carbon Chemical Corp.

<sup>3/</sup> Provided by E. I. duPont de Nemours Co.

<sup>4/</sup> Provided by Shell Chemical Co.

<sup>5/</sup> Phenyl mercury triethanol ammonium lactate - provided by Gallowhur Chemical Co.

As shown in table 1, treatment with manganese ethylene bisdithiocarbamate resulted in 98.5 percent control of the disease. Crag 658 controlled 91.0 percent; Puratized Agricultural Spray, 69.5 percent. Slight control was observed with DHA-S. Severe injury with OS-377D necessitated the discontinuance after the first application. DHA-S caused the leaves to become yellow and to drop, and Puratized Agricultural Spray caused some leaf-flecking. A highly undesirable residue left by Crag 658 and manganese ethylene bisdithiocarbamate was alleviated only in the case of the latter fungicide by the addition of 1/16 teaspoonful of malachite green per  $1\frac{1}{2}$  gallons of water.

Table 2. Results of spray tests for the control of powdery mildew of rose at the Pikeview Greenhouses, Colorado Springs, 1951 1/.

Treatment	Rate of application (per 100 gal.)	Ave.pct. mildew	Pct. control	Av.Pct. mildew	Pct. control
Dithane Z-78 <u>2/</u>	2 lb.	43.1	52.8%	9.0	89.0%
Zerlate <u>3/</u>	do	24.4	73.3%	12.8	84.7%
Crag 658	do	54.3	40.5%	7.8	90.5%
Sulferon	4 lb.	15.6	82.9%	26.8	67.3%
Goodrite z. a. c. <u>4/</u>	2 lb.	6.9	92.5%	16.6	79.7%
Arathane <u>5/</u>	8 oz.	4.3	95.3%	5.1	93.8%
Iscothane <u>5/</u>	do	2.8	96.9%	5.1	93.8%
Check	untreated	91.3		81.9	

L. S. D. (pct. mildew) - 5 pct. level = 7.1  
 1 pct. level = 9.4

- 1/ Appreciation is due Gordon Koon for his cooperation and invaluable assistance in this test.
- 2/ Zinc ethylene bisdithiocarbamate - provided by Rhom & Haas Co.
- 3/ Zinc dimethyl dithiocarbamate - provided by E. I. duPont deNemours Co.
- 4/ Zinc dimethyl dithiocarbamate, cyclohexamine complex - provided by B. F. Goodrich Chemical Co.
- 5/ Dinitro capryl phenyl crotonate.

The results in table 2 show that Arathane and Iscothane provided control of the disease on both varieties; Goodrite z.a.c. was equally good on the Red Delight variety. The evidence indicated that Pink Delight was significantly less susceptible than was Red Delight to infection. The variability exhibited by the reactions of the different materials on the two varieties probably was due primarily to the varietal reaction to both disease and the fungicides.

Arathane caused a slight bluing of petals when the spray was applied to open blossoms. Some foliage wilt was observed with both Arathane and Iscothane at high temperatures. Crag 658, Goodrite z. a. c., and Zerlate left undesirable residues on the plants, and Goodrite z. a. c. caused a slight blanching of the buds.

On the basis of these tests, it is evident that either Arathane or Iscothane are suitable fungicides for the control of powdery mildew of roses. There is also a possibility that, with further investigation of dosage, manganese ethylene disdithiocarbamate may be a promising material in the future.