Controlling powdery mildew in greenhouse roses

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Powdery mildew of rose, resulting from the fungus *Sphaerotheca pannosa,* frequently causes malformed leaves and unsightly flowers which reduce economic returns to growers. Because of the availability of several new fungicides effective against powdery mildews, they were evaluated in rose greenhouses in San Diego County.

1975 trial

The variety Mary DeVore was used in this trial. Plots consisted of 30 rose plants, replicated four times for each treatment. Light powdery mildew was present before application of the first spray.

Fungicide treatments with rates of materials per 100 gallons of water were: EL 222 12.5%, 4 oz; Plondrel 50W, 8 oz; Dodemorph 3.3 lb/gal, 2 pt; Benlate 50W, 8 oz; and the check or no treatment. Four ounces of X77 spreader sticker per 100 gallons of water were used in all plots except Dodemorph and check treatment. Sprays were applied to runoff with a 2-gallon CO_2 Hudson sprayer at 30 pounds per square inch (psi). Applications were made on December 13 and 23, 1974, and January 2 and 12, 1975. Disease was rated on a scale of 0 to 4 on January 21, a 0 rating indicating no disease, a 4 rating indicating mildew completely covering both sides of the leaves (see table 1). Rose powdery mildew was effectively controlled by El 222, Dodemorph or Plondrel. Intermediate control was obtained with Benlate. All fungicides were significantly better than no treatment.

1977 trials

The variety Samantha was used in 1977 trials and the plots consisted of 30 rose plants per plot replicated four times for each treatment. Fungicide treatments with rates of materials per 100 gallons of water were: Sisthane (RH 2161) 2 lb/gal, 1 qt; CG 64251 1OW, 8.4 ounces; Nimrod 2 lb/gal, 28 ounce and 20 ounce; DuPont 4423 2 lb/gal, 1 quart/1 pint and the check or no treatment. DuPont 4423 was used at 1 quart in the first sprays, but because of phytotoxicity the rate was reduced to 1 pint in subsequent applications. Sprays were applied as in the 1975 trial and applications made on June 8, 22, and 28 and July 7, 1977. Four ounces of B-1956 spreader sticker per 100 gallons of water were used in all plots except Nimrod and check treatments. Disease ratings were made as before, and the results are shown in table 2.

Sisthane, CG 64251, and Nimrod at both 28 and 20 ounces controlled powdery mildew significantly better than all other materials tested. DuPont 4423 effectively controlled powdery mildew at the 1 quart rate, but caused light green to yellow blotches on the leaves and distorted the foliage. DuPont 4423 at the 1 pint rate did not cause phytotoxicity, but failed to control mildew adequately. All fungicides were significantly better than no treatment.

In the second trial in 1977, the variety Samantha was used in a commercial sized plot. Each replicate consisted of a rose bed 120 feet long, 3.5 feet wide, with 400 rose plants per replicate. All treatments were replicated four times. Fungicide treatments with rates of materials per 100 gallons of water were: Sisthane (RH 2161) 2 lb/gal, 1 quart; Nimrod 2 lb/gal, 20 ounce; and Pipron 2 lb/quart + Parnon 0.08 lb/quart at 4 oz each; and the check or no treatment. Four ounces of B-1956 spreader sticker per 100 gallons of water were used in all plots except the check treatment. Treatments of Sisthane and Nimrod were applied approximately every 14 days and were applied on July 21, August 4, and August 19, while Pipron-Parnon were applied approximately every 7 days and were applied on July 21 and 28, and August 4, 11, and 19. Sprays were applied with a hand gun at 200 psi and using a 200-gallon John Bean piston pump sprayer. Disease was rated on the scale of 0 to 4 and results are shown in table 3.

Under the conditions favoring medium amounts of disease, rose powdery mildew was effectively controlled by Sisthane or Nimrod with sprays applied approximately every 14 days and were significantly better than Pipron-Parnon applied approximately every 7 days. While Pipron-Parnon was intermediate in control, it was significantly better than no treatment.

1978 trials

The variety Volare was used in the first trial of 1978 and the plots consisted of 30 rose plants per plot replicated four times for each treatment. Powdery mildew was present before application of the first spray.

Fungicide treatments with rates of materials per 100 gallons of water were: CG 64251 10W, 10 ounces; Sisthane 2 lb/gal, 0.75 quart; Boots 7789 25 percent, 25 ounces; Bayleton 25W, 8 ounces; and Pipron 2 lb/quart + Parnon 0.08 lb/gal, 4 ounces each; and no treatment. Four ounces of B-1956 spreader sticker per 100 gallons of water were used in all plots except the check treatment. Applications were made on May 22, June 1 and June 8. Sprays were applied to runoff with a Hudson sprayer as before. Disease was rated on a scale of 0 to 4 on June 8 and 15. Results are shown in table 4.

CG 64251 and Sisthane were significantly better than all other materials tested for control of powdery mildew on June 8, and these materials along with Boots 7789 were significantly better on June 15. Bayleton provided intermediate control on June 8, but was not significantly different from no treatment on June 15. Under the severe disease conditions of this trial, Pipron-Parnon was not significantly different from no treatment. Sisthane at various rates was compared with the standard Pipron-Parnon in another commercial plot in 1978. The variety Forever Yours was used in plots 120 feet long, 3.5 feet wide, with 400 rose plants per replicate. Fungicide treatments with rates of materials per 100 gallons of water were: Sisthane 2 lb/gal at 2 quarts, 1 quart

TABLE 1. Comparison of Fungicides for the Control of Rose Powdery Mildew, 1975—Variety- Mary DeVore

Treatment	Rate 100/gal	Disease Rating Jan 21
El 222, 12.5%	4 oz	0.3*a
Plondrel, 50W	8 oz	0.2 a
Dodemorph, 3.3 lb/gal	1 qt	0.6 a
Benomyl, 50W	8 oz	1.3 b
No treatment	—	2.6 c

*Sign. 5%

and 1 pint; and Pipron-Parnon at 4 ounces each. Four ounces of B-1956 spreader sticker per 100 gallons of water were used in all plots. Sisthane treatments were applied approximately every 14 days and were done on May 13 and 27 and June 10. Pipron-Parnon treatments were applied approximately every 7 days and were done on May 13, 20, and 27 and June 3, 10, 17, and 24. Plots were sprayed with a handgun at 200 psi, using a John Bean piston pump sprayer. Results are shown in table 5. Sisthane used at 1 or 2 quarts applied every 14 days was significantly better for control of powdery mildew of rose than the standard Pipron-Parnon sprayed every 7 days. Sisthane at 1 pint sprayed every 14 days gave intermediate control.

Darker colored foliage and shortened internodes were consistently noted in all trials where CG 64251 was applied.

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TABLE 2. Comparison of Fungicides for the Control of Rose Powdery Mildew, 1977—Variety-Samantha

Treatment	Rate 100/gal	Disease Rating July 15
Sisthane (RH 2161), 2 lb/gal	1 qt	0.7*a
CG 64251, 10W	8.4 oz	0.9 a
Nimrod, 2 lb/gal	28 oz	1.1 a
Nimrod	20 oz	1.2 a
DuPont 4423, 2 lb/gal	1 qt/1 pt	2.1 b
No treatment	—	2.7 c

*Sign. 5%

TABLE 3. Comparison of Fungicides for the Control of Rose Powdery Mildew in Commercial Size Plots, 1977—Variety-Samantha

Treatment	Rate 100/gal	Disease Rating Aug 19
Sisthane (RH 2161)	1 qt	0.7*a
Nimrod	20 oz	0.8 a
Pipron + Parnon	4 + 4 oz	1.5 b
No treatment	—	3.0 c

*Sign. 5%

TABLE 4. Comparison of Fungicides for the Control of Rose Powdery Mildew, 1978—Variety-Volare

Treatment	Rate 100/gal	Disease Rating June 8	Disease Rating June 15
CG 64251, 10W	10 oz	1.7*a	1.3 a
Sisthane, 2 lb/gal	0.75 qt	2.2 ab	1.3 a
Boots 7789, 25%	25 oz	2.7 b	1.5 a
Bayleton, 25W	8 oz	2.7 b	2.2 b
Pipron + Parnon	4 + 4 oz	3.5 c	2.7 b
No treatment	—	3.5 c	2.4 b

*Sign. 5%

TABLE 5. Comparison of Fungicides for the Control of Rose Powdery Mildew in Commercial Size Plots, 1978—Variety-Forever Yours

Treatment	Rate 100/gal	Disease Rating June 15	Disease Rating June 29
Sisthane, 2 lb/gal	2 qt	0.28*a	0.25a
Sisthane, 2 lb/gal	1 qt	0.4 a	0.5 a
Sisthane, 2 lb/gal	1 pt	1.0 b	1.5 b
Pipron + Parnon	4 + 4 oz	1.7 c	2.2 c

*Sign. 5%

Stem lesion of Easter lilies—a complex disease

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Every year, lesions appear on the stems of field-grown Easter lilies; but the serious effects of the disease known as "stem lesion" are very erratic. The lesions are most frequently superficial and one-sided, and reduce yield and quality very slightly or not at all. In some seasons and in some fields the lesions deepen and expand around the stem, interfering with transport of nutrients and reducing the yield and quality of the bulbs. Conditions promoting the intensification of symptoms are not understood; this fact and the erratic incidence of the disease in its serious form make experiments on control of stem lesion very difficult. Unfortunately, field experiments so far have been done only during seasons and in fields where the disease has been evident but has not become serious.

Cause

Stem lesion has been associated with another symptom, rotting on the tips and sides of bulb scales, known as scale tip rot. The two symptoms may reasonably be considered due to one disease. The same organisms have been isolated from both types of lesion. These are, (1) a fungus, *Fusarium oxysporum,* isolates of which can cause basal rot of lilies, and (2) a bacterium, *Pseudomonas* sp. Both organisms have been isolated many times from single lesions. They have also been inoculated to lilies singly and in combination, causing lesions, and have been recovered by subinoculation.

Inoculation of *Fusarium* causes different symptoms according to the severity of the isolate applied. Some isolates cause surface yellowing due to penetration between the surface cells only. Others cause various types of lesions of bulb stems and roots. The most severe syndrome is rotting of the basal plate of the bulb and the bases of scales, so that the bulb falls apart and the plant is destroyed.

In a susceptible cultivar, 'Croft,' inoculation of bulb scales with even a mild isolate of *Fusarium,* plus the bacterium, *Pseudomonas,* caused an expanding and destructive rot. *Pseudomonas* alone caused definite but restricted lesions. The combined damage was much more severe than the sum of the damage caused singly by each organism.

Pseudomonas gains entry to the tissues through wounds and natural openings, but it seems capable also of unaided entry into the tips of bulb scales, particularly the paper-thin tips of young scales. Thus penetration by both *Fusarium* and *Pseudomonas* may be independent. Each appears capable of establishing itself in lily bulb tissues in the soil. There is also sufficient superficial wounding of bulbs between digging and planting and sufficient movement and mixing of bulbs to allow many infections to occur when bulbs are out of the ground and in the packing shed.