Powdery Mildew Control on Some Ornamental Plants

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Powdery mildews can cost you money whether you grow begonias, hydrangeas, saintpaulias, sweet peas, snapdragons, stocks, gerberas, calendulas, delphiniums, euonymuses or roses. Even outdoor plants such as perennial phlox, aster, and chrysanthemum, or the annual sunflower, zinnia, centaurea, and dahlia, and woody plants such as rose, spirea, lilac, peach, and willow are commonly affected.

For best results don't wait until you see mildew to start treatment. On many crops mildew appears at about the same time each year. The best insurance against mildew is the presence at all times of a protectant such as sulfur.

However, if mildew gets established on your plants, Mildex (formerly Iscothan) has proved to be an excellent eradicant in our tests. This material must be weighed or measured accurately and applied carefully to obtain control without injury to plants.

Most powdery mildews thrive under "dry" conditions and may actually be injured by free water. Careful experiments with rose mildew conducted by Longre (1939) showed that the germination of spores and the growth of the fungus is best at high relative humidities (96 to 99 per cent), and that spores did not germinate well nor did the fungus develop in liquid water. Yarwood (1951) working with powdery mildew on bean and cucumber reported that better control of mildew was obtained when plants were sprayed with, rather than dipped in, the fungicidal solution. In other words, the impact of sprayed water is an effective aid in controlling mildew. These experimental results substantiate the observation of many growers that syringing hinders the development of the fungus. Further, any fungicide used for mildew control should be more effective if applied as a spray.

Depending upon how they work, fungicides can be classified as protectants or eradicants though some materials may have both types of action. Sulfur dust acts only as a protectant because it cannot penetrate the waxy felt of mycelium on the mildew lesion. Sulfur sprays, however, act both as protectant and eradicant. When the emphasis is on prevention, there are few cases where the sulfurs cannot be used to safely and effectively control mildew. The sulfur fungicides have some limitations: they will bleach colored blossoms and they will cause plant injury if applied during periods of high temperature or in combination with the oil-containing sprays or immediately before or after such oil sprays. For the many crops on which mildew appears at a certain season each year, preventative applications of one of the sulfur materials before the mildew gets underway are recommended.

Eradicating fungicides are necessary if mildew gets well established before control measures are started. These, in general, are much less satisfactory than protectants because of plant injury. The combination of effective mildew control and safety to plants is difficult to obtain. Of the several materials we tested, the organic chemical dinitro capryl phenyl crotonate* was the most effective against mildew.

* Dinitro capryl phenyl crotonate was originally manufactured and packaged by the Rohm and Haas Company, Philadelphia, as Arathane, later as Karathane. In 1951 this same material was marketed as Iscothan by Innis, Speiden & Co., Inc., and in September 1952 the same material was taken over by Larvacide Products, Inc., and sold as Mildex.

In the first two spray trials dinitro capryl phenyl crotonate, another organic material, and three sulfur-containing materials were applied to replicated plots of snapdragon plants heavily infected with mildew. The organic and the three sulfur materials either were ineffective against mildew or caused severe plant injury at effective rates of application. The dinitro capryl phenyl crotonate fungicide was consistently superior in eradicating mildew. Excellent control without plant injury was obtained when this material was used at the rate of 4 ounces per 100 gallons of water. Only the dinitro capryl phenyl crotonate was employed in the later tests.

Several tests were conducted in February, March and April, 1952 with sprays made from Iscothan containing 15% dinitro capryl phenyl crotonate. Spray applications were made with four ounces of Iscothan to 100 gallons of water, plus six ounces of B 1956 wetting agent (phthalic glycerol alkyd resin of Rohm & Haas Co.). The fungicidal sprays were applied with a compressed air, three gallon hand sprayer. The plants were sprayed until the mycelium of the fungus and the foliage were thoroughly wet. Applications were made on good drying days when greenhouse temperatures did not exceed 80°F. The results of several tests are summarized in table 1.

Table 1. Powdery Mildew Control With Iscothan

Plants Treated	Control	Remarks
Calendula	Excellent 2 appl.	No injury
Chrysanthemum	Excellent 1 appl.	No injury
Delphinium	Excellent 2 appl.	No injury
Euonymus	Nearly perfect 1 application	No injury
Gerbera	Upper leaf surface-excellent 2 appl. Lower leaf surface-fair to good 2 appl.	No injury
Hydrangea	Nearly perfect 1 application	No injury
Rose	Good with 1 appl.	Slight injury young foliage
Saintpaulia	Perfect 1 appl.	No injury
Snapdragon	Excellent 2 appl.	No injury

The degree of control apparently depended only on the thoroughness of application. On saintpaulia the powdery mildew occurred only on the upper surface of the leaves. Here, as far as we could discern with the unaided eye, perfect control was obtained with a single application. On euonymus and hydrangea the open habit of growth permitted thorough coverage and near-perfect control was obtained with a single application. With gerbera the dense foliage prevented thorough coverage of the under surface of the leaves. On these plants, the control was not too good even with two applications.

Microscopic examination of mildew lesions showed that the mycelial threads of the fungus were matted down and both mycelium and spores were shrivelled and turned yellow by the fungicide. In only a few cases did a lesion continue to enlarge with new hyphae and spores produced at the margin. Lesions on non-treated

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plants continued to increase in diameter. When non-treated plants were adjacent to the treated ones, new infections appeared in about 5 to 8 days following spray application. The new lesions occurred almost entirely on the new growth. Iscothan was used as an eradicant in these trials, but numerous observations indicate that the chemical has some protective action though this was not determined experimentally.

This material will burn if foliage remains wet for long periods, if the concentration of the chemical is too high, or if the leaf temperature is too high. Two cases of severe plant injury have been brought to our attention. One, on chrysanthemum, was caused by excessive fungicide (3-5 pounds per 100 gallons of water) and poor agitation in the spray tank, the other, on snapdragon, was caused by excessive fungicide (estimated 8 to 10 ounces per 100 gallons of water) and practically no wetting agent.

Apparently most plants will not tolerate excessive concentrations of the chemical. For this reason we emphasize the necessity for accuracy in weighing or measuring and for care in application.

Suggestions for use: Weigh or measure the material accurately and apply carefully. Weigh with an accurate scale or measure carefully with a regular household measuring spoon. Use 3 to 4 ounces of Mildex in 100 gallons of water and add sufficient wetting agent to obtain thorough wetting of the fungus mycelium and of the foliage. Spray should spread evenly over the leaf surface and not stand in drops. The prepared fungicidal spray must be kept well agitated to prevent settling out. Make spray applications on good drying days so that the foliage will dry rapidly, but avoid very hot days.

When these suggestions were followed we obtained effective mildew control, without plant injury, on chrysanthemum, calendula, delphinium, euonymus, gerbera, hydrangea, saintpaulia, and snapdragon. Despite the relatively low margin of safety to plants, the superior mildew control warrants the use of this material if mildew gets out of control.

REFERENCES CITED:

Longre, Karla. The effect of temperature and relative humidity on the powdery mildew of roses. Cornell Memoir 223. 1939.

Yarwood, C. E. Fungicides for powdery mildews. Proc. 2nd Int. Congress Crop Protection. 1951.

EQUIVALENT QUANTITIES FOR MILDEX IN WATER

100 gal.	25 gal.	10 gal.	3 gal.
4 oz.	1 oz. OR 5 T.	5 t.	1 1/2 t.

T = level tablespoonful
t = level teaspoonful
3 level teaspoons = 1 level tablespoon

Do not pack fungicide in measuring spoon. Strike measuring spoon level with a straight edge such as a pot label or knife blade.

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