

# Downy Mildew Control

**new chemicals greatly reduce damage from downy mildews of leafy garden vegetables**

**C. E. Yarwood**

**Zineb spray** is the best fungicide yet tried for the control of the downy mildews of spinach, beets, lettuce, and hops.

Zineb is the compound zinc ethylene bisdithiocarbamate.

Studies have been underway on spinach downy mildew for 15 years. No method of fungicidal control of the disease was known in 1939.

The studies were made because downy mildew occurs each year in places where spinach is grown. It is also frequent on beets and lettuce. Sometimes it causes great loss to these crops in California.

Downy mildew appears as pale spots on the upper side of leaves and as fuzzy, gray-looking spots on the lower side. It occurs chiefly on the older but still vigorous leaves and slowly kills them.

In 1946, greenhouse trials showed that several spray and dust fungicides control downy mildew under conditions of heavy inoculation. Sulfur dust was apparently more effective than copperlime dust.

## **Trial Conditions at Milpitas**

Four trials under natural conditions were undertaken at Milpitas in 1947-49. In two trials the incidence of disease was too low to yield dependable results.

In the 1947 plot, two varieties—Bloomsdale and Viroflay—were seeded in raised double rows on January 24th. The area

was divided into treatment plots four feet long with a two-foot row of buffer plants between each treatment.

Plants in the buffer areas were inoculated by spraying them with downy mildew sporangia collected in another field.

On March 3d, and weekly thereafter until April 8th, duplicate randomized plots were sprayed or dusted with a variety of fungicides. Seven randomized plots were left untreated. On April 11th incidence of disease and yield of plants were recorded.

## **Spinach Test Results**

All fungicides tested reduced significantly the amount of disease as compared with the untreated plots.

Sprays used included 0.1% phygon with spreader, 0.2% zineb with spreader, and 0.2% bismuth subsalicylate with spreader. Also tried were 0.3% bordeaux with spreader, 0.3% bordeaux with 0.3% cottonseed oil, 0.5% resin soap with 0.5% lime sulfur, and 1% lime sulfur with 0.1% zinc sulfate.

The dusts used were sulfur, 5% spergon with 95% sulfur, and 6% zerlate with 94% inert material.

Zineb was the most effective spray. Bismuth subsalicylate was the spray next most effective. This compound must be finely divided for best results.

Of the three dusts tested, a mixture of 5% spergon—tetrachloroquinone—and 95% dusting sulfur was the best. Sulfur alone gave significant control.

In the 1949 test at Milpitas, 10 plots of spinach 16 feet long were marked out. Five alternate plots were treated April 1st, 7th, and 14th with 0.2% zineb plus spreader. There was a slight but uncounted amount of mildew in the field when the test was started.

On April 21st, the mildew lesions on seven random leaves per plot averaged 11 for the untreated areas. None was found on treated areas.

## **Tests on Beets and Lettuce**

The same treatments with sprays and dusts were used in 1947 for the control of beet downy mildew and lettuce downy mildew.

On the highly susceptible beet variety, Asgrow Canner, downy mildew was more severe and fungicidal control was less successful than with spinach mildew. On the untreated plots, 84% of the plants became systemically infected.

Zineb spray reduced systemic infections to 29%, while spergon-sulfur dust reduced them to 61%. Only these two treatments gave good control.

On Imperial No. 615 lettuce the con-

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## **WALNUTS**

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tors becomes more apparent with an increase in population. This is particularly true in regards to predators and parasites, which often occur in large numbers when their host becomes very abundant. To some extent this happened with the codling moth during the 1949 season. There was a very large second brood of codling moths, and in the experimental orchard at Linden there was a heavy deposition of eggs. The average number of eggs per nut was something more than 1.75, which was considerably higher than usually encountered. The eggs were heavily parasitized by *Trichogramma embryophagum* Hartig. Parasitized eggs usually contained three parasites.

A number of surveys were made to determine the degree of parasitism and

the information obtained is given in the accompanying table. It should be noted that approximately 50% of the eggs laid were parasitized.

Although the amount of parasitism was insufficient to successfully control the codling moth, the data show that the large codling moth population created conditions favorable for a rapid rise in a parasite population.

The conflict between the codling moth and its natural controlling factors is always present, but the value derived is seldom clearly seen. A more thorough knowledge concerning the relations that exist between the two is certainly deserving of intensive investigations.

Environmental resistance appears to play an important role in the success of a codling moth spray control program on walnuts. Apparently satisfactory control is easily obtained when environmental

resistance is at a high level, but when it is low, timely and thorough applications are necessary for successful control.

Because of the powerful natural environmental factors that tend to regulate codling moth population efforts should be made to avoid practices that might shift them to favor the codling moth.

Control measures should be used with discrimination, applied only when needed, and the insecticide used at a rate no higher than necessary to insure satisfactory control.

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**GUM DISEASES OF CITRUS IN CALIFORNIA**, by L. J. Klotz. *Exp. Sta. Cir. 396, June 1950. Contains the latest available information on the cause, prevention and treatment of gum diseases on citrus trees in California.*

## MILDEW

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trols averaged 49 downy mildew lesions on eight heads per plot. Zineb spray with three lesions, spergon-sulfur dust with three lesions, and sulfur dust with 15 lesions per eight heads, gave clearly significant control.

## Tests on Hops

The trials with hop downy mildew were independent of the other tests.

Field results under epidemic conditions for hop downy mildew were difficult to obtain. The disease was severe in only two of the 15 years of the studies.

In one test, 0.8% tribasic copper sulfate, 0.6% spergon, and 0.2% zineb were applied May 25th and 30th; and June 4th, 9th, and 14th, 1948 to adjacent single rows of hops 26 hills long.

On June 14th the untreated vines showed 63% of the trained terminal shoots with systemic infection, 52% of the untrained basal shoots with systemic infection and an average of 312 downy mildew lesions per leaf on the lower leaves.

The row treated with tribasic copper sulfate showed 4% of trained and 4% of the basal shoots with systemic infection and 38 lesions per leaf. The row treated with spergon showed 7% of the trained and 9% of the basal shoots with systemic infection and 21 lesions per leaf.

Zineb again gave the best control. The zineb-treated row showed 8% of the trained and 3% of the basal shoots with systemic infection and two lesions per leaf.

This result was similar to that on all the other tests in the studies in that zineb proved itself the most effective fungicide.

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