

Chemical Control of Powdery Mildew on Sugar Beets

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Two applications of sulfur dust at 35 or 40 pounds per acre gave good control of sugar beet powdery mildew and was superior to Benomyl, wettable sulfur, cupric hydroxide, or three proprietary fungicides. None of the materials was phytotoxic.

An epiphytotic of powdery mildew on sugar beets was experienced in the Imperial Valley, California in the spring of 1974. The disease reappeared in the winter of 1974 and became epiphytotic in January-February 1975. The causal agent of the disease was identified by Dr. C. E. Yarwood as *Erysiphe polygoni* type. The disease can considerably reduce root yield and sugar content in sugar beets.

The severity and wide incidence of this disease caused an understandable concern in the local sugar beet industry. This disease was never before an economic factor in U.S.A. and the reaction of the disease to various chemicals had not been worked out.

The sugar beet varieties USH 9 and USH 10, which are mostly grown in California, have other desirable contributes but not resistance to powdery mildew. The work reported herein was undertaken to evaluate various chemicals against powdery mildew on sugar beet under desert environment.

Materials and methods

Large plot experiments, April-May, 1974. Three distantly located sugar beet fields were selected. Seventy to 95 percent of the plants in these fields were moderately to severely infected. Nonreplicated plots ranging from 10 to 30 acres in size were treated commercially by either sulfur 98 percent dust at the rate of 35 pounds per acre or by Benlate

50 percent W (methyl 1-(butylcarbolmoyl)-2-benzimidazol carbamate) 50 percent formulation in 10 gallons of water per acre. Sulfur was applied once or twice by a fixed-wing plane whereas Benlate 50 percent W was applied once on one field by a helicopter and on a second field by a fixed-wing plane. The chemicals were applied in late April and May 1974. The average daily ambient temperature at the time of application was around 85 F. The efficacy of each treatment was evaluated 2 weeks after application.

Individual plant treatment, May 1974. About 2 percent of the plants in the same field were much more susceptible to powdery mildew than the rest of the plant population. The leaves of such plants were practically covered with mycelial growth on both sides and they appeared as if they were heavily dusted with a white-grayish powder. Several of these severely infected plants were selected at random in a field and they were treated. There were 10 plants per treatment. Benlate 50 percent 1/2 pound; Afugan 32.8 percent (pyrazophos) at 10 fl. oz. and sulfur 92 percent WP, 5 pounds in 100 gallons of water each were sprayed to run-off on the selected plants. The results were recorded about 15 days after application.

Small randomized plots April, 1975. Plots consisting of one bed 20 ft. long each were treated with sulfur 98 percent dust (40 lbs./acre), Thiolut 80 percent (wetable micronized sulfur, 5 lbs./A), Afugan 32.8 percent (10 fl. oz./A) Bay MEB 6447 (5 lb./A), Dow Co 199 (5 lb./A), RH 3928 (5 lb./A) or Kocide 101S (cupric hydroxide 50 percent, sulfur 32 percent, 2 lbs./A). With the exception of sulfur 98 percent dust all the compounds were applied at the rate of

40 gallons of water per acre. Ten milliliters of spreader-sticker per 40 gallons of preparations were added. The plots were sprayed with a CO₂ pressurized hand sprayer on April 4, 1975. Each treatment was randomized and replicated four times. The plots were moderately but uniformly diseased. The treatments were evaluated 13 days after application. Cool, windy, and moist weather prevailed for 4 to 5 days following application.

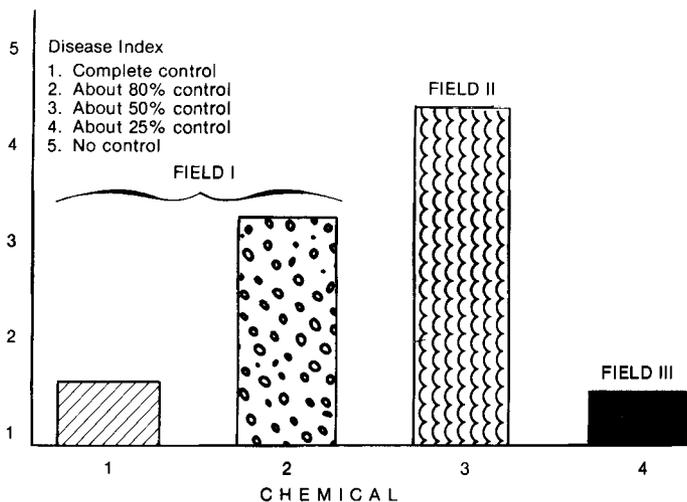
The 1974 large plot field experiments indicated that sulfur 98 percent dust at 35 pounds per acre, applied once or twice on sugar beet fields with high disease incidence and moderate to severe infection, suppressed powdery mildew by 90 to 95 percent. On the other hand, Benlate 50 percent W at 1/2 pound formulation in 10 gallons of water per acre applied commercially once, concurrently with sulfur dust application on large plots of the same fields, controlled the disease by only 25 to 50 percent (graph 1).

The tests with individual plants which were severely infected with powdery mildew showed that Benlate 50 percent W, 1/2 pound per acre and sulfur 92 percent W at 5 pounds formulation per acre controlled the disease by about 40 percent and 70 percent, respectively (graph 2).

The small plot experiments of 1975 have also indicated the superiority of sulfur against powdery mildew. One application of sulfur 98 percent dust at 40 pounds per acre on moderately infected sugar beets suppressed the disease by about 95 percent! The second best treatment was Bay MEB 6447 which controlled the disease by approximately 88 percent. The differences were statistically significant at the 1 percent level (see table).

GRAPH 1. BENLATE 50% WP AND SULFUR 98% DUST AGAINST POWDERY MILDEW ON SUGAR BEETS IN IMPERIAL VALLEY, 1974 (Large field plots-commercial applications)

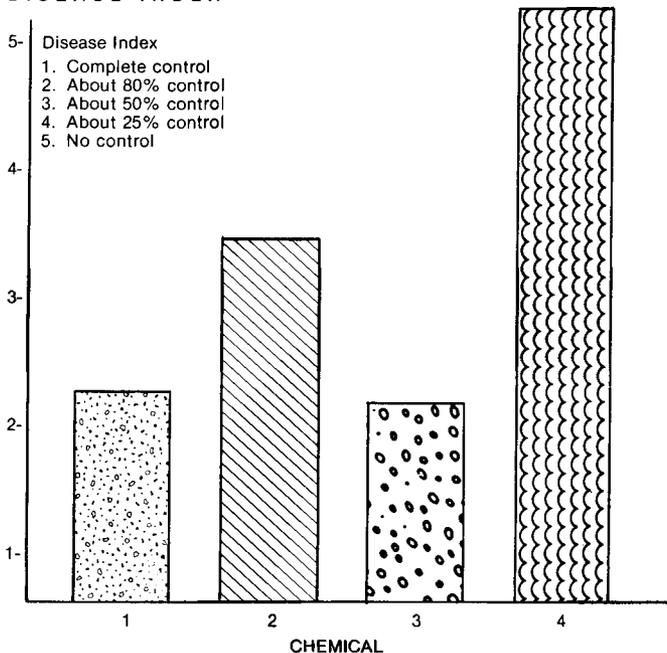
DISEASE REDUCTION
(control on same plant,
two weeks after treatment)



1. Sulfur 98% dust; 35 pounds/Acre applied once by plane (Moderate infection at treatment time).
2. Benlate 50% WP; ½ pound/Acre applied once by plane (Disease severity as in item #1).
3. Benlate 50% WP; ½ pound/Acre applied once by helicopter (About 98% of plant population moderately to severely infected at application time).
4. Sulfur 98% dust; 35 pounds/Acre applied twice at 3-week interval by plane. (High disease incidence, moderate infection).

GRAPH 2. VARIOUS CHEMICALS AGAINST POWDERY MILDEW ON SUGAR BEETS IN IMPERIAL VALLEY, (INDIVIDUAL PLANT TREATMENT).

DISEASE INDEX



1. Afugan 32.8% (10 fl. oz. or 295.7 ml/100 gallons water).
2. Benlate 50% WP, (½ lb/100 gallons water).
3. Sulfur 92% Wettable (5 lbs/100 gallons water).
4. Plain water.

Applied: May 14, 1974.
Observed: May 29, 1974

CONTROL OF POWDERY MILDEW ON SUGAR BEET (small, replicated plots, 1975).

TREATMENT	INCIDENCE	DISEASE INDEX
Sulfur 98% dust -- 40 lbs/Acre	0.6 a*	
RH 3928 ½ lb. formulation/40 gals water/Acre	2.9 de	0 : No Disease
Thiolux 80% 5 lbs/40 gals water/Acre	2.1 bc	1 : About 10% Disease
Afugan 32.8% 295.7 ml/40 gals water/Acre	2.3 cde	2 : About 20% Disease
Dow Co. 199 ½ lb/40 gals water/Acre	2.3 cd	3 : About 50% Disease
Bay MEB 6447 ½ lb/40 gals water/Acre	1.3 ab	4 : More than 50% Disease
Kocide 101S 2 lbs/40 gals water/Acre	2.1 bc	
Non-treated (ck)	3.0 c	

*Significant at 1% level. 0.66 LSD

Discussion

In the 1973-74 sugar beet season powdery mildew appeared late, namely in April-May 1974 whereas in the sugar beet season 1974-75 the disease was noticed in December 1974 which was very early in the sugar beet development. Sugar beet is normally planted in September-October. In both years the disease was first observed in the northern part of the valley which is near the Salton Sea.

In April-May the local daily temperature usually is above 80F and the nights are quite warm in the Imperial Valley but in December-January the daily temperature may fluctuate, from 35F to 78F and the night temperature may drop below 30F.

Powdery mildew developed well in cool and warm local environment.

Sulfur dustings applied under both cool or warm environmental conditions performed exceptionally well against the disease. Even gusty winds starting three to four hours after application and continuing for the following three days did not impair the effectiveness of sulfur against powdery mildew.

At present, Sulfur 98 percent dust is the most effective, least expensive, and probably the most safe chemical against powdery mildew on sugar beets in the Imperial Valley. Besides powdery mildew it also controls mites.

Wettable sulfur 92 percent, on the other hand, was less effective against powdery mildew than sulfur dust. Furthermore, it frequently clogged the spraying nozzles and its application was not easy. Thiolux was as effective as wettable sulfur

and it did not clog the spraying nozzles.

Sulfur has been reported to be effective against powdery mildew on sugar beets elsewhere. BAY MEB 6447 performed well. It appears to be a promising chemical against powdery mildew on sugar beets and it deserves further consideration.

None of the chemicals tested was phytotoxic to sugar beet.

It should be noted that these chemicals were applied when the disease was well established. Had the chemicals been applied prior to, or at first signs of, disease, their performance would probably have been better.

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