

CONTROL OF CERCOSPORA

... under

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Benomyl was significantly better than all other materials tested for control of *Cercospora* leafspot of sugar beet when applied by ground or aerial application, and was equally effective on a 10-, 18-, or 21-day spray schedule. This is a progress report of research. Benomyl is not registered for use in sugar beets at this time.

CERCOSPORA LEAFSPOT OF SUGAR BEET, *Cercospora beticola* Sacc., has been of no economic importance in the Riverside-Hemet area of southern California in furrow-irrigated sugar beet fields. However, higher labor and water costs in recent years have caused growers to turn to sprinkler irrigation—resulting in medium to severe epidemics of *Cercospora* leafspot.

Chemical control of this disease since World War II has revolved around the dithiocarbamate and copper-containing fungicides. The dithiocarbamates are effective for periods of from 10 to 14 days between applications. Recently, the tin and benzimidazole fungicides became available, and showed promise of extending the period of effective control. Experiments reported here were designed to test various fungicides and application schedules for the control of *Cercospora* leafspot of sugar beet under sprinkler irrigation in southern California.

Summer trials, 1969

Sugar beet seed, of the *Cercospora*-susceptible variety USH-5, was planted February 25 at the University of California South Coast Field Station near Santa Ana. The two-row plots were 32 inches wide and 30 ft long. Plants were 8 inches apart in the row, and each treatment was replicated six times. Plots were sprinkler irrigated two to three

times per week to stimulate development of *Cercospora* leafspot. All plots were inoculated with a suspension of *Cercospora* spores several times during the course of the experiment. Inoculum was prepared by grinding up severely-infected sugar beet leaves in a Waring Blender for approximately one minute, straining through cheesecloth, and spraying the resulting spore and mycelium suspension over the plants. Sprinklers were then activated for several hours to wet the foliage completely.

Treatments were as follows: (Benlate) 50W (benomyl) 6 or 12 oz; triphenyl tin hydroxide (Duter) 47.5%W 8 oz; maneb-D 80W 3 lbs; Kocide 101 86% 2 lbs; and the check treatment. Four ounces of Triton B-1956 spreader-sticker was used with the maneb D treatment. One hundred gallons of the fungicidal mixture was applied per acre and rates of materials listed are per 100 gallons of water. Fungicidal sprays were applied at 150 psi on June 19 and July 7 with a tractor mounted sprayer.

Disease symptoms were rated July 22 on a scale of 0 to 5. Zero rating indicated that no disease symptoms were evident, and a five rating indicated that lesions completely covered the leaves and the plant had completely collapsed.

Fall trials, 1969

Since the summer trial indicated that some materials would last at least 18 days, an experiment was set up to test different fungicides on a 10- and 21-day spray schedule. Variety USH-5 was planted at South Coast Field Station on June 1. Plots were single rows 20 ft long, and treatments were replicated five times. Treatments and rates (per 100 gallons of water) were as follows: benomyl 50W 6 or 12 oz; TBZ 60W 5 or 10 oz; Difolatan flowable 2 lbs per gallon, 2 qts; Daconil 2787 75W 2 lbs; Polyram 80W 2 lbs; Duter 47.5%, 9 oz; maneb-D 80W 3 lbs plus 4 oz of Triton B-1956; Kocide 101 86W% 3 lbs; TC-90 48% 3 qt; El-273 4.5% EC 25 or 50 ppm; and the nontreated check. One hundred

gallons of the fungicidal mixture was applied per acre at 150 psi with a tractor sprayer. Sprays were applied on August 18, 28, September 8, 18, and 26 for the 10-day spray schedule and August 18, September 8, and 29 for the 21-day schedule. Benomyl was only applied at the 21-day interval while maneb-D, Kocide 101 and TC-90 were only applied on the 10-day schedule. *Cercospora* inoculum was applied to the plot six times during the early part of the experiment. Disease ratings on a scale of 0 to 5 were made on October 2.

Summer trial, 1970

This experiment was designed to determine whether the effectiveness of some materials could be increased by addition of various adjuvants under a 21-day spray schedule and to compare these treatments with benomyl when used alone. Treatments were as follows: benomyl 50W 8 oz; TBZ 60W 10 oz; TBZ 60W 10 oz plus Nu-Film 17 spreader sticker

TABLE 1. RESULTS OF CHEMICAL TREATMENT FOR THE CONTROL OF CERCOSPORA LEAFSPOT OF SUGAR BEET IN SUMMER 1969 TRIALS

Treatments	Disease ratings July 22
Benomyl 50W, 6 oz	1.0 a**
Benomyl 50W, 12 oz	1.0 a
Triphenyl tin hydroxide 47.5%, 8 oz	2.6 b
Kocide 101 86%, 2 lbs	2.6 b
Maneb-D, 80W, 3 lbs	2.7 b
Check or no treatment	3.3 c

** Significant 1% level. Treatments with same letter are not significantly different.

TABLE 2. COMPARISON OF 10- AND 21- DAY SPRAY SCHEDULE FOR THE CONTROL OF CERCOSPORA LEAFSPOT OF SUGAR BEET UNDER SPRINKLER IRRIGATION IN FALL 1969 TRIALS

Treatments	Disease rating	
	10 day	21 day
Benomyl 50W, 12 oz	-†	0.1 a**
Benomyl 50W, 6 oz	-	0.4 a
TBZ 60W, 10 oz	1.0 b	1.4 b
Dac 2787 75W, 2 lb	1.0 b	1.7 bc
Kocide 101 86%, 3 lb	1.0 b	
TBZ 60W, 5 oz	1.2 bc	2.2 bcd
Triphenyl tin hydroxide 47.5%, 9 oz	1.4 bc	2.2 bcd
Dfn Flowable, 2 qts	1.6 bcd	1.9 bc
Maneb-D 80W, 3 lb	1.9 cd	-
TC-90 48%, 3 qt	2.3 de	-
Polyram 80W, 2 lbs	2.3 de	2.6 cde
El-273 4.5%, 50ppm	2.7 e	2.8 de
El-273 3.5%, 25ppm	2.8 e	3.0 de
Check or no treatment	3.1 e	3.1 e

** Significant at the 1% level.

† Benomyl applied only on 21 day schedule.

LEAFSPOT OF SUGAR BEET

sprinkler irrigation

1 pt; Kocide 101 86% 3 lbs; Kocide 101 86% 3 lbs plus Nu-Film 17 1 pt; maneb-D 80W 3 lbs plus Nu-Film 17 1 pt; Dfn. flowable 2 qts; Dfn. 2 qts plus Bio-Film spreader-sticker 6 oz; Dfn. 2 qts plus Nu-Film 17 1 pt; and the untreated check. One hundred gallons of the fungicidal mixture were applied per acre, and application rates listed are per 100 gallons of water. Plots were sprayed on June 17, July 10 and 31. Disease ratings on a scale of 0 to 5 were made on August 18.

Aerial trial, 1970

Airplane application trials were conducted to compare benomyl and TBZ with a standard control material currently in use by growers. A sugar beet field near Hemet, California, planted in mid-January with the variety USH-9, was selected for this trial. Treatments were as follows: TBZ 60W 8 oz; benomyl 50W 8 oz; Dithane M-45 80W, 2 lbs and the untreated check. Rates of materials listed are per 10 gallons of water per acre. Materials were applied with an Aero Commander airplane equipped with a Transland spray system. A 60-ft spray width pattern was used but all disease ratings and yields were taken within the center 40 ft. The field was sprinkler irrigated and treatments were replicated five times. Sprays were applied on August 6 and 28.

Disease ratings on a scale of 0 to 5 were made on September 17. Yield data

were tabulated on September 24 and 25. The percentage of sugar for all trials was analyzed by the Holly Sugar Company, Santa Ana.

Data

The data from the summer 1969 trial are presented in table 1, those from the fall 1969 trial in table 2, comparison of adjuvants in table 3, those from the aerial 1970 trial in table 4.

In the summer 1969 trials, benomyl at both 6 or 12 oz per acre, applied on an 18-day spray schedule was significantly better than all other treatments. Triphenyl tin hydroxide, maneb-D and Kocide 101 were significantly better than the check but gave medium to poor disease control under severe inoculum pressure.

Benomyl was again significantly better than all other treatments in the fall trial even though these treatments were only applied on a 21-day spray schedule. Next in effectiveness was TBZ, Daconil 2787, Kocide 101, triphenyl tin hydroxide and Difolatan. Daconil 2787, TBZ at the 5 oz rate, or triphenyl tin hydroxide gave significantly better control on the 10-day schedule than on the 21-day schedule Kocide 101 was only applied on the 10-day schedule.

In the summer plot, benomyl used without an adjuvant was significantly better than all other materials tested. Observation of the plot 28 days after the last fungicide application showed that

only benomyl was still giving commercial control. In a second category was TBZ alone, TBZ plus Nu-Film, Kocide plus Nu-Film, maneb-D plus Nu-Film and Difolatan alone. Kocide plus Nu-Film produced better control of Cercospora leafspot than Kocide used alone. There was no significant difference in yield or percentage of sugar from any treatments, although the check treatment had the lowest yield, and percentage of sugar.

Benomyl

The aerial plot confirmed the results of previous trials in that benomyl gave significantly better control of Cercospora leafspot when applied on a 21-day schedule. Next in effectiveness was TBZ or zinc plus maneb, but zinc plus maneb was not significantly different from the untreated check. No significant differences were found between any of the treatments in regard to yield, or percentage of sugar. However, a trend appeared again toward higher yields with the fungicide treatments.

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TABLE 3. CONTROL OF CERCOSPORA LEAFSPOT OF SUGAR BEET COMPARING FUNGICIDES ALONE AND FUNGICIDES PLUS ADJUVANTS IN SUMMER TRIAL, 1970

Treatments	Disease ratings	Weight/root	Sugar
	Rating†	lb	%
Benomyl 50W, 8 oz.	0.4*a	3.54	13.45
TBZ 60W, 10 oz. plus Nu-Film 1 pt.	2.0 b	3.31	13.33
TBZ 60W, 10 oz.	2.3 bc	3.45	13.50
Kocide 101 86%, 3 lb. plus Nu-Film 1 pt.	2.6 bcd	3.28	13.70
Maneb-D 80W, 3 lb. plus Nu-Film 1 pt.	2.8 bcd	3.84	12.40
Difolatan F, 2 qts.	2.8 bcd	3.80	13.15
Difolatan F, 2 qt. plus Bio Film 6 oz.	3.0 cde	3.56	13.70
Difolatan F, 2 qt. plus Nu-Film 1 pt.	3.1 de	3.45	13.70
Kocide 101 86%, 3 lb.	3.3 de	3.45	13.78
Check or no treatment	3.8 e	3.06	12.88
		NS	NS

* Significant at 5% level. † Rating scale: 0 to 5.

TABLE 4. RESULTS OF CHEMICAL TREATMENT BY AERIAL APPLICATION FOR THE CONTROL OF CERCOSPORA LEAFSPOT IN SUMMER, 1970

Treatments	Disease ratings Sept. 17	Yield per acre	Sugar	Sugar per acre
	Rating†	tons	%	tons
Benomyl 50W, 8 oz	1.2**a	44.15	12.30	5.43
TBZ 60W, 8 oz	1.9 b	42.38	12.74	5.40
Zinc plus maneb 80W, 2 lb plus Nu-Film 1 pt	2.6 bc	42.08	12.45	5.24
Check or no treatment	2.9 c	41.67	12.31	5.13
		NS	NS	NS

** Significant at the 1% level.

† Rating scale: 0 to 5.