Ripe Fruit Rot in Tomatoes

early maturity of fruit and harvest before fall rains are factors in reducing loss

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Fruit rot in the California canning tomato crop is an important problem because state standardization laws require that fruit having 5% or more rot at the time of inspection be rejected as unfit for processing.

The fruit-rot problem in this state is considerably different from that in the Eastern and Middle Western States where the primary troubles are diseases of pathogenic origin such as Early Blight—*Alternaria solani*, Late Blight—*Phytophthora infestans*, and Anthracnose—*Colletotrichum phomoides*.

A spray program is practically mandatory in order to harvest a normal crop in areas where these pathogens are active. In such areas rots caused by secondary fungi also occur, but are relatively unimportant as compared to the pathogenic diseases mentioned.

In California the major concern is rot caused by molds such as *Alternaria, Rhizopus, Penicillium, Monilia,* yeast, and bacteria which only attack ripe fruit and then only through wounds or dead areas in the fruit skin.

Some loss is suffered from fruit rots in California every year. The damage is much greater in some years than in others. In 1948 the loss from fruit rot was heavy while in 1949 the loss was relatively slight.

A comparison of climatic factors of the two years, temperature and precipitation—made at Davis, which is typical of the major canning tomato area—showed a considerable difference between 1948 and 1949.

A relatively cool year was recorded for 1948. The average temperature was about 5° F, lower than normal—77 year average—for the seven months of the growing season from February through August. There was also considerable rainfall during the spring months of April, May and June. Lower temperatures caused a slower rate of growth of plants before and after transplanting and rainfall during these months caused a delay in transplanting since fields in many cases were too wet for cultivation. The two factors acted together to cause the crop to be late in maturing.

In contrast, 1949 was about normal and temperature was considerably above 1948 in March, April, May and June. There was very little rainfall after March.

Average Monthly Temperature and Rainfall at Davis, California during 1948 and 1949

1948

	Aver. temp. F°	Temp. departure*	Aver. precipitation inches
Feb.	46.7	–4.1	0.84
Mar.	49.6	–5.3	2.97
Apr.	53.4	–6.0	2.48
May	60.6	–5.2	2.53
June	70.2	–2.4	0.51
July	73.9	–2.3	0.00
Aug.	71.6	–3.3	0.00
Sept.	69.4	–1.4	0.35
Oct.	63.2	–0.4	1.27
Nov.	52.4	–1.8	0.27

1949

	Aver. temp. F°	Temp. departure*	Aver. precipitation inches
Feb.	46.0	–4.8	1.37
Mar.	52.2	–2.7	4.51
Apr.	60.9	+1.5	0.00
May	64.7	–1.1	1.52
June	72.2	–0.4	0.00
July	73.8	–2.4	0.00
Aug.	71.4	–3.5	0.05
Sept.	71.8	–1.0	0.00
Oct.	60.7	–2.9	0.04
Nov.	54.7	–0.5	1.14

* From 77-year average.

Growers were able to produce normal sized plants and to set them in the field as early as temperature permitted—usually about April 20th to May 15th.

A comparison of the fall seasons of the two years shows that rains occurred in September of 1948 when most growers had only started to harvest the crop. In 1949 there were practically no rains immediately before or during the harvest season and rot was not serious. This is the usual situation. Secondary fruit rots of tomato are more prevalent in years in which the major portion of the crop has not been harvested before fall rains begin.

Since loss from secondary fruit rot is so sporadic in its occurrence, fungicidal control measures must be cheap and easy to apply. Dustings are regularly made by most growers for control of insect pests. If fungicidal dusts should prove effective, they could be applied in the same operation. Sprays would require a separate operation and even if control of fruit rot was obtained by their use, the cost of materials and applications would not prove profitable in most years.

Fungicidal dusts were tested in a 5 × 5 Latin square design plot about six miles west of Davis during the 1949 season. The following dusts were used:

Dithane Z78 ..5% with pyrophyllite
Basi Cop ....7% with pyrophyllite
Zerlate ....10% with pyrophyllite
Fermate ......10% with pyrophyllite

The dusts were applied with dusters at the estimated rate of 70 pounds to the acre. Each block consisted of a 30 foot section of three rows, but counts of fruit rot were made only on the center row dusted. The first application was made August 25th and a second application to one half of each block on September 1st.

Effect of Fungicidal Dusts on Percentage Fruit Rot in the First Picking* of Tomatoes

Average of Five Replications

Treatment	Percentage mold: Field readings, Dustings: One	Field readings, Dustings: Two	Stored samples, Dustings: One	Stored samples, Dustings: Two
Untreated ck.	3.56	3.22	12	16
Zerlate	2.96	3.25	14	14
Fermate	3.64	2.90	10	14
Dithane	3.40	3.94	10	18
Basi Cop	3.23	3.02	12	16

* The amount of mold in the second picking was slightly less than in the first, but there was no indication of control from any treatment.

Two pickings were made at the time the remainder of the field was picked, the first on September 27th and the second on October 14th. Each fruit was examined for mold in the field immediately after picking and a 50-fruit sample of apparently clean fruit was taken and

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standard grade into canning quality. Merely raising the average size one, or even two, grades might not justify the thinning expense. Reducing the volume of a given crop by thinning may improve the possibilities of obtaining a more satisfactory crop the following year. Thus the tendency toward alternate bearing will probably be reduced.

Further experiments are planned on fruit thinning of olives, and it is hoped that a technique for spray thinning can be developed which will further reduce the thinning costs.

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stored at room temperature for three days, when another reading was made.

Results of this work indicate that the application of fungicidal dusts did not effect any control of rot.

There was no consistent difference between the no-treatment blocks and the fungicidal dust treatments nor was there any difference between one or two applications of the dusts in either the field reading or in the readings from the stored fruit samples.

Almost all of the rots occurred at damaged places on the fruit such as skin cracks, worm holes, stem scars, and sun scald spots. It was not unusual to find a rotted fruit where the mold had entered exposed tissue following a fruit growth crack even though the fruit had been previously covered with a protective dust.

It is generally agreed that the incidence of rot is much greater if rains occur shortly before or during the harvest season. One explanation of this is that moist conditions are more favorable for spore production, spore germination, establishment and development of the organisms concerned.

Another idea is that rains may cause an increase in fruit growth cracks especially if the roots and other parts of the plant are in an active condition.

Since irrigation alone does not cause any appreciable increase in growth cracks, rains probably exert their effect by increasing humidity of the air. Increased humidity of the air would lessen water loss from plants and thereby cause an increase in turgidity. Such an increase might cause rupturing of the fruit skin, providing openings for infection. Such turgid fruit would also be more subject to mechanical injury during picking.

This hypothesis might explain why more secondary rot in fruit has been found in some instances from sprayed than from unsprayed plots. Since defoliation by leaf spotting fungi has been prevented, plants have been kept in an actively growing condition. This has caused an increase in the number of growth cracks and mechanical injury during picking, probably resulting in more secondary rots. Unsprayed, and therefore defoliated, plants produced fruit which was flaccid. This fruit probably had fewer growth cracks and less mechanical damage during picking resulting in less secondary rot.

Since fruit rots are correlated with wet weather during harvest season and since these fall rains usually come late in the season, any practice which would bring the crop to maturity earlier to escape these rains might be of some value for control. Plant breeders might also select for earliness of maturity so that the crop can be harvested before the fall rains begin.

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ducted near Woodside. Tests were made in late May on valley oaks and blue oaks which were heavily infested with the least pit scale. The treatments were each made on two trees while four trees were used as checks. One treatment consisted of a 2% light-medium emulsion-type foliage oil containing 4½% DDT, while the other treatment consisted of a 2% light-medium emulsion-type foliage oil along with one quart of 60% toxaphene emulsion—containing 1½ pounds actual material per quart—per 100 gallons of diluted emulsion.

Counts were made of the number of scales on 30 twigs from each tree, and infestations were calculated on a basis of scales per square inch of twig surface. Pretreatment counts were based on overwintering females, while counts made four months after treatment were based only on the new generation of scales. A comparison of the results showed that excellent control was obtained with oil and toxaphene, while oil and DDT gave negligible control.

Weekly band counts of crawlers were also made in connection with these tests. These counts indicated that practically no reproduction occurred following the oil and toxaphene spray, while crawler activity was not affected for more than one week after the oil and DDT spray.

Tests were also made in late July, 1949, on three valley oaks which were very heavily infested with the least pit scale. There was no apparent control on the tree which was sprayed with toxaphene alone at the rate of one quart of the 60% emulsion per 100 gallons of water. One hundred per cent control was obtained on a tree sprayed with 2% light-medium emulsion-type foliage oil along with one quart of 60% toxaphene emulsion per 100 gallons of diluted emulsion.

Summary of Results of Dormant Oil Sprays on February 22, 1949, for Control of *Asterolecanium minus*.

	Pretreatment Feb. 21	Post-treatment Aug. 24	
	Scales/ sq. in.	Scales/ sq. in. old wood	Scales/ sq. in. new growth
5% oil—80% emulsion	7.5	0.0+	11.9
5% oil—80% emulsion 2 # DDT—50% wettable	1.9	0.0+	10.6
5% oil—80% emulsion, 1 qt. toxaphene, 60% emulsion	9.4	0.0+	12.5
Checks	5.0	4.4	6.3

The Summary of Results of Light-Medium Oil Combination Sprays on May 21, 1949, for Control of *Asterolecanium minus*

	Pretreatment May 19	Post-treatment Sept. 14	
	Adults/ sq. in. old wood	Scales/ sq. in. old wood	Scales/ sq. in. new growth
Valley oaks			
2% oil—80% emulsion, 1 qt. toxaphene, 60% emulsion	29.4	0.0+	0.6
Check	21.9	25.6	93.8
Blue oaks			
2% oil—80% emulsion containing 4.5% DDT	23.8	30.0	56.9
Check	21.9	17.1	46.3

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