

Improving Tomato Fruit Set

use of hormone spray treatment for improvement of fruit set for spring and early summer harvest

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The failure of tomatoes to set fruit is a common problem in California in the spring and early summer months.

Evidence to date indicates that low night temperatures, high day temperatures, poor soil moisture conditions, faulty nutrition and insect or disease damage may adversely affect fruit set. The supply of available food within the plant also has a bearing on fruit set. For example, a period of heavy fruit setting is usually followed by a period of poor setting.

Low temperatures, particularly at night, appear to be one of the main causes of poor fruit set in California. On young, vigorously growing plants the processes leading to fruit set are impaired when night temperatures fall below 60° F. On older plants, night temperatures seem to be slightly less critical. When day temperatures range above 100° F fruit set is usually poor.

Use of Hormones

Plant hormones are organic compounds that are produced in plants and regulate certain responses such as bud development, root growth and fruit setting. Recently materials similar to the natural plant hormones have been produced artificially. These have been termed *growth regulating substances*, *growth promoting substances*, or *growth substances*. The term hormone also has been loosely applied to this group of synthetic substances and is the name most common in popular use.

Hormone treatment can be expected to help when poor set of tomatoes is due to low night temperatures. This is most likely to be the cause of poor fruit set during the first two or three weeks of the blossoming period of spring and summer crops. Whether or not this treatment might improve set satisfactorily during periods of unfavorably high temperatures is not known. Hormone treatment can not be expected to be beneficial when poor setting is due to the other disorders or when normal setting is occurring.

Hormones will be most useful on crops where early maturity is of prime importance as it often is on the early market crop and where it is practical to use hand sprayers for applying the hormone spray treatment.

Plant Injury

Tomato plants are sensitive to most of the hormone materials at strengths used for setting fruit.

Usually in 10 to 15 days after treatment, evidence of injury begins to appear on the new foliage. The new leaves are smaller and may be deformed.

When the minimum spray strengths are used and the spray is confined mostly to the flower clusters the injury is slight and does not persist long.

With high concentrations or with less careful application the foliage injury is more pronounced, plants may be stunted to some extent, and late yields may be reduced.

The injury is most severe when the whole plant is sprayed. Apart from the direct injury of the hormone, a reduction in vegetative growth may be expected when a relatively large number of fruits are set early by the treatment.

Because of these hazards, hormones should be used only when the grower is fairly certain conditions are such that set will be improved and the resulting yield increase will occur during a period of favorable market conditions.

Yields

Early yields have been increased from one half to five pounds per plant during the period in which treated fruits were harvested.

Provided the treatment is satisfactory, the increase will depend on the number of blossoms open at the time of spraying, the size and vigor of the plants and the amount of natural setting.

The first fruits reach the harvest stage 45 to 60 days after treatment depending on the variety and the growing conditions. The fruits, set from one application, mature over a period of about two weeks. Following this period, the production of treated plants drops off and then, as naturally set fruits begin to mature, production increases again.

The volume of this later yield is determined, to a large extent, by the amount of injury the plant suffered from the treatment. With a short harvest period of about one month, yields from the treated plants usually exceed those from un-

treated plants when, of course, the treatment proves effective.

With long harvest seasons, the yields from untreated plants often catch up with and sometimes may exceed those of the treated.

In general, hormone treatments do not increase the total yielding capacity of tomatoes, but shift a portion of the yield forward in the season.

Two treatments to the same plants two weeks apart may give greater yields during the first month of harvest than one treatment. But the greater damage to the plants may materially reduce later yields, and added foliage injury may cause loss of much fruit from sunburning. If early and late treatments are to be given, it will be safer to divide the field into two sections and apply just one treatment to each portion.

Fruit Size

Hormones increase the size of fruit from 10% to 50% over naturally set fruit. A spray concentration of 25 ppm—parts per million—of 4-chlorophenoxyacetic acid has given larger sizes than higher concentrations.

Fruit Quality

Fruits set with the growth substance are usually seedless but are normal in flavor and texture. They tend to be more pointed than is normal for the variety, but seldom has this change in shape been objectionable.

The number of excessively rough fruits may be increased by the treatment although often this is not a direct effect of the hormone. Deformed flowers, which commonly develop on early flower clusters, produce rough fruit if set. These usually do not form fruit unless the plants are treated.

Puffiness and blossom-end rot may be accentuated by the treatment if these defects are occurring in the field. With moderate to severe foliage injury, the amount of sunburned fruit will likely be increased.

Treatment increases the percentage of fruits which have a persistent green color of the jellylike material in the seed cavities.

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INSECTICIDES

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more than 200 related to chlordan have been investigated.

Preliminary Studies

In preliminary laboratory studies, some of these compounds have proven more effective than their parent materials and may be insecticides of the future.

The laboratory investigations are only the beginning steps in the proving of a new insecticide. If a material proves

highly effective in the screening tests, a larger sample is procured. This is then given preliminary field studies to determine its effectiveness under field conditions, its toxicity to citrus trees, and its effects on beneficial insect populations.

If these tests still indicate promise, the material is carefully considered from the standpoint of toxicity to warm-blooded animals, most suitable formulations and methods of application, duration of residual effectiveness as determined by chemical and biological assays and finally cost of application.

Of approximately 2,400 compounds

Comparative Toxicities of Some New Organic Insecticides to the Citrus Red Mite and the Greenhouse Thrips

Material	Per cent concentration for 50% kill	
	Citrus Red Mite	Greenhouse Thrips
2,2-bis-(p-chlorophenyl)-1,1,1-trichloroethane (DDT)	>10.0	0.001
gamma-benzene hexachloride	1.0	0.0001
chlordan	1.0	0.0035
toxaphene	>1.0	0.0025
2,2-bis-(p-chlorophenyl)-1,1-dichloroethane (DDD)	>1.0	0.006
2,2-bis-(p-methoxyphenyl)-1,1,1-trichloroethane (methoxychlor)	>1.0	0.03
bis-(p-chlorophenoxy)-methane (Neotran)	0.025	1.0
1,1-bis-(p-chlorophenyl)-ethanol (DMC)	0.1	1.0
tetraethyl pyrophosphate	0.0005	0.0003
parathion	0.0001	0.0001

FRUIT SET

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Although the information is limited, there is some indication that treated fruits soften quicker after reaching full maturity than do those that have set by normal pollination.

Varieties

In tests in California, hormones have set fruit on several strains of Earliana, on Pearson, Pritchard, Stokesdale, Stone and Pennheart.

These results, and information from other states, indicate that the treatment will set fruit on most varieties providing conditions are favorable. However, from the standpoint of quality, the treatment may not prove satisfactory on those varieties that tend to be rough, puffy, or have blossom-end rot.

Sunburning of the fruit may be a factor on varieties that have sparse foliage.

Early Market Crops

Hormone treatment is most likely to prove useful for increasing early harvest on crops grown for the spring and early summer market.

Hormones have improved fruit set and increased early yields in one or more tests in each of the early market districts of the state. On the other hand, in some tests the treatments proved unsuccessful because good set was occurring naturally,

while in others poor set was due to causes which apparently cannot be corrected by the treatment.

Due to variations in climatic conditions, results are likely to vary from year to year as well as among districts.

Since it is difficult to predict results, commercial tomato growers are advised to proceed cautiously with the use of hormones. Extensive use of the material should not be attempted until the grower has determined to his own satisfaction that the treatment will prove beneficial under his growing and marketing conditions.

Late Market Crops

Poor fruit set is seldom a problem on tomatoes grown for late summer and fall marketing.

The few tests conducted on these crops have shown the treatment was of little or no value. Even when fruit set has been increased late in the fall, cold weather or frosts terminated harvesting before the treated fruit matured.

Canning Tomatoes

Hormone treatment, at the present time, is not recommended for the canning tomato crop.

In the first place, only occasionally is delayed fruit set a serious problem on most of the acreage, and this is difficult to predict early in the season.

studied to date—exclusive of those studied as fumigants—only about 70, or less than 3% have proven promising enough

Comparative Toxicities of Some New Organic Insecticides to California Red Scale and Citrus Red Mite Eggs

Material	Per cent concentration for 50% kill	
	Red Scale	Red Mite Eggs
parathion	0.01	0.009
tetraethyl pyrophosphate	0.1	0.7
loral-2-thiazolanyl sulfide (IN-4200)	0.1	0.02
di-(2-ethylhexyl)-phthalate	0.25	0.1
DDT	nontoxic	nontoxic
gamma-benzene hexachloride	nontoxic	nontoxic

to be investigated in the field, and of these 70, less than 20 will eventually show enough promise to warrant extensive field studies.

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Earliness is not usually as important on this crop as it is with market tomatoes because the price of the crop is more stable. Therefore, the failure of the first few flowers to set is seldom considered serious. However, in those areas where fruit set is poor over prolonged periods, hormone treatment should be tested further.

Care Required

Another disadvantage is the danger of reducing total yields. While this may be avoided by careful application of the spray, most growers agree that hand spraying of tomato fields grown for canning is impractical. With 4-CPA—4-chlorophenoxyacetic acid—whole plant spraying usually causes too much plant damage and at the same time is not as effective in setting fruit as cluster spraying.

If materials or methods of application less injurious to the plant are discovered, treatment of the canning crop may become feasible.

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Local experience on the results of hormone treatment can be obtained from the Farm Advisors' offices. Staff members of those offices cooperated in the studies reported here.