

Temperature Effects on Tomato

hormone-set fruits of Early Pak variety develop different types of abnormalities at different controlled temperatures

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Out-of-season tomato production varies unpredictably as to yield and fruit quality.

Although field observations may indicate that a period of poor plant growth, inadequate fruit set, or abnormally shaped fruit coincides with a period of low temperatures, it is impossible to be certain of the relationship. Other factors—such as sunlight, humidity, nutrient supply, or water—may also be changing at the same time.

Experiments with the effects of temperature on the production of fruit abnormalities by plants treated with fruit-setting hormone sprays were carried out in small climate-control chambers. A bank of fluorescent lamps provided uniform artificial illumination for 15 hours each day. Temperatures were changed from day to night, with about three hours required for equilibration at the new temperature. The plants were placed in these chambers for only a six-weeks period, during which fruits were set and developed.

The plants used were of the Early Pak tomato variety, grown in 10" pots in a greenhouse with a maximum day temperature of 85°F and a minimum night temperature of 65°F. Complete nutrient solution was applied weekly. All fruits which set in the greenhouse were removed.

Individual plants selected for uniformity—each with 4-6 flower clusters—were transferred to the climate-control chambers, and all flowers then present or pro-

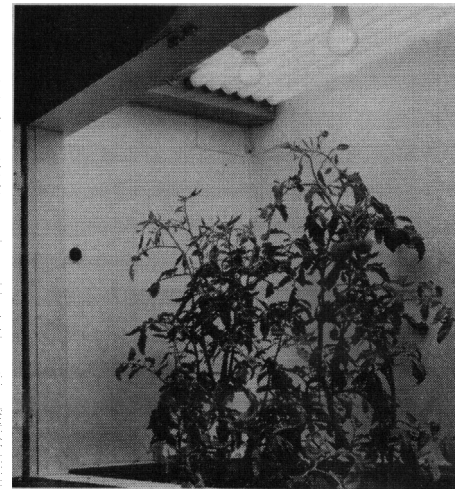
duced later were sprayed with 50 parts per million of 4-CPA—4-chlorophenoxyacetic acid—to induce parthenocarpic set of fruit. Plants in the chambers were supplied with water as needed and with nutrient solution on a weekly schedule.

Four individual plants constituted the replications of each temperature treatment. Their positions were changed once a week, to minimize differences in plant response caused by location with respect to lights, air supply, and other factors. Although the conditions of growth were not normal and the duration of the test was too brief to represent a field-grown tomato plant, the figures obtained may serve to indicate the relative effect of temperature on the aspects of growth that were measured.

The three temperature conditions tested in these studies are designated 86/59, 77/59, and 68/50, with the first figure in each case approximating the average daytime temperature and the second the average night temperature, in the Fahrenheit scale.

The effects of the three temperature conditions on the development of hormone-set fruit are summarized in two tables. Although there was no statistically significant difference in the number of fruits set under each condition, the fruit produced at higher temperatures, particularly higher night temperatures, tended to be heavier at the time the experiments were terminated. The average fruit size, as indicated by the diameter at the equator, increased with an increase in temperature. The total soluble solids of the juice—an approximate measure of sugars and thus of sweetness—decreased significantly with the higher temperatures, as did the acidity of the juice.

There was a definite and significant tendency for the hormone-set fruits pro-



Climate-control chamber with tomato plants. Fluorescent and incandescent lamps on ceiling provide artificial illumination.

duced under the 68/50 conditions to be more pointed than those grown at higher temperatures. The reverse tendency was shown in the percentage of puffy fruit. Both the pointed and puffy conditions are characteristic of fruit from the Early Pak variety, and the amount of such misshapen fruit is usually increased by use of fruit-setting hormone sprays. There was complete absence of either cracked or blossom-end rotted fruit on the 68/50 plants, and only small amounts of these types of fruit were produced at the higher temperatures.

The preliminary test reported here indicates that, in addition to the expected differences in the relative growth rate of tomato fruits caused by temperature, there are some rather pronounced effects of temperature on the production of various abnormal fruits, with pointedness apparently favored by lower temperatures while puffiness, blossom end rot and growth cracks are all accentuated by higher temperatures. A more exact estimate of the optimum temperature range for tomato fruit production will be attempted next, and the importance of differing day and night temperatures in producing abnormal tomatoes will be investigated.

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Effects of Temperature on Yield and Juice Composition of Hormone-Set Early Pak Tomato Fruits Produced Under Artificially Controlled Conditions.

All figures are average values.

	Treatment		
	No. 1 86/59	No. 2 77/59	No. 3 68/50
No. of fruit per plant	20.5	13.5	16.0
Fresh weight of fruit per plant—grams—	667*	607*	350
Dry weight of fruit per plant—grams.	35.8	32.5	34.2
Fruit size—mm	42.6*	35.1	31.9
Total soluble solids of juice (as sucrose)—%	3.95*	4.60	4.72
Total titratable acidity of juice (as citric)—%	1.28*	2.26	2.22

* Significantly different from treatment No. 3 at the 5% level.

Effects of Temperature on the Production of Abnormal Fruit by Early Pak Tomato Plants Treated with Fruit-Setting Hormone Sprays.

All figures are percentages.

	Treatment		
	No. 1 86/59	No. 2 77/59	No. 3 68/50
Pointed fruit	37*	34*	58
Puffy fruit	23*	17	13
Blossom-end-rotted fruit	11*	15*	0
Cracked fruit	6*	2	0

* Significantly different from treatment No. 3 at the 5% level.