The Effect of Chlorflurenol on Set and Concentrated Yield of Processing Tomatoes

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Abstract. A single spraying of 2-chloro-9-hydroxyfluorene-9-carboxylic acid (chlorflurenol) on the foliage increased the set rate of processing tomatoes under conditions of high temperature as compared with untreated control or 4-CPA-treated plants. As the rate applied increased, chlorflurenol inhibited vegetative growth, increased fruit malformation, and decreased the pH of fruit juice (0.1 unit). No differences could be detected in juice viscosity and in total soluble solids of treated and control fruits.

Since processing tomatoes are harvested all at one time, it is important to obtain a max amount of red, ripe and uninjured fruit at harvest. Such a concentrated yield may be obtained by application of growth regulators that induce parthenocarpic fruit-set of many flowers simultaneously. Parthenocarpic fruits are easily induced in tomatoes by a broad range of growth regulators (2, 7, 8), and many of the synthetic auxin-like growth regulators are more effective than natural ones (8).

Most of the available data on commercial application of growth regulators to improve fruit-set under unfavorable climatic conditions refer to treatment of individual flowers or clusters only (2, 7), and very little has been done regarding field treatments that fully cover the foliage. The most effective method for inducing fruit-set in processing tomatoes in Israel during the summer has been a full-coverage spray with parachlorophenoxyacetic acid (4-CPA) at the rate of 4 g active material per 1,000 m². The compound is applied when a population of 6,000 plants per 1,000 m² bear an average of 10-12 flowering clusters per plant (5).

Chlorflurenol, a relatively new growth regulator, was found to induce parthenocarpic fruit development in cucumber (3, 4) and in tomato flowers after prior emasculation (6). Its effectiveness in inducing fruit-set under field conditions was therefore tested. Chlorflurenol and 4-CPA were sprayed by means of a CO₂ gas-pressure sprayer, and the amount of water was kept constant at the rate of 10 liters per 1,000 m². Treatment was applied to the foliage of ‘Roma VF’ 2 or 3 days before or after irrigation, at the rate of 1, 5 or 10 ppm chlorflurenol in a single, full-coverage spray. Sixty clusters were tagged on treatment day for each treatment; the first flower in each cluster was at anthesis.

Setting % was determined after 12 days, and results showed that chlorflurenol at the rates of 5 and 10 ppm was highly effective in inducing fruit set (Table 1). Growth of treated plants was severely inhibited and they differed significantly from the untreated control plants, by exhibiting epinasty of the leaves. Inhibition was dependent upon the chlorflurenol concn applied.

In the 2nd series of experiments, the effect of chlorflurenol on total yield of ‘Roma VF’ tomatoes and on the concentration of induction was investigated (Table 2). A single full-coverage spray of chlorflurenol on plants bearing 12 flowering clusters, at the rate of 5 ppm produced yields which were higher than those obtained by any other treatment. It was also the best treatment tested for concentrating yield.

In the 2 following field experiments we tested the effect of chlorflurenol (5 ppm) on the amount of red-ripe fruit of ‘Roma VF’ at harvest as compared with that of 4-CPA (4 g active material per 1,000 sq m) and an untreated control. Results showed that chlorflurenol is significantly more efficient in concentrating production (Table 3). We found that chlorflurenol-induced parthenocarpic fruits were badly deformed. Higher rates of chlorflurenol produced badly hollowed, severely faciated fruits with protruding ends. Laboratory examination of fruit quality (Table 4) showed no change in total soluble solids between treated and untreated fruit. No reduction in juice viscosity was found at increased chlorflurenol rates, but the decrease in pH as a result of increased concentration was significant. This decrease was at most 0.1 pH units, which is not significant for the processor.

Chlorflurenol applied as a full-coverage treatment is very effective in inducing fruit-set in tomato and in producing yield concentration even when not applied directly to the flowers. However, the occurrence of side effects such as increased fruit malformation at higher chlorflurenol rates limits its practical use. In addition, vegetative growth is strongly inhibited resulting in increased exposure of fruit to direct sun irradiation, which may cause a high incidence of sun-scaled fruit.

Table 1. The effect of chlorflurenol treatments on fruit-set % of tagged clusters of ‘Roma VF’ (1971).

<table>
<thead>
<tr>
<th>Chlorflurenol (ppm)</th>
<th>Fruit-set (%)</th>
</tr>
</thead>
</table>
| 0                  | 34.7 b
| 1                  | 38.7 b
| 5                  | 66.2 a
| 10                 | 66.1 a

2Mean separation in columns by Student-Newman-Keuls multiple range test, 5 % level.

Table 2. The effect of chlorflurenol rates on total yield (kg/10 m²) of ‘Roma VF’ tomatoes and on % of red fruits.

<table>
<thead>
<tr>
<th>Chlorflurenol (ppm)</th>
<th>Total yield (kg per 10 m²)</th>
<th>Red fruit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>72.3 b</td>
<td>68.2 b</td>
</tr>
<tr>
<td>1</td>
<td>68.7 b</td>
<td>72.8 ab</td>
</tr>
<tr>
<td>5</td>
<td>82.4 a</td>
<td>79.2 a</td>
</tr>
<tr>
<td>10</td>
<td>74.7 b</td>
<td>75.9 ab</td>
</tr>
</tbody>
</table>

2Mean separation in columns by Student-Newman-Keuls multiple range test, 5 % level.

Table 3. The effect of 4-CPA and chlorflurenol on the yield of red ripe of ‘Roma VF’ in 2 field experiments (1971).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Expt. A</th>
<th>Expt. B</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>49.5 c²</td>
<td>44.0 b²</td>
<td>46.7</td>
</tr>
<tr>
<td>4-CPA (4 g/1000 m²)</td>
<td>56.0 b</td>
<td>43.4 b</td>
<td>49.7</td>
</tr>
<tr>
<td>Chlorflurenol (5 ppm)</td>
<td>65.7 a</td>
<td>55.7 a</td>
<td>60.7</td>
</tr>
</tbody>
</table>

2Mean separation in columns by Student-Newman-Keuls multiple range test, 5 % level.

Table 4. The effect of chlorflurenol treatments on the quality of processing tomatoes ‘Roma VF’ (1971).

<table>
<thead>
<tr>
<th>Chlorflurenol (ppm)</th>
<th>Total Soluble solids (%)</th>
<th>pH</th>
<th>Viscosity differential²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5.6</td>
<td>4.34 a²</td>
<td>20.2</td>
</tr>
<tr>
<td>1</td>
<td>5.4</td>
<td>4.35 a</td>
<td>21.9</td>
</tr>
<tr>
<td>5</td>
<td>5.4</td>
<td>2.48 ab</td>
<td>21.0</td>
</tr>
<tr>
<td>10</td>
<td>5.7</td>
<td>4.25 b</td>
<td>19.6</td>
</tr>
</tbody>
</table>

2Mean separation in columns by Student-Newman-Keuls multiple range test, 5 % level.

Viscosity was determined by the Wagner and Miers method using an Efflux pipette (the flow of distilled water in such a pipette lasts 8.0 sec).
Respiration Rates of Sweet Corn Kernels Associated with Maturity and Genotype

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Abstract. Whole kernels of sweet corn (Zea mays L.) were excised from 4 cultivars of varying stages of maturity. The oxygen uptake per g. of dry kernel weight showed a curvilinear decrease with maturity as measured by % kernel moisture. Distinct differences were observed in the respiration rates of the 4 cultivars.

Recently (1) significant correlations were demonstrated among inherited quantitative plant characteristics and the time required for sweet corn cultivars to pass through various phases of development. The total no. of leaves on the main stalk, ear length, yield and oil content of the kernels played significant roles only in specific phases. Indicies based on the rates of leaf appearance in the seedling stage were important in all phases of development from planting to harvest at 72% kernel moisture and in large part explain the differences in the time required for the cultivars to go from silk to harvest. This relationship for the 4 midseason cultivars used in this study is in Table 1. It was hypothesized that the rate indicies reflect inherent differences in the metabolic rate among the cultivars and that they should be reflected in the relative respiration rates of kernels. The experiment described here was designed to obtain supportive evidence for this hypothesis.

On the assumption that the respiration rate would be a function of kernel maturity, harvests were made over an 8 to 12 day period selected to cover the maturity range over which sweet corn is harvested for fresh or processed consumption. Harvests were made at about 3 day intervals. In order to increase the sample no. and the uniformity of the individual sample, advantage was taken of the fact that the maturity of individual ears harvested at the same time varies significantly. Ears from individual harvests were divided into 2 or 3 maturity groups based on kernel color. Four ear samples were selected from each group and each ear was broken near the middle. This was necessary because there is a maturity gradient along the ear. In preliminary sampling tests, this gradient was reflected in a higher respiration rate for kernels near the tip of the ear compared to that obtained with kernels near the base of the same ear. A single kernel which was fully exposed at the break was excised by cutting the rachis with a scalpel just below the base of the kernel. Adherent fragments were removed with a tweezer. One kernel from each ear was used to make a 4 kernel sample. The process was repeated to make a duplicate sample. The duplicate samples were weighed and transferred to Warburg flasks. The step was taken within 1 hr after harvest.

Respiration was measured with a Gilson Differential Respirometer (2). The water bath was held at 30°C. Samples were incubated for 30 min. After this time, O2 uptake was measured for 20 min. The accumulated value was corrected to a 760 mm barometric reading. The kernels were then placed in a dessicator cooled to room temp and weighed.

Respiration results are reported as µl of O2 uptake per min per g of dry wt. Estimates of kernel maturity were based on the % moisture as calculated

![Graph](image-url)

**Fig. 1.** Respiration rates of sweet corn cultivars at various levels of % kernel moisture.

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1. Received for publication July 31, 1973.

2. Professor of Vegetable Crops, Department of Horticulture.

Literature Cited


