

## RATE OF COLOR BREAK OF TOMATOES AS INFLUENCED BY PREHARVEST LOW-LEVEL APPLICATIONS OF ETHEPHON<sup>1</sup>

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**Abstract.** 'Walter' and 'Florida MH-1' tomato plants were sprayed with 50 to 1000 ppm of ethephon prior to harvest. Fruits were harvested, sized and separated into colored and green types. The green fruits were held at 20°C, and the number of breakers were recorded daily for large (6 x 6), medium (6 x 7) and small (7 x 7) tomatoes. In general, the higher ethephon levels tended to increase the percent of fruit showing color during the first 6 days after harvest. An application of ethephon 5 days prior to harvest appeared to be more effective than if applied only 2 days before harvest. The effectiveness of ethephon appeared to be limited to one maturity. There was no difference in firmness of ripened fruits.

Applications of 2-chloroethylphosphonic acid (ethephon) stimulate tomato fruit ripening whether applied before or after harvest (1, 2, 4, 5, 6, 7). Much of the work was done with processing tomatoes where it was desirable to get as much of the fruit completely ripe as possible (6). Preharvest applications of ethephon have been applied to fresh market tomatoes in order to ripen fruit on the vine (1, 6, 7).

The majority of tomatoes produced in Florida are harvested mature green. The fruit usually goes from packing line to ripening rooms where it receives ethylene gas to bring about more uniform ripening. Duration of ethylene treatment may be from 1 to 4 days depending on fruit response and amount of color desired by the buyer.

The work reported here was conducted to test the possibility of preharvest ethephon application to promote postharvest ripening of tomatoes. Relatively low concentrations of ethephon were ap-

plied and a wide range of fruit maturity was tested in an effort to find a concentration of ethephon which would stimulate ripening of mature fruit without ripening immature fruit or causing plant injury. A response of this type would allow harvesting mature-green tomatoes, eliminate some of the problem with immature fruit and remove the necessity of special ripening rooms.

### Materials and Methods

'Walter' tomatoes, growing in a commercial field in Dade County, were sprayed on February 29, 1972, with 0, 50, 100, 200, or 400 ppm ethephon. 'Florida MH-1' tomatoes in an adjoining block were sprayed with 0, 50, or 200 ppm ethephon on the same date. Each treatment consisted of 20 feet of row and different rows were used for the 3 replications. Treatments were at random within the row. The 'Walter' tomatoes were harvested during the afternoon of March 2, 1972 and the 'Florida MH-1' fruits were harvested during the morning of March 3, 1974. All fruits size extra small (7 x 8) and larger were harvested. Immediately after harvest, the fruit was sized, graded and separated into red, pink and green color classes. The green large, medium and small fruits of both varieties were transported to Gainesville during the afternoon of March 4. The tomatoes were held at 20°C and 90-95% R.H. and examined daily for the development of pink color on the blossom end (color break).

An additional test involving 'Florida MH-1' was sprayed with 0, 125, 250, 500, or 1000 ppm ethephon on March 18, 1972 and harvested 5 days later. The harvesting, grading, and handling procedures were the same as above. Firmness was determined on the ripe fruit from all tests by means of a Cornell Pressure Tester.

### Results

The ethephon treated 'Walter' and 'Florida MH-1' tomatoes harvested 2 and 3 days after application respectively, were not significantly different from the controls in the percent of fruits showing color within any size either 3 or 6 days after harvest (Tables 1 and 2). There was a difference among sizes in that the large fruit had the greatest percentage showing color and the small tomatoes had the least percentage showing

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Table 1. The effect of ethephon sprays applied 2 days before harvest on the percentage of 'Walter' tomatoes showing color 3 and 6 days after harvest.

Ethephon ppm	Fruit showing color (%)					
	3 days aft harv			6 days aft harv		
	Fruit size			Fruit size		
	lg.	med.	sm.	lg.	med.	sm.
0	16a <sup>z</sup>	4a	2a	83a	40ab	16a
50	36a	5a	0a	92a	52ab	19a
100	18a	4a	0a	80a	30a	13a
200	30a	7a	2a	86a	56b	21a
400	39a	7a	2a	87a	47ab	22a

<sup>z</sup>Numbers within a column followed by different letters are significantly different at the .05 level (Duncan's Multiple Ranges Test).

color. Six days after harvest 'Walter' fruit showed significantly more medium tomatoes with color from the 200 ppm ethephon treatment than comparable fruit which received 100 ppm.

Small 'Florida MH-1' tomatoes from the plots which received applications 5 days prior to harvest showed a significant increase in color development 6 days after harvest with increased ethephon concentration (Table 3).

Although there was no difference in color development of the large fruit of the two varieties, the small and medium 'Florida MH-1' had a higher percentage of the control fruit showing color 6 days after harvest than the comparable 'Walter' samples.

Table 2. The effect of ethephon sprays applied 3 days before harvest on the percentage of 'Florida MH-1' tomatoes showing color 3 and 6 days after harvest.

Ethephon ppm	Fruit showing color (%)					
	3 days aft harv			6 days aft harv		
	Fruit size			Fruit size		
	lg.	med.	sm.	lg.	med.	sm.
0	58a <sup>z</sup>	22a	12a	93a	65a	43a
50	52a	19a	4a	99a	64a	31a
200	65a	34a	4a	96a	87a	39a

<sup>z</sup>Numbers within a column followed by different letters are significantly different at the .05 level (Duncan's Multiple Ranges Test).

Ethephon treatments had no effect on the percentage of fruit showing color at harvest nor firmness of the ripened fruit in any of the tests.

### Discussion

There was no significant response in the percentage of fruit showing color 3 days after harvest. This was particularly evident when the plots were sprayed either 2 or 3 days before harvest. Dennis, et al (4), have shown that when tomatoes on the plant were sprayed with 10,000 ppm ethephon there is an immediate burst of ethylene which quickly subsides and is followed about 4 to 5 days later by a gradual, more natural increase in ethylene production. The lack of increase in the amount of color both at harvest and 3 days later may have been due to lack of absorption or the time interval was too short for the normal ethylene production to cause an effect. The fact that 'Florida MH-1' showed more response to ethephon when harvested 5 days after application than when harvested 3 days after indicates that 3 days was not sufficient for these concentrations to promote ripening.

Six days after harvest the small control fruits ranged from 16% (Walter) to 43% (MH-1) showing color. On the other hand, the comparable large fruit ranged from 80% to 93% (both MH-1). It is apparent that although the mean maturity within each harvest does relate to fruit size, there is a wide range of maturities within each size and in this case the mean maturity for a particular size varied between lots of tomatoes. The difference in the size-maturity relationship between varieties

Table 3. The effect of ethephon sprays applied 5 days before harvest on the percentage of 'Florida MH-1' tomatoes showing color 3 and 6 days after harvest.

Ethephon ppm	Fruit showing color (%)					
	3 days aft harv			6 days aft harv		
	Fruit size			Fruit size		
	lg.	med.	sm.	lg.	med.	sm.
0	42a <sup>z</sup>	19a	3a	80a	53a	34a
125	41a	20a	9a	83a	58a	30a
250	57a	18a	13a	78a	56a	46b
500	59a	32a	19a	83a	68a	51bc
1000	45a	30a	21a	88a	58a	56c

<sup>z</sup>Numbers within a column followed by different letters are significantly different at the .05 level (Duncan's Multiple Ranges Test).

was probably influenced by the fact that 'Florida MH-1' has a more concentrated pattern of fruit set than 'Walter' (3) and therefore, had less difference in the physiological stage of development among sizes. If the effectiveness of ethephon was limited to a particular stage of maturity, some effect might be shown in all size groups but should be most pronounced in the size that had the greatest percentage of fruits between the mature and immature stages. The fact that ethephon was effective on only one size of each lot indicated that the higher concentrations were sufficient to stimulate ripening in fruits that were on the borderline. The more mature samples were probably producing ethylene to the point where that produced by the ethephon provided no additional stimulus. On the other hand, the less mature fruits were probably not developed to the point where the level of ethylene produced by ethephon was sufficient to stimulate natural production.

In contrast to Crill, et al (2), who found no effect of maturity on rate of ripening, there was an effect of maturity on ripening of both control and ethephon treated fruits. The maturity range in this study was probably much greater because different size fruits were utilized. Iwahori and Lyons (5) found that preharvest applications of

ethephon had the same effect on age of fruit at color break whether the applications were made at 15 or 35 days after anthesis.

The response indicates a potential for preharvest applications of ethephon to concentrate post-harvest ripening of fruit harvested mature green. There is also a possibility of using a relationship between concentration of ethephon and time between application and/or harvest and color break on the fruit to eliminate immature fruit.

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## ABG-3030: AN ABSCISSION CHEMICAL FOR PROCESSING ORANGES: ANALYTICAL, RESIDUE AND ENVIRONMENTAL CONSIDERATIONS

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**Abstract.** ABG-3030 is under development as an abscission agent for processing oranges. Analytical procedures developed for the detection of this material in citrus and citrus by-products is described. Data on the fate of ABG-3030 and its distribution within the environment is presented.

#### Materials and Methods

**Location.** Experiment Station, Lake Alfred, Florida.

**Application.** Active ingredient of ABG-3030 at 250 ppm sprayed at 15 gal./tree (3 lb./acre) containing surfactant X-77 (Colloidal Products, Inc.) at 8 oz./100 gal.

**Code.** Treatment 1, control; treatment 2, spray date April 1, 1974; treatment 3, spray date April 4, 1974. All treatments mechanically harvested April 5, 1974, stored in cold room before washing April 8, 1974 and processed April 9, 1974.

**Citrus Processing Procedure.** Oranges were processed in the same manner as a commercial

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