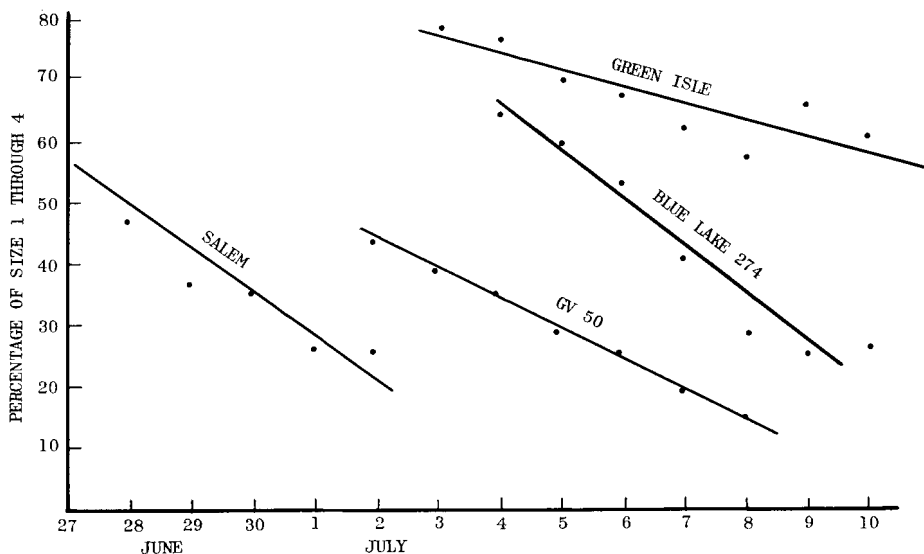


through 4 was 133 lbs per acre for Blue Lake 274, 154 lbs per acre for GV 50, 74 lbs per acre for Salem, and 128 lbs per acre for Green Isle.

In all four varieties there was a high correlation of pod size (in terms of pounds per 100 pods) with date of harvest. Pod size in terms of pounds per 100 pods increased at the rate of .073 lb for Blue Lake 274, .057 lb for GV 50, 0.73 lb for Salem, and .013 lb for Green Isle.

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CORRELATIONS OF BUSH SNAP BEAN PERCENTAGE OF SIZES 1 to 4 WITH DATE OF HARVEST



ACCELERATING tomato fruit maturity WITH ETHREL

SHUICHI IWAHORI • JAMES M. LYONS

THE NEW GROWTH REGULATOR, Ethrel (2-chloroethyl phosphonic acid), is similar in action to ethylene in its effects on various plant processes: it accelerates post-harvest ripening of tomato, banana, and honeydew melon fruits; it induces flowering in pineapple plants; it causes female flower differentiation in cucumber plants; and it acts as a thinning agent by accelerating abscission of flowers and young fruit in certain trees and by loosening fruit at harvest to aid mechanical harvesting. These experiments were initiated to examine the effects of Ethrel on growth and maturation of tomato fruit

on the vine under both greenhouse and field conditions.

Greenhouse trials

Of a group of tomato plants (cv. VF 480) grown in the greenhouse, each flower on the first to third clusters was tagged at anthesis. Ethrel at 500 ppm was sprayed on each fruit with a small hand sprayer. The chronological age of the fruit at treatment time varied from 15 to 35 days after anthesis. The date of the first appearance of red color (breaker) was recorded and, thereafter, ripening of fruit was determined daily as follows:

(1) breaker; (2) up to 25 per cent pink; (3) 25 to 50 per cent pink; (4) 50 to 75 per cent pink; (5) full red color, still firm; and (6) red and soft.

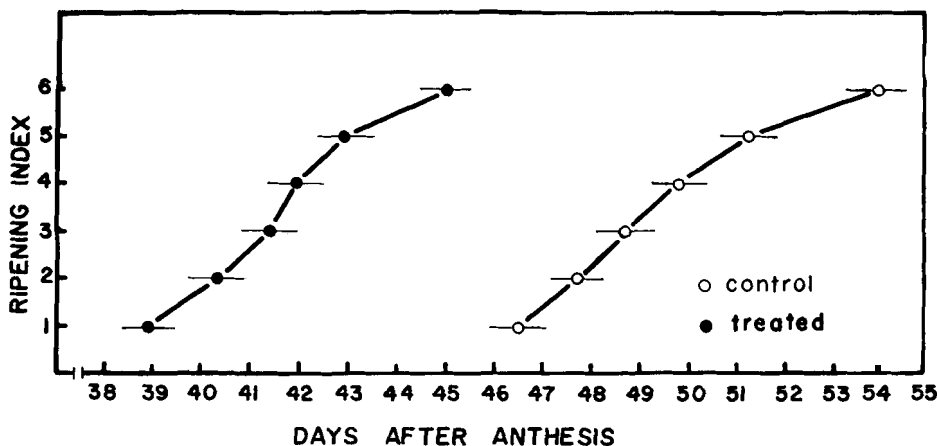
Maturation of tomato fruit treated with 500 ppm Ethrel was accelerated by seven days, while fruit weight remained the same as for the control fruit (graph 1). The treated fruit reached the breaker stage 39 days after anthesis, while the control fruit reached the same stage in 46 days. While maturation of the fruit was accelerated markedly by the treatment, the ripening process on the vine, as evidenced by color change, was only slightly affected.

Thus, Ethrel-treated fruit reached full red color (or index 5) four days after the breaker stage, and the control fruit in five days. The age of the fruit at time of treatment had no effect on the number of days they took to mature. In another trial, Ethrel at 250 ppm sprayed on individual fruit 14 days after anthesis or when they

EFFECTS OF ETHREL ON YIELD OF FIELD-GROWN TOMATO FRUIT

Treatment	Yield per plant		Number of fruit		Early yield	Early number of	Average fruit weight
	lb	(index)*	Av. no.	(index)*	per plant	fruit per plant	
Control	8.36	(1.52)*	28.1	(6.5)*	0.93	3.0	4.56
250 ppm Ethrel	13.96	(0.90)	53.8	(3.7)	6.00	44.3	4.13
1000 ppm Ethrel	8.27	(1.61)	36.1	(7.5)	3.40	27.0	3.62

* Value in parentheses is for green fruit picked at the end of experiment (Sept. 19). Early yield harvested by Aug. 26.



Graph 1. Effect of Ethrel on maturation and ripening of tomato fruit. Ethrel was applied at 500 ppm when fruit were 15 to 35 days old. Ripening index: 1—breaker; 2—up to 25 % pink; 3—25 to 50% pink; 4—50 to 75% pink; 5—full red color, firm; 6—red and soft.

were at the mature green stage, did not alter the pattern of fruit growth nor final size, but accelerated maturation considerably. Thus, Ethrel can be applied over a wide range of time—a fact of considerable importance in commercial use of the material.

As a result of the accelerated maturation, the early yield was markedly increased by the treatment, although the total yield remained approximately the same. About 75 per cent of the total yield was harvested in the treated plot 10 days earlier than in the control. This time saving would be a significant advantage to many commercial growers for fresh market.

Fruit quality

Both treated and control fruit were sampled at various ripening stages to study the effects of Ethrel on certain internal quality factors. Juice was obtained by crushing the fruit with a juicer just after sampling and filtering it through three layers of cheesecloth. PH, titratable acidity and total soluble solids were measured.

The pH was lowest at the breaker stage and gradually increased as the fruit ripened (graph 2A). No difference was observed between the treated and the control fruit. The change in acidity correlated adversely with change in pH. Thus, acidity was highest at the breaker stage and then decreased as the fruit ripened (graph 2B). The treated fruit had somewhat higher acidity than the control from breaker through ripening index 3. At the fully ripened stage (indexes 5 and 6), however, no difference was observed. The soluble solids content of the fruit varied considerably, and there was essentially no consistent change

through ripening. The treated fruit contained somewhat higher content of solids than the control (graph 2C). Thus, after it had accelerated maturation of the fruit, Ethrel exerted no undesirable effects on the fruit's quality.

Field trial

In a field trial, tomato plants (cv. VF 428) were direct-seeded and grown under regular cultural practices. Two days before the first harvest, Ethrel at 250 and 1,000 ppm was sprayed on whole plants. The treatments were replicated three times in a randomized block design. Fruits were harvested twice a week over a 44-day period when they developed to the breaker or more advanced stages. Upon termination of harvest all green fruits of marketable sizes were also picked.

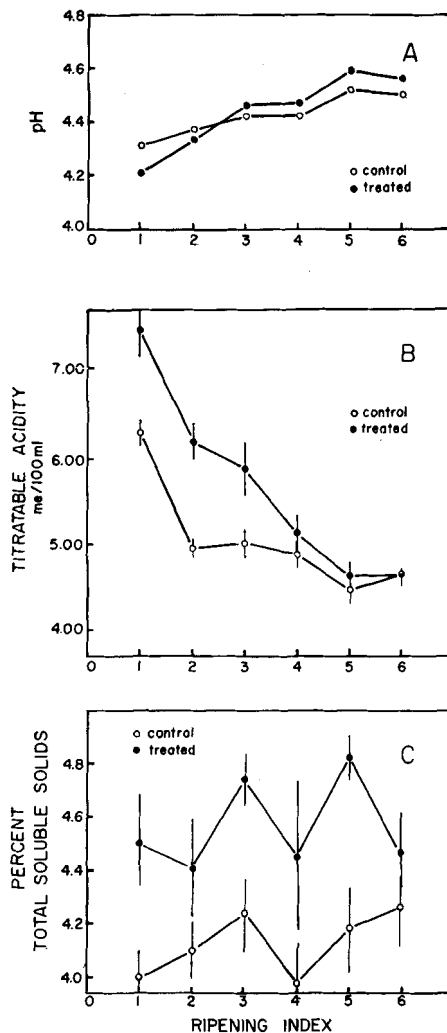
There was some yellowing and senescence of leaves observed after the Ethrel applications—especially at 1,000 ppm. The symptoms were not severe, however, and did not appear to present a serious limitation. Although the date of the beginning of harvest was the same in all the plots, Ethrel at 250 and 1,000 ppm increased early yield considerably, both in the number and weight of fruit (table 1). The total yields of the control and of the 1,000 ppm-Ethrel plots were the same. The effect of Ethrel at 1,000 ppm in this experiment was to shift the yield toward earliness without influencing total yield. However, Ethrel at 250 ppm increased both the total yield and the early yield. Tomato fruits with the Ethrel treatment tended to be smaller, although they were not significantly different from the controls.

In a commercial field in San Diego, 1,000 ppm Ethrel was sprayed on 40-day-

old tomato fruit (cv. Grand Pak) which were either treated with 4-CPA or pollinated by mechanical vibration. Again, Ethrel-sprayed fruit matured several days earlier than the corresponding pollinated or 4-CPA-sprayed control.

Ethrel accelerated maturation of tomato fruit on the vine, either when sprayed on individual fruit under greenhouse conditions, or when sprayed on the whole plants under field conditions just prior to harvest. Fruit size was not affected by the treatment. The Ethrel-treated fruit also had the same quality as the control fruit in terms of pH, titratable acidity, and total soluble solids.

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Graph 2. Effect of Ethrel on (A) pH, (B) titratable acidity, and (C) total soluble solids of tomato fruit at various ripening stages.