SOME EFFECTS OF ETHREL ON RIPENING AND YIELD OF DWARF TOMATOES

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SUMMARY

The experiments demonstrated under New Zealand conditions that ethrel application, by significantly increasing the proportion of rip fruit at a single harvest, provides a means for facilitating mechanical harvesting of dwarf tomatoes. The chemical's effect was influenced by time of application, time of harvest after application, environmental factors and by variety.

INTRODUCTION

The growth regulating chemical 2 chloroethane phosphonic acid (ethrel) applied as a preharvest spray has been shown to accelerate ripening of tomato fruit (Robinson et.al. 1968, Collin 1969, Iwahori et.al. 1969, Sims 1969). Application of the chemical to dwarf tomato plants in the field offers the possibilities of obtaining a higher proportion of ripe fruit and of increasing yield at a single harvest in dwarf tomatoes.

This paper describes experiments which examined the effects of applying ethrel at different times, and the time of harvest after application on the proportion and yield of ripe fruit obtained at a single harvest in a number of varieties of dwarf tomatoes. Experiments were conducted at both Levin and Hastings.

MATERIALS AND METHODS

For all experiments plants were raised in boxes and trans-planted 0.6 m apart in 1.5 m rows in the field during November. In the Levin experiments 10:18:8 fertiliser at the rate of 900 kg/ha and in the Hastings experiment dried blood 190 kg, superphosphate 625 kg and sulphate of potash 250 kg/ha was applied before transplanting. Regular spraying for pest and disease control was carried out.

Each experiment was laid down using a split plot design. There were four replicates of each treatment.

At the appropriate time plants were sprayed to run off with water or an aqueous solution of 2500 ppm ethrel containing 0.5% "Shellestol" wetting agent.

In the single destructive harvest at the end of each experiment yield of red ripe fruit and total yield were recorded.

The meteorological records kept at Levin H.R.C. and at Hastings were consulted for temperature, rainfall and soil moisture figures.

1. Time of Application Experiments:

The variety Sleaford Abundance, an F_1 hybrid in which individual plants mature evenly was used. two experiments were undertaken at Levin, the first using plants which were trans-planted in early November, the second using plants which were trans-planted in late November 1969.

One treatment was applied when about 15% of the fruit on individual plants was pink or red ripe, others when 25%, 35% or 50% respectively of the fruit was coloured.

Harvests were made 10 days after ethrel had been applied except after the first two applications to the late November planting, when half the plot was harvested 10 days after treatment and half 17 days after treatment.

2. Time of Harvest Experiments:

One experiment using varieties Scoresby Dwarf, Sleaford Abundance, Primabel, Tamu Chico III, Stonors Dwarf Gem, R16-13 and V6810 was planted at Levin in early November 1970. Another experiment using varieties Scoresby Dwarf and Stonors Dwarf Gem was planted at Hastings in early November 1970. Treatments were applied when approximately 15% of the fruit was coloured. Harvests of one-third of each plot were made 10, 15 or 20 days after treatment.

RESULTS

1. Time of Application Experiments:

A significantly higher proportion of red rip fruit was obtained from ethrel treated plants than from untreated plants ten days after the first and second applications in the early November planting and 17 days after the first application in the late November planting (Table 1). Though yield was higher in treated than in untreated plants on these three occasions also, on only one, the first application in the late November planting, was the difference significant (Table 1). After all other ethrel applications there were no significant differences in the proportion or yield of red ripe fruit from treated and untreated plants in both plantings (Table 1).

TABLE 1: Proportion (% by weight) and Yield (kg/ha) of Ripe Fruit From Early and Late November Plantings. 10 and 17 days After Ethrel Treatment.

% Ripe at Start	Ethrel Concn.	Proportion 10 days	Proportion 17 days	Yield 10 days	Yield 17 days
Early November Planting					
15	0	40	--	17830	--
	2500	75*	--	23850	--
25	0	40	--	14320	--
	2500	65*	--	22350	--
35	0	48	--	15820	--
	2500	58	--	18830	--
50	0	48	--	18080	--
	2500	55	--	15820	--
Late November Planting					
15	0	23	47	12810	24610
	2500	29	69*	22850	38670
25	0	37	72	13060	36660
	2500	37	81	22850	45200
35	0	69	--	38170	--
	2500	68	--	36660	--
50	0	74	--	43190	--
	2500	70	--	39920	--

* Values for 2500 ppm are significantly higher than corresponding values for 0 ppm at the 5% level.

2. Time of Harvest Experiments:

In the Levin experiment a significantly higher proportion of red ripe fruit was obtained from ethrel treated plants than from untreated plants 10 days after ethrel was applied in all varieties except Primabel and Stonors Dwarf Gem (Table 2). After 15 days the proportion of ripe fruit was significantly higher in treated plants in all varieties except Sleaford Abundance (Table 2). After 20 days only two varieties, Tamu Chico III and V6810, had a significantly higher proportion of ripe fruit from treated plants (Table 2).

As in the time of application experiments, however, a significant increase in the proportion of ripe fruit did not always lead to a significant increase in yield of ripe fruit (Table 2).

In the Hastings experiment the results for varieties Scoresby Dwarf and Stonors Dwarf Gem were similar to those of the Levin experiment (compare Tables 2 and 3). However, the noticeable increase in proportion of ripe fruit after ethrel treatment occurred slightly later than at Levin.

TABLE 2: Proportion (% by Weight) and Yield tonnes/hectare of Ripe Fruit 10, 15 and 20 Days After Ethrel Application in Seven Dwarf Tomato Varieties Grown at Levin H.R.C.

Variety	Ethrel ppm	Proportion			Yield		
		10 Days	15 Days	20 Days	10 Days	15 Days	20 Days
Scoresby	0	30	36	34	30.1	3.49	30.3
	2500	47*	52*	50	46.7	44.7	46.9
Sleaford	0	29	66	73	21.8	47.0	40.4
	2500	49**	69	72	30.3	45.4	43.1
Primabel	0	20	36	40	15.8	29.3	38.4
	2500	33	55**	56	28.8	48.4*	50.4
Tamu Chico III	0	31	33	41	22.6	23.6	27.1
	2500	54**	70**	61*	34.9	46.2**	36.9
Stonors	0	17	33	43	14.8	26.6	31.8
	2500	27	63**	46	20.5	42.1	36.1
R16-13	0	25	34	34	14.3	18.0	21.5
	2500	48**	56**	41	20.0	25.1	17.8
V6810	0	24	39	38	11.3	23.8	19.8
	2500	47**	57**	61**	19.8	26.3	28.1

*, ** values for 2500 ppm significantly higher than corresponding values for 0 ppm at the 5% or 1% level respectively.

TABLE 3: Proportion (% by Weight) and Yield (tonnes/hectare of Ripe Fruit 10, 15 and 20 Days After Ethrel Application in Scoresby Dwarf and Stoners Dwarf Gem Grown at Hastings.

Variety	Ethrel ppm	Proportion 10 Days	15 Days	20 Days	Yield 10 Days	15 Days	20 Days
Scoresby	0	20	35	37	19.8	39.2	34.9
	2500	33*	50*	51*	29.1	46.7	50.0
Stoners	0	15	24	32	11.5	13.8	21.1
	2500	21	35	56**	13.3	19.3	31.1

*, ** values for 2500 ppm significantly higher than corresponding values for 0 ppm at the 5% or 1% level respectively.

DISCUSSION

A significantly higher proportion of red ripe fruit was obtained where plants had been treated with ethrel than where plants were not treated. The application of ethrel provided a means of obtaining a higher proportion of red ripe fruit from a single harvest in dwarf tomatoes. These results are of significance in New Zealand, since most varieties at present grown here do not ripen evenly nor is the proportion of ripe fruit at a single harvest ever very high. The application of ehtrel to these varieties would have the advantages of accelerating ripening and increasing the maximum proportion of ripe fruit that could be obtained at a single harvest, and thus make single harvesting, whether by machine or by hand, a worthwhile proposition. In varieties which would give a high proportion of ripe fruit without ethrel treatment in New Zealand conditions, the application of ethrel would have the advantage of accelerating ripening, as ethrel treatment did with variety Sleaford Abundance in these experiments.

The yields obtained in these experiments were higher, though not always significantly higher, in treated compared with untreated plants every time ethrel application gave a significant increase in proportion of ripe fruit. The large variation in yield between varieties would have obscured some significant differences. The maximum yields, of between 37500 and 50000 kg/ha obtained from all varieties except R16-13 and V6810 and Stonors Dwarf Gem at Hastings suggest that ethrel application, particularly at a spacing closer than the 1.5 m by 0.5 m spacing used in these experiments, would give economic yields at a single harvest.

An increased proportion of ripe fruit was obtained in these experiments if ethrel was applied when between 15% and 25% of the fruit was pink or red ripe. Though it could be concluded that an increase in proportion of red ripe fruit is unlikely if ethrel is applied when more than 25% of the fruit is coloured, other workers (Robinson et.al. 1968, Sims 1969) have obtained an increase if ethrel was applied when up to 65% of the fruit was coloured. A decision on the optimum time of application is not possible yet.

In these experiments the optimum time for harvest was about 15 days after ethrel was applied. The time taken for treated fruit to ripen would probably depend on variety and environmental conditions. Some varieties in these experiments, particularly Primabel and Stonors Dwarf Gem ripened more slowly that others. In lower temperatures than the 18°C to 19.5°C mean temperatures which prevailed in these experiments ripening could be slower. Sims (1969) found that fruit ripened more slowly in cooler temperatures late in the season. Soil moisture also appears to affect the response to ethrel treatment. Under very dry conditions, such as existed when ethrel was applied at the first two times to the late November planting in the time of application experiment, treated plants ripened more slowly than when conditions were more moist, as in the remainder of the experiment. In glasshouse experiments conducted since this field observation was made, treated plants have taken about three days longer to ripen in dry than in moist conditions (Bussell, unpublished data).

These experiments have indicated that ethrel application has a potential in aiding single harvesting of dwarf tomatoes under New Zealand conditions. However, further studies on the time of application, the time of harvest after application, the influence of environmental factors, and spacing will be needed before the full value of ethrel application for ripening tomatoes can be ascertained.

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REFERENCES

Collin, G.H., 1969: Field Application of Ethrel to Hasten Tomato Ripening. Rep. Hort. Res. Inst., Ontario 1968: p.41.

Iwahori,S., Ben Yehoshua, S., and Lyons, J.M., 1969: Effect of 2-Chloroethane phosphonic Acid on Tomato Fruit Development and Ripening. Bioscience 19, 40.

Robinson, R.W., Wilczynski, H., and Dennis, F.G., Jnr., 1968: Chemical Promotion of Tomato Fruit Ripening. Proc. Amer. Soc. Hort. Sci., 93: 823.

Sims, W.L. 1969: Effects of Ethrel on Ripening of Tomatoes - Greenhouse, Field and Post Harvest Trials. Calif. Agric., 23:(7), 12.