Table 1. Effect of GA_3 on bolting of onions, Yuma, Ariz., 1981. Sprayed once on March 7, 1981 (53-cm average height).

GA_3[z] concn (ppm)	Bolting May 13, 1981 (%)	Mean no. plants per 15-m row	Seed yield (g/m)	Seed wt (g/1000 seed)	Germination (400 seed, 10-day at 20°C) (%)
0	65.5 c[y]	1100	45.3 c	2.88 b	22.5
25	74.7 b	1060	59.0 b	2.88 b	30.5
50	81.9 ab	1180	67.6 ab	3.02 ab	22.8
500	84.4 a	1220	74.6 a	3.04 a	25.5
Increase of 500 over 0 ppm	23.0%	NS	39.3%	5.3%	NS
"Reference" (field planted 1 mo. earlier)			82.3	3.44	35.2

[z]Sprayed once on March 7, 1981; 53-cm average height.
[y]Mean separation in columns by Duncan's multiple range test, 5% level.

The results of our 50 ppm of GA_3 applied in 731 liters/ha of water are comparable to results reported by Corgan and Montano (1). Their single application of GA_3 at 1000 ppm was applied in either 150 or 300 liters/ha of water. The response we obtained with only 50 ppm may indicate that the use of GA_3 is economically feasible when planting dates have been delayed by rain, other unavoidable problems, or management decisions. In agreement with Naamni et al. (2), we visually observed more uniformity in plant height and earliness in bolting with less lodging in the higher GA_3 treatments. Further, when synchrony of bloom between the fertiie and sterile lines is anticipated to be a problem, 1 treatment with GA_3 might be used to achieve the synchrony of bloom. These attributes could benefit the grower and beekeeper (who supplies pollinators) in developing a uniform crop for earlier harvest with fewer lodging problems. Additional tests are needed in different geographical regions to determine the optimum treatment level and date (physiological stages) for application.

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Effect of Ethephon on Carrots[1]

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Additional index words. *Daucus carota*, growth regulator, (2-chloroethyl)phosphonic acid

Abstract. **Field application of (2-chloroethyl)phosphonic acid (ethephon), to carrots (*Daucus carota* L. cvs. Spartan Bonus and Spartan Fancy) at 136 g/ha in 1979 and at 92, 136, and 364 g/ha in 1980, reduced leaf lengths of 'Spartan Bonus' by 20% and 'Spartan Fancy' by 11%. 'Spartan Bonus' yield increased 17% in 1979 and 37% in 1980 with applications of ethephon, but 'Spartan Fancy' yield was unaffected.**

Foliar applications of ethephon induce a number of effects on vegetable plants, including stunting of foliar growth, increased branching, stem elongation, and flowering alterations (3). Foliar applications of ethephon on greenhouse-grown carrots at the 2-leaf stage induced a slight growth check, after which the carrots recovered (3). The objective of this study was to assess the effect of ethephon on the yield of fresh market and processing carrots in the field.

These trials were conducted at the Michigan State University Organic Soils Research Station near East Lansing on a Houghton muck soil (Euic, Mesic, Typic, and Medisatrists).

1979 field trials. The carrots were sown May 10 with a Planet Jr. cone seeder using a 5.1-cm scatter shoe. The seedlings were thinned to 78 plants/m for 'Spartan Fancy' and 52 plants/m for 'Spartan Bonus'. Each plot consisted of 3 rows 0.51 m apart by 7.6 m long. The 2 outer rows were guard rows, and the center rows were harvested. Each cultivar was considered a separate experiment due to the differences in cultivar type. 'Spartan Bonus', a processing Danvers type, requires a long growing season (ca. 120 days) for horticultural maturity, and has large, vigorous foliage. 'Spartan Fancy', a fresh market Imperator type, reaches horticultural maturity in 90 to 100 days, has less vigorous foliage, and produces about half the total yield as a Danvers type. The experiments were designed as randomized complete blocks with 3 replications. Both cultivars were treated with rates of 0 and 136 g ethephon in 374 liters water/ha as a foliar spray with a hand-carried CO_2-powered sprayer. 'Spartan Fancy' was treated July 3 and 'Spartan Bonus' was treated August 9, about 6 weeks before the expected harvest dates. 'Spartan Fancy' and 'Spartan Bonus' were harvested August 17 and October 2, respectively. Root fresh weight measurements were obtained by sampling 3 m of row from each plot. Soluble solids of roots were determined by homogenizing 6 randomly selected roots in a Waring blender. The sample was extracted through cheesecloth and analyzed on a Bausch and Lomb ABBE-3L refractometer. Percentage of dry matter was determined by cutting 0.5 kg of root samples into 1-cm^3 sections and drying for 4 days at 50°C until constant weights were obtained.

'Spartan Bonus' treated with ethephon yielded significantly more root fresh weight (24.7 MT/ha) than untreated controls (21 MT/ha). However, untreated 'Spartan Bonus' carrots had significantly higher soluble solids in roots (10.1%) than those treated with ethephon (9.4%). 'Spartan Bonus' treated with ethephon contained less dry matter (9.2%) than untreated controls (10.1%). This indicates that the increase in fresh weight was due primarily to an increase in water content. Root fresh weights, soluble solids of roots, and percentage of dry matter of 'Spartan Fancy' were unaffected by ethephon application.

1980 field trails. Both cultivars were sown on May 6 with identical design and cultural practices as in the 1979 field trials. Foliar sprays of 0, 92, 136, and 365 g ethephon in 374 liters water/ha were appplied to 'Spartan Fancy' on July 2 and to 'Spartan Bonus' on September 2. 'Spartan Fancy' was harvested on August 12 and 'Spartan Bonus' was harvested on September 29. Root fresh weights and soluble solids of roots were sampled and analyzed as in the 1979 trials, except per-

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Table 1. Effect of ethephon on root yield and shoot length of 'Spartan Bonus' and 'Spartan Fancy' carrots, 1980.

Ethephon (g/ha)	Yield (MT/ha)		Shoot length (cm)	
	S. Bonus	S. Fancy	S. Bonus	S. Fancy
0	17.5 c[z]	14.1 a	78 a	60 a
92	22.3 b	13.3 a	70 b	58 a
136	22.8 b	14.3 a	70 b	59 a
365	24.1 a	13.8 a	62 b	53 b

[z]Mean separation in columns by Tukey ω-procedure, at the 5% level.

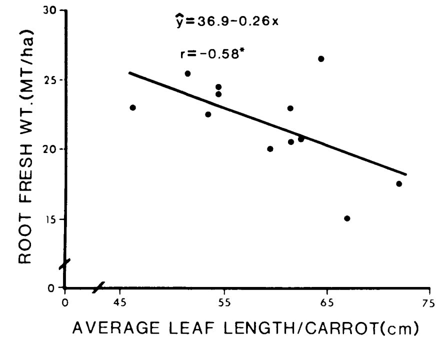

Fig. 1. Relationship of root fresh weight and average leaf length of 'Spartan Bonus' carrots treated with ethephon.

centage of dry matter data was not obtained. Additional parameters measured for 1980 trials were root diameters and root and shoot lengths. Root diameters were measured at the root shoulder. Root and leaf lengths and root diameter of 15 plants/plot were measured. Data from the 1980 experiments were analyzed using the Tukey ω-procedure or correlation analysis where applicable.

Total root fresh weights of ethephon-treated 'Spartan Bonus' carrots were consistently higher than controls (Table 1). The highest concentration of ethephon resulted in the greatest yield. 'Spartan Fancy' root fresh weight was unaffected by ethephon rate. Root diameters, soluble solids of roots, and root lengths of 'Spartan Bonus' and 'Spartan Fancy' were unaffected by ethephon treatments. 'Spartan Bonus' root fresh weight was inversely correlated with leaf length ($r = -0.58$) (Fig. 1). Leaf lengths of both cultivars were reduced by ethephon application.

The differences in response of the 2 carrot cultivars to ethephon was probably due to differences in their relative maturity at time of application. Imperator-type fresh market carrots ('Spartan Fancy') are harvested immature, while leaves and roots are still actively growing (2). Danvers-type processing carrots ('Spartan Bonus') are harvested at a more mature stage, after foliar growth has declined. Since translocation into sinks increases near maturity (1), ethephon may have enhanced the movement in 'Spartan Bonus', but had no effect on the less mature 'Spartan Fancy'.

The increase in root fresh weight of 'Spartan Bonus' after ethephon application appeared to be due to an increase in water content, since both percent of dry weight and soluble solids declined. Since the increase in yield of processing carrots appeared to be only an increase in water content, and there was no effect on yield of fresh market carrots, ethephon probably has little economic value in increasing carrot yield.

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Heat Adaptability of the Tomato[1]

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Additional index words. *Lycopersicon esculentum*, heat tolerance, heat acclimation

Abstract. **Leaf heat tolerances of 'Saladette' (heat tolerant) and 'UC-82B' (less heat tolerant) tomato (*Lycopersicon esculentum*, Mill) were evaluated after heat acclimation. When plants of both genotypes were grown in a temperature regime below 30°C, there was no difference in heat tolerance. When plants of both genotypes were exposed to a temperature regime of 35° (day/night), 'UC-82B' could reach a higher level of heat tolerance, similar to 'Saladette,' but 'UC-82B' required 6 cycles of high temperature exposure, whereas 'Saladette' needed only a single cycle.**

According to fruit set performance in the high temperature environment, Stevens and co-worker have specified the 'Saladette' tomato to be a heat-tolerant genotype (1, 10), and that 'UC-82B' is a less heat tolerant genotype (M. A. Stevens, personal communication). In a previous report (3), we observed that: 1) when plants were grown in temperature regimes below 30°C, leaf tissues of both genotypes were killed in about 15 min at 50°, indicating no tolerant difference; 2) both genotypes increased significant tolerance upon exposure of plants to temperatures above 30° for 24 hr, with a faster increasing rate in 'Saladette' than in 'UC-82B'; and 3) during a 48-hr acclimation at 35°, there was no further increase in heat tolerance in both genotypes after 24-hr exposure. We suspected, due to the prolonged high temperature stress (35°), that plants might be impaired and, thus, lose the acclimation capability, because the process of heat acclimation has been considered to be a specific reaction of the cells toward the injurious reaction of heat (2). In the present study, 'Saladette' and 'UC-82B' tomatoes were used in order to determine whether the environmentally induced heat tolerance is accumulative in the tomato.

Seeds obtained from the Department of Vegetable Crops, University of California, Davis, were directly planted in 15-cm-diameter pots with a mixture of 3 soil:2 sand:2 sphagnum peatmoss (by volume). Plants were thinned to 1 per pot and grown in a 14-hr photoperiod and 20°/15°C day/night (D/N) temperature regime (control). After 6 weeks, plants of each genotype were divided into 3 groups for the following heat treatments. The first group was treated in a chamber with a regime of 35° (D/N) temperature and 14 hr of light for 24 hr and then placed in the control. The second group was treated 3 times, first at 35° (D/N; 14 hr of light) for 24 hr and then in the control for 24 hr. The third group was treated the same as the second group, but with 6 cycles.

Following the conditioning treatment, mature leaves were excised and heat tolerance was evaluated immediately after the last heat treatment and after 24 and 48 hr in the control. Heat tolerance was determined by measuring the electrolyte leakage as previously

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