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CULTURAL RESEARCH WITH PROCESSING TOMATOES 1981-1984

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Studies on culture and physiology of tomatoes for processing were conducted at 2 locations of OARDC--Main Campus, Wooster, and the Vegetable Crops Branch (VCB), Fremont.

Research on the Wooster campus is usually of a preliminary nature and requires frequent observations and data collection. The soil is a Wooster silt loam with good uniformity throughout the experimental area. The plots receive 600 or 700 lbs/A of 10-20-20 fertilizer each year after plowing, but before final fitting for planting. No additional fertilizer was applied except for specific treatments. Diphenamid and chloramben were used for weed control according to standard recommendations. Other pesticides were applied according to recommended practice. No serious problems with weeds, insects or diseases occurred during the 4 years of studies. Rainfall and temperature data are summarized in Table 1.

Soil at VCB ranges from a sandy loam to a clay loam and every effort is made to have maximum uniformity within a particular study. The clay loam soil is fall bedded using a power bedder. The sandy soil is bedded in the spring prior to planting. The beds are on 60-inch centers with 48-inch tops and furrows 6-8 inches deep. The P & K fertilizer is applied after plowing in the fall or spring but before bed formation. Nitrogen is applied in the spring immediately prior to planting and usually incorporated 1-2 inches deep at the same time as the herbicide incorporation. The herbicides used were napropamide (Devrinol) and/or metribuzin (Sencor or Lexone) at recommended rates. Insecticides and fungicides were also used according to standard recommendations. Generally, no serious weed, insect or disease problems occurred, although bacterial speck and/or spot were evident in a few studies.

Additional specific details are given with each study.

2/85-400

TABLE 1. Temperature and Rainfall Data.

	Averge Temperatures (°F)				Rainfall (in.)			
	1981	1982	1983	1984	1981	1982	1983	1984
			Wooster Campus					
April	51.0	43.6	46.0	47.3	4.51	1.47	5.04	3.97
May	56.5	64.0	54.9	54.3	3.61	3.77	4.69	5.38
June	68.6	63.1	67.3	69.4	5.31	4.70	2.29	1.66
July	71.2	70.5	72.9	68.6	3.29	2.54	4.38	2.94
August	68.5	65.3	72.6	69.7	2.13	2.71	1.51	5.09
September	61.0	60.1	63.6	60.0	3.65	2.40	2.44	2.41
			Vegetable Crops Branch					
April	50.4	43.5	44.8	47.2	3.55	2.64	4.50	4.21
May	56.4	65.4	54.7	55.1	3.25	5.72	4.08	4.81
June	69.3	65.6	69.5	72.2	9.25	4.73	5.08	1.96
July	72.5	72.9	74.6	70.9	1.80	2.94	4.98	2.82
August	69.6	69.6	71.9	70.5	2.68	1.35	1.21	3.20
September	61.7	61.7	64.7	60.5	8.38	2.66	2.50	2.52

I. STAND ESTABLISHMENT STUDIES

A. Transplants: Shipping and Packing Studies

This study was conducted in cooperation with L.A. Risse, USDA-ARS, Orlando, Florida and C.A. Jaworski, USDA-ARS, Tifton, Georgia to ascertain the influence of overpacking plants on plant survival. (A detailed report of this study is being published in HortScience, a journal of the American Society for Horticultural Science.).

Treatments were: 1) conventionally packed crates containing about 30 lbs. of plants; 2) over-packed crates containing about 40 lbs. of plants; 3) over-packed with soil weighing about 40-45 lbs. per crate (about the same number of plants as treatment 1, but not all the soil was shaken from the roots); 4) moist plants and soil with crates weighing about 40 lbs. (plants were watered about 1 hr. before pulling). The crates of plants were stacked in the middle of a trailerload.

Two plantings were made in 1982--May 17 and June 3. Data were taken on plant fresh and dry weights, and soluble solids in the juice expressed from the stems of representative samples. The plants were transplanted by conventional methods as soon as received. Stand counts were made about 3 weeks after transplanting. Yields were taken from a machine harvest when about 80% of the fruits were usable on the check plants (conventional pack).

In 1983, two plantings were also made--May 18 and June 13. In addition, samples of the plants were held in the garage at the VCB for 6 days in the case of May 18 shipment and 2 days for the June 13 plants. Temperatures during storage were in the low fifties for the early plants and in the seventies for the June 13 plants. Yield data were not taken from the 1983 study.

Results are presented in Tables 2 and 3. Stands were acceptable from all treatments in 1982, as were yields. Yields were not taken in 1983 because of the obvious differences between stands. Overpacking had a very significant influence on stand from the first planting. Plant stand was generally very poor from the second planting, although the plants appeared in all cases to be reasonably good plants. Stand was greatly reduced from storage of the plants for 6 days under relatively good storage conditions for the first planting and for 2 days of very poor storage with the second planting. Transit temperature data suggest that over-packed plants do not cool properly in transit and this can have a detrimental effect on plant survival.

There are numerous factors that influence plant survival and appearance does not appear as a reliable indicator of plant quality.

TABLE 2. Influence of packing in field crates in Georgia on plant quality. survival and subsequent yield in Ohio, 1982.

Planting Date	Treatment	Plants Fr.Wt. (gms)	Plants Dry Wt. (gms)	Plants Dry Wt. (%)	Soluble Solids (%)	Stand Count (%)	Yield (Ripe) Tons/A
5/17/82	Control	46.0	6.0	11.4	5.6	93.8	22.5
	Overpacked	36.7	5.2	12.5	6.3	95.4	23.6
	Overpacked-wet	47.1	7.5	13.9	5.4	94.8	24.9
	Overpacked-soil	42.7	5.2	11.0	4.8	84.7	22.8
6/3/82	Control	136.9	16.3	10.6	3.2	97.3	28.6
	Overpacked	86.1	10.1	10.5	3.2	98.8	23.6
	Overpacked-wet	140.8	15.5	9.9	2.9	100.0	25.9
	Overpacked-soil	95.5	11.2	10.4	2.7	100.0	28.4
LSD 5%		26.6	2.9	1.3	0.5	NS	3.8

Fresh and Dry Wts. taken from 10-plant samples on same day as transplanting; Soluble Solids was taken from the 3-plant samples on same day as transplanting using a refractometer; Survival data taken on 6/7/82 for the first planting and 6/24/82 for the second planting; Yields are machine harvest data.

TABLE 3. Influence of packing in field crates in Georgia on plant quality and survival in Ohio, 1983.

		Plants			Soluble	Survival (%)	
							Stored 6 days
Planting Date	Treatment	Fr.Wt. (gms)	Dry Wt. (gms)	Dry Wt. (%)	Solids (%)	Imed. Plant	Tons/A
5/18/82	Control	38.1	4.6	11.92	4.36	91.40	32.03
	Overpacked	46.0	7.2	15.49	3.13	47.28	0
	Overpacked-wet	49.3	5.5	11.08	3.57	96.87	7.03
	Overpacked-soil	36.1	4.4	12.31	4.03	97.65	16.40
							Stored 2 days
6/13/82	Control	53.8	5.4	10.03	3.17	53.02	40.49
	Overpacked	45.1	4.9	10.78	3.93	53.29	18.93
	Overpacked-wet	68.6	6.3	9.16	2.17	74.60	37.45
	Overpacked-soil	49.8	6.8	13.59	3.40	89.69	44.12
LSD 5%		13.25	2.09	2.14	.44	15.28	

Cultivar: H-2653; Fresh and Dry Wts. were from 10 plants taken same day of planting, replicated 3 times; Soluble Solids were taken the same day of planting from the stems of 3 plants using a hand refractometer, replicated 3 times; Survival data: Planting #1 taken on 6/10/83; Planting #2 taken on 6/24/83

Transplant Treatment Studies-Ethrel:

The use of Ethrel (ethephon) for blossom/fruit control and quality improvement of transplants has caused some problems in Georgia, as well as in Ohio. Timing of application in relation to flower development and plant harvest has been difficult. Further, root proliferation on plants has made plant separation troublesome. It also appears that there is some variability in cultivar response.

A study was conducted in 1982 on 20 cultivars to determine the cultivar relationship. The experiment was done with the cooperation of C.A. Jaworski, USDA-ARS, Tifton, GA. The application of 1 pt./A Ethrel was made when the first blossom buds were evident, but no flowers were open and the plants were pulled 12 days after application.

The cultivars and results we summarized in Table 4. The plots suffered from severe water damage shortly after transplanting. Consequently, plant stand and yield data are questionable and will not be presented. The data are paired to compare treated and untreated plants (check plants).

In general, treatment of the plants with Ethrel reduced plant height, had no influence on stem diameter, increased soluble solids in the expressed juice from the plant stems, greatly increased adventitious root development on the plant stems, reduced the number of flowers on the plants and increased the percentages of dry matter accumulated in the plants. With the exception of the plants with excessive adventitious roots (ratings of 3.5 or higher), all these factors indicate an improvement in plant quality.

Past data have shown that plants treated with Ethrel in the plant beds in Georgia become established and regrowth occurs more quickly and maturity occurs earlier than on untreated plants. It is unfortunate that problems of scheduling application and harvest are so difficult that this treatment cannot be more widely used in transplant production.

TABLE 4. Influence of Ethrel treatment of tomato transplants on plant quality factors, 1981.

	Plant Ht. (cm)		Stem Diam. (mm)		Soluble Solids (%)		Root Rating[1]		#Flowers/ Plant		Plant Dry Wt.(%)	
Cultivars	Trt	Ck	Trt	Ck	Trt	Ck	Trt	Ck	Trt	Ck	Trt.	Ck
Chico III	21.7	23.4	4.4	4.1	4.77	4.90	2.7	-	0	0	11.5	9.9
Heinz-1630	19.1	23.3	4.9	4.8	6.40	4.17	3.2	-	0	0	12.9	8.8
Campbell-28	14.8	21.4	4.8	4.7	4.83	3.67	3.5	-	0	2.7	12.4	10.2
L-8990-A	17.3	22.1	4.7	4.5	4.93	3.33	2.5	-	0	5.0	13.0	11.1
Heinz-1706	20.2	21.5	4.5	4.9	5.30	3.40	1.3	-	0	0	12.9	8.5
VF-134-1-2	18.7	23.4	3.8	4.3	5.73	4.07	2.6	-	0	.7	15.4	10.7
P-95	17.5	22.2	4.4	3.8	5.20	3.87	1.2	-	0	5.0	14.4	11.0
Campbell-37	21.7	22.9	4.5	5.1	5.37	4.40	1.0	-	0	0	11.1	9.5
Heinz-2653	20.7	24.3	5.0	5.0	5.67	5.07	3.2	-	0	1.0	12.4	9.8
Heinz-318	21.4	23.7	4.5	4.6	5.83	4.43	1.1	-	0	1.7	13.3	9.3
Campbell-38	21.6	22.1	4.3	4.3	6.43	3.60	4.3	-	0	0	12.4	9.1
Veepro	22.4	22.8	4.4	4.2	6.37	5.70	3.2	-	0	.3	12.1	9.3
Heinz-727	21.0	23.2	4.6	4.7	5.53	3.97	3.3	-	0	.3	13.1	10.4
HT-304	21.7	22.9	4.1	4.7	5.07	2.83	1.7	-	0	0	12.1	9.6
Ohio-7663	20.2	22.3	4.1	3.6	5.27	4.20	2.8	-	0	0	11.4	8.6
L-7241	22.1	24.6	5.1	4.5	5.40	3.77	5.0	-	0	.3	11.3	10.9
New Yorker	23.2	24.5	4.9	4.4	3.83	4.63	.7	-	0	.3	8.9	9.8
Heinz-722	22.8	23.0	5.1	5.4	4.07	3.73	4.7	-	0	.7	10.9	10.3
L-68	22.2	23.8	4.6	5.0	4.77	4.60	3.0	-	0	0	11.9	9.0
FM-6203	23.4	23.8	5.4	5.2	4.70	4.20	2.3	-	0	.7	12.4	11.5
LSD .05	1.4		0.4		0.96		0.7		1.0		0.9	

[1] Root Ratings: 1 - no adventitious roots present; 2 = some roots starting to grow; 3 = some roots 1/8 to 1/4" long; 4 = many roots 1/8 to 1/4" long; 5 = many roots over 1/4" long; Check plants would all be rated at 1.

Transplant Treatment Studies-Root Dipping:

Studies were conducted in 1983 and 1984 to determine the possible benefits of dipping the roots of transplants in mixtures of some of the hydrophyllic colloids, either prior to shipment from Georgia or prior to transplanting in Ohio.

The treatments and results from the preliminary 1983 trial are summarized in Table 5. The results suggest that dipping the plants in Georgia may be helpful at times, but the plants must be planted immediately upon receipt in Ohio. Any delay results in plants that become extremely moldy, soft and nearly impossible to plant, let alone few survive. These early data also suggest that dipping plant roots in Ohio just prior to transplanting may improve stand, especially in the early plantings. However, this needs more work to work out the method and material which will give optimum results. It must be remembered that dipped plants are wet, difficult to handle and cold to the labor when planting.

Treatments used in 1984 and yield data are presented in Table 6. No treatment had any apparent influence on stand, earliness, or yield.

TABLE 5. Influence of root dipping treatment with hydrophyllic colloids on plant quality, survival and yield. 1983.

Planting Date	Treatment	Plant Fresh Wt. (gms)	Plant Dry Wt. (gms)	% Dry Wt.	Soluble Solids (%)	Survival (%) Imed. Plant	Survival (%) Stored 6 days	Yld. Ripe T/A Imed. Plant	Yld. Ripe T/A Stored 6 Days
5/18/83	Terra Sorb-OH Dip	-	-	-	-	100.0	57.5	12.9	10.1
(H-727)	Agrigel-OH Dip	-	-	-	-	100.0	30.8	13.8	4.6
	Natrosol-OH Dip	-	-	-	-	100.0	31.7	11.2	5.2
	Terra Sorb-GA Dip	147.8	17.8	12.0	3.4	95.5	0	10.5	0
	Syntehtic-GA Dip	98.5	10.5	10.8	2.4	97.7	0	11.5	0
	Check	68.6	8.3	12.0	2.6	97.0	20.5	13.6	5.4
						Imed. Plant	Stored 3 days	Imed. Plant	Stored 3 days
6/13/83	Terra Sorb-OH Dip	-	-	-	-	63.4	36.6	25.9	15.7
(Chico	Agrigel-OH Dip	-	-	-	-	82.6	66.9	25.3	24.4
III)	Natrosol-OH Dip	-	-	-	-	65.1	36.2	24.7	13.6
	Terra Sorb-GA Dip	33.9	3.2	9.5	3.2	80.4	16.5	28.6	8.0
	Synthetic-GA Dip	50.7	5.4	10.5	2.8	74.6	0	29.8	0
	Check	36.1	4.4	12.4	3.0	52.5	45.3	23.9	17.9
	LSD 5%	35.1	5.3	NS	0.5	17.0		5.2	

TABLE 6. Influence of transplant treatment on plant recovery and yield-1984.

Treatment	Yield-Tons/A Ripe	Yield-Tons/A Green
Check-no water or starter fert.	30.1	2.4
Check-water only with plants.	32.2	1.9
Check-water + starter fert. with plants.	32.5	2.2
Terra Sorb in transplant water only-no starter fert.	31.4	2.6
Terra Sorb root dip-no water or starter fert. with plants.	32.7	3.4
Terra Sorb root dip + water & starter fert. with plants	32.5	2.2
Top of plants dipped in anti-transpirant, no water or starter fert. with plants	32.5	2.3
	NS	NS

Cultivar H-722, transplanted 6/1/84; single rows 30' long; 60" between rows; 12" between plants; Water applied with transplanter was approximately 0.5 pt. per plant; "Terra-Sorb" in transplant water was 1.0 lb/50 gal; as a dip was 0.5% w/w in water; Anti-transpirant dip for leaves and stems only was a 10% v/v water mixture ("Cryotec" acrylic co-polymer used).

B. Field Seeding-Fluid Drilling

Efforts were made to further evaluate fluid drilling (gel seeding) in 1981, as a method for field seeding in Ohio. Also, the use of anticrustants and starter fertilizer with the gel were studied. Plug mix seeding was included in the trial to evaluate very fine vermiculite as a carrier because horticulture grade #2 vermiculite is in short supply.

The treatments and results are given in Table 7. Statistical analysis was not made on the plant stand data because figures from the fluid drilling treatments were individual plant counts, while the others were clumps of plants. Nevertheless, the results suggest 1) that vermiculite in the seed trench assisted in emergence; 2) the fine vermiculite was a satisfactory medium for plug-mix planting; 3) pre-germination resulted in earlier maturity then non-germinated dry seed.

TABLE 7. Field seeding of tomatoes, 1981.

Seeding Treatment	Plants/10 ft. of row	Yield Tons/A Ripe	Yield Tons/A Green
Fluid Drill	11.5	16.8	3.9
Fluid Drill + Vermiculite	20.0	20.5	4.7
Fluid Drill + Starter Fert. in gel.	12.8	17.4	4.3
Fluid Drill + Starter + Vermiculite	17.8	17.2	4.1
John Deere 33 dry seed + Starter + Vermiculite	9.0*	16.5	10.0
Plug Mix with Jiffy Mix Plus	7.8*	17.1	4.4
Plug Mix with #2 Vermiculite	7.8*	22.1	4.6
Plug Mix with #4 Fine Vermiculite	9.4*	21.4	4.8
LSD 5%	-	5.1	2.2

*Clumps per 10 ft. of row; J.D. 33 on 9" spacing and Plug Planter on 11" spacing; fluid drilling as a continuous row using 1 liter/167 ft. of row and 1.9 grams of seed/liter (2.5 oz./10 gal.), Gel was 0.75% w/w Agrigel Viterra II.

Cultivar = H722, seeded on May 8, 1981; 5 ft. between 30' rows; 4 replications per treatment. All treatments were pre-germinated except the John Deere 33 vegetable seeder treatment. Harvested by machine on 9/22 & 23/81.

Cultivar Influence on Field Seeding

Grower experiences suggest that cultivars differ in their ability to establish stands from field seeding. Nine cultivars were fluid drilled in 1983 using procedures similar to the 1981 study. Vermiculite was also used as an anticrustant in all plots.

The cultivars and results are given in Table 8. The results suggest that indeed, varieties do differ in their response to field seeding. The number of plants/30 ft. of row ranged from 34.7 to 75.2, depending upon cultivar. However, stand did not always relate to yield, as long as the stand was satisfactory and in all cases the stand was acceptable.

TABLE 8. Relation of cultivar to stand from field seeding, 1983.

Cultivar	No. Plants per 30' row	Yield (Tons/A) Ripe	Yield (Tons/A) Green
H-727	34.7	11.4	1.5
H-2653	67.7	9.2	1.9
Peto-95	54.7	14.3	2.8
H-1784	59.7	16.0	1.8
O-7814	72.7	16.0	1.4
FM-6203	56.7	18.6	1.8
L-68	75.2	18.5	1.9
O-7870	65.0	19.4	1.4
H-722	49.0	19.3	3.0
LSD 5%	15.5	2.96	NS

Seeded on 5/12/83; seed not pre-germinated; harvest started on 9/19/83 and continued for 10 days, depending upon cultivar; harvested by machine; rows 30 ft. long on 5 ft. centers, treatments replicated 4 times.

Liquid Anticrustant For Field Seeding

Interest in liquid anticrustants has increased because of both ease of application and cost. However, previous research with "NALCO 2190" indicated that this compound was ineffective in Ohio and had a delaying effect on fruit maturity. Preliminary work with Miller Chemical liquid anticrustant indicated this compound may improve emergence. To further establish criteria for possible use of these materials in Ohio, a study was conducted in 1984 using these materials with and without vermiculite in the seed furrow. Seeding was done with a John Deere 33 vegetable seeder placing 3-5 seeds in 9-inch clumps, 1/2 to 3/4 in. deep. Vermiculite was used at the rate of 24 cu. ft. per acre in the seed furrow ahead of the split-press wheel. The Miller Chemical anticrustant was applied as a 1.5% v/v water mixture using a CO_2 pressure hand-sprayer at a spray rate of 35 gal/A in an 8 in. band. The tap water treatment was applied similarly in an 8 in. band. The Nalco 2190 was applied by the Technical Representative of the producer, using a tractor mounted sprayer and in a 2 in. band after the seeder press wheel.

Treatments and results are presented in Table 9. The cultivar used was C-28 and plots were harvested before the optimum of 70% + ripe so that data would more reliably indicate maturity. The stand count data indicate that Nalco 2190 had an unfavorable influence on plant stand. However, the equipment used by the technical service representative could have had an influence on thoroughness of seeding, although the same John Deere 33 seeder was used for all plots. It is also interesting that vermiculite in the seed furrow appeared to improve the performance of Nalco 2190. It also appears that the vermiculite reduced the influence of the Nalco 2190 in delaying plant development and subsequent fruit maturity. Based upon these data, plus previous research, Nalco 2190 does not appear useful in field seeding in Ohio.

TABLE 9. Influence of liquid anti-crustant on stand, yield and maturity of tomatoes, 1984.

Treatment	Stand Clumps/12'	Yield T/A	Ripe %
With Vermiculite in the seed furrow			
Nalco 2190 20 gal/A dilute 15:1	7.3	21.7	57.7
Nalco 2190 20 gal/A dilute 30:1	7.0	19.3	54.9
Nalco 2190 20 gal/A dilute 60:1	5.3	19.8	53.1
Nalco 2190 40 gal/A dilute 15:1	7.5	20.7	57.1
Miller Chemical 1.5% 35 gal/A	10.3	21.4	57.7
Check - Tap Water	12.0	23.3	62.8
Without Vermiculite in the seed furrow			
Nalco 2190 20 gal/A dilute 15:1	4.5	16.9	52.5
Nalco 2190 20 gal/A dilute 30:1	6.8	16.7	50.0
Nalco 2190 20 gal/A dilute 60:1	4.5	12.6	43.2
Nalco 2190 40 gal/A dilute 15:1	4.5	14.8	45.6
Miller chemical 1.5% 35 gal/A	11.0	23.5	61.4
Check - Tap Water	10.0	26.5	66.4
LSD 5%	3.3	5.9	10.3

Cultivar: C-28; seeded 5/15/84; stand count taken on 6/12/84; harvested by machine on 9/19/84.

Seed Quality

A very extensive study on the influence of micronutrient deficiencies on seed quality was conducted by Dr. Nazir Hadidi, a graduate student in the Department of Horticulture. All his work cannot be presented in this summary, but the conclusions will be given. His studies were done with sand culture using controlled levels of N, P, K, Ca, Mg. Deficiency levels were 10% and 50% of the optimum levels of each of the elements.

Root and shoot growth of tomato plants were reduced from 10 and 50% N and 10% P and K treatments with less effect due to lower Ca and Mg treatments.

Tomato fruit yield and size were reduced from the 10% N, P, K, Ca treatments. Tomato fruit yield was also reduced from the 50% N and K treatments.

Tomato seed yield was reduced from the 10 and 50% treatments of all five macronutrients. Seed yields were positively correlated with all five macronutrients in the leaves.

Tomato seed quality was reduced from the 10 and 50% of the five micronutrients. However, the 10% treatments had greater effect on seed quality than the 50% treatments. Tomato seed quality was positively correlated with the N, P, Ca and Mg content of the leaves and the seeds and with the K content of the leaves. A negative correlation was also found with the K content of the seeds.

Results from this study suggest that nutrient levels of the parent plants may play a significant role in determining the vigor of the seed and seedlings of tomato. This needs much more investigation.

II. Cultural Practices Studies

A. Single vs. Twin Rows

Previous work with twin rows was done with field seeding because it was felt that twin rows with transplants would be too costly. However, later work with the newer, small-vined, and especially early cultivars, twin rows with transplants appeared to provide a significant economic advantage. Fertilizer timing and placement, especially with N (more recently with K), were unknown factors and considerable effort was made to determine the optimum N application for transplanted twin row culture.

A summary of the early studies (published in Horticulture Series No. 502, July 1981) indicates that, in general, 2/3 of the N should be applied pre-plant broadcast in 1/3 side-dressed 2-3 weeks after transplanting for the early cultivars. Data suggest that for main season and late cultivars, all the N can be applied as a pre-plant broadcast treatment. Source of N had no apparent influence on production and fruit quality factors.

An extensive study on twin rows was conducted in 1983 by David Frost, a graduate student in the Department of Horticulture. His results are published in detail in his thesis, and are too numerous to report in this short report. In general, he found that as plant populations increased, yield of H-2653 increased (Fig. 1). However, yields of H-722 peaked at 11,600 plants/acre and levelled off or declined at higher populations. Furthermore, H-722 did not have higher yields in twin rows than in single rows (Table 10).

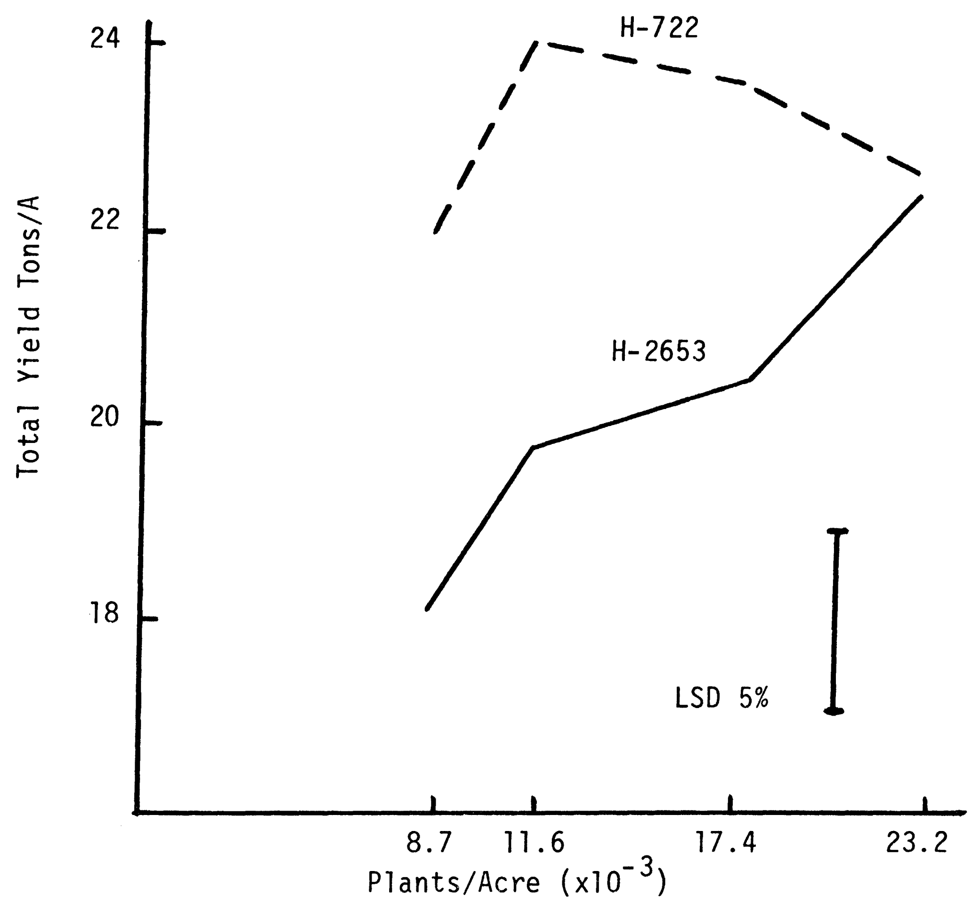

Fig. 1. Total fruit yields of 'Heinz 722' and 'Heinz 2653' at different density levels.

TABLE 10. Influence of plant spacial arrangements on yield of 2 cultivars of tomatoes, 1983.

Treatment	Yield-Tons/A	
	Ripe	Green
H-2653		
Single	10.5	3.9
Twin-Rectangular	13.7	4.9
Twin-Triangular	12.9	5.2
H-722		
Single	19.3	2.5
Twin-Rectangular	19.2	2.4
Twin-Triangular	19.9	2.5
LSD 5%	1.4	0.5

Figures are averages of 3 rates of N fertilization and 4 spacing treatments; Plants were transplanted on 5/26 & 27/83; Beds were on 5 ft. centers, plots were 30 ft. long and each treatment was replicated 4 times. Twin rows were 18 in. apart and plants were opposite in "rectangular" treatment and alternate in "triangular" treatment.

The plant populations--single vs. twin row trial was repeated in 1984. The only differences were that the N fertilization and the alternate vs. opposite treatments were omitted. The results summarized in Table 11, indicate that again twin rows of H-2653 had significantly higher yields than single rows. The H-722 variety did not respond to twin row culture. Contrary to 1983, plant population in single rows of H-2653 had no influence on yield, but the 9 in. spacing had higher yields than the 24 in. spacing for twin rows. Growing conditions were much more favorable in 1984 and this undoubtedly influenced the yield response differences between 1983 and 1984.

TABLE 11. Influence of plant populations on yield of 2 cultivars of tomatoes, 1984.

Cultivar	Plants/ Acre	Yield-Tons/Acre Ripe Single	Twin	Green Single	Twin
H-2653	8,712	24.7	27.8	1.7	1.5
	11,616	23.2	29.8	2.9	1.4
	17,424	24.4	30.5	1.8	0.6
	23,232	24.5	31.2	1.2	0.8
H-722	8,712	34.4	36.3	1.9	1.6
	11,626	35.7	35.7	2.3	1.7
	17,424	36.3	35.8	1.3	1.0
	23,232	34.6	35.6	1.6	0.8
LSD 5%		3.9		0.8	

Plants transplanted on 5/18/84; on beds spaced 5 ft. apart. Twin rows were 18 in. apart. Plots received 60 lbs/A N pre-plant, broadcast plus 25 lbs/A N side-dressed 3 weeks after transplanting/ All plots received 800 lbs/A of 0-26-26 prior to bed shaping. Plants were treated with 3 pts. of Ethrel at appropriate time and machine harvested at maximum ripening.

A separate arrangement study was conducted in 1984. The twin rows were 18 in. apart on 5 ft. beds and the plants within each row were 12 in. apart. The results (Table 12) suggest that arrangement had no influence on yield. It is also interesting to note that the yields of H-2653 were higher than those of H-722.

TABLE 12. Influence of arrangement of plants in twin rows on yield, 1984.

Cultivar	Arrangement	Yield-Tons/Acre Ripe	Green
H-2653	Opposite	39.9	1.4
	Alternate	40.7	1.2
H-722	Opposite	37.3	4.8
	Alternate	35.5	4.5
LSD 5%		1.4	1.0

Transplanted on 6/1/84; 60 lbs. of N applied broadcast prior to planting plus 25 lbs. N side-dressed 3 weeks after planting. All plots received 800 lbs/A of 0-26-26 prior to bed shaping. Plants were treated with 3 pts. Ethrel at appropriate time and machine harvested at maximum ripeness.

B. Fertilizer Timing and Placement

Leaf samples from growers have shown a significant decline in K content. In some cases the plants should have shown serious deficiency symptoms. Some research reports have suggested that the newer varieties have a smaller root system and more concentrated fruit set which, 1) have reduced rooting area to absorb K and 2) the high sink effect during the growth of a highly concentrated fruit load causes a great drain on K from the leaves.

Variety: Potassium Relationships

A study was run in 1983 at the Vegetable Crops Branch to compare leaf content of several varieties of processing tomatoes under 3 regimes of K fertilization. The treatments and results from leaf analyses are given in Table 13.

TABLE 13. Relationship of variety to leaf content of K, 1983

		Variety - % K in Leaves				
Treatment	Sample Date	H-1350	Peto 95	FM 6203	H-722	H-2653
0 lb/A K_2O	7/10/83	2.70	2.59	2.55	2.52	3.00
150 lb/A K_2O		3.05	2.83	2.27	2.33	2.81
300 lb/A K_2O		2.86	2.11	2.23	2.56	2.92
0 lb/A K_2O	8/5/83	1.71	1.49	1.24	1.29	1.38
150		1.84	1.00	1.95	1.31	1.20
300		2.07	1.07	1.46	1.13	1.32

These results suggest that although there is an indication of varietal differences, they are very slight and that indeed, the K levels are very low during and after fruit enlargement. It appears that the more vigorous H-1350 variety may have higher levels of leaf K at the early August sampling. The other interesting observation is that the rate of applied K appeared to have little influence on leaf K.

There were no differences in fruit yield from any of the K treatments.

Variety - Potassium-Timing of Application

A follow-up trial was conducted in 1984 with 3 varieties and 4 K treatments at the Vegetable Crops Branch. The treatments and leaf analyses results are given in Table 14.

TABLE 14. Relationship of variety and timing of K application to leaf content of K. 1984.

Treatment	% K in Leaves*		
	H-1350	H-722	FM-6203
0 K_2O	2.86	3.21	3.35
150 lbs/A K_2O pre-plant	3.33	3.07	2.92
300 lbs/A K_2O pre-plant	3.50	3.33	3.39
150 lbs/A K_2O pre-plant + 150 lbs/A at full bloom	3.54	3.18	3.06

*Samples on July 19, 1984, FB-July 13, 1984

As with the 1983 trial, there were no significant differences between varieties or fertilizer treatments. Further, there were no treatment influences on fruit yield.

Nitrogen-Potassium-Variety Relationship

A preliminary study was conducted in 1984 to determine if there were any relationships between timing of N and K fertilizer applications on yield and leaf K. The treatments and results are summarized in Table 15.

TABLE 15. Relationship of timing of N and K fertilization on leaf content of K, 1984.

Treatment	% K in Leaves*	
	H-2653	O-7870
Pre-plant 80 lbs/A N + 150 lbs. K_2O/A	2.31	2.52
Pre-plant 60 lbs/A N + 100 lbs. K_2O/A + 20 lbs N and 50 lbs. K_2O 3 wks after transplanting	2.17	2.46
Pre-plant 60 lbs/A N + 50 lbs/A K_2O + 20 lbs. N and 100 lbs K_2O 3 wks after transplanting	2.16	2.44
Pre-plant 60 lbs/A N + 50 lbs/A K_2O + 20 lbs N and 50 lbs. K_2O 3 wks after transplanting + 50 lbs K_2O 6 wks after transplanting	2.29	2.50

*Sampled July 19, 1984

Again, no significant influence of time of application of K_2O on K content of the leaves. Yields also were not influenced by treatment and were near 30 tons/A for H-2653 and near 42 tons/A for O-7870.

Potassium Sprays and Leaf K Content

A study was conducted at OARDC in Wooster to determine the influence of repeated sprays of KNO_3 on leaf K content. The treatments and results are given in Table 16.

TABLE 16. Influence of KNO_3 sprays on leaf content of K, 1984.

	% K in Leaves			
	H-1350		0-7870	
Treatment	8/13	9/5	8/13	9/5
0 K_2O - Check	1.22	1.09	1.09	1.03
K side-dress after transplanting-100 lbs/A K_2O	1.23	1.19	1.44	1.04
K spray-5 lbs/100 gal. KNO_3 at 60 gal/A, weekly starting at fully bloom for 7 sprays (stop 7/31)	0.96	0.89	1.21	1.02
K spray-same as above treatment except starting 2 weeks later for 5 sprays (stop 7/31)	0.87	0.82	1.20	0.85

Results indicate that sprays were not effective in increasing the amount of K in the leaves and indeed, the levels were lower where sprays only were used to apply K. However, the amounts of K applied by the sprays were very low compared to the amount added by the side-dressing. Yields of H-1350 were influenced by the treatments--the 0 treatment had lower yields than the other treatments which may have resulted in the higher K leaf content than from the spray treatments.

Nitrogen Timing & Placement on Twin-Rows

A study was conducted in 1984 to determine the influence of timing and placement of N fertilizer on yield, maturity and leaf N content in twin-row culture. The plots were in spring beds on 5 ft. centers. The initial broadcast treatments were applied by hand and lightly incorporated with a power bedder immediately before transplanting. The side-dress treatments were applied with a side-dress drill attached behind a cultivator shoe so that it was applied about 2 inches deep. Ammonium nitrate was the source of N. The treatments and results are summarized in Table 17.

TABLE 17. Influence of timing and placement of N fertilizer on yield and leaf N content of tomatoes, 1984.

N Treat-lbs/Acre		Location*		H-2653 Yield-Tons/A		H-2653 Leaf N	O-7870 Yield-Tons/A		O-7870 Leaf N
Pre-plant	Side-dress	between	outside	Ripe	Green	(%)	Ripe	Green	(%)
80	--	-	-	33.8	3.6	2.90	39.3	1.3	3.11
--	80	+	-	33.9	3.2	3.13	44.5	2.6	4.14
60	20	+	-	35.0	2.0	3.07	43.2	1.0	3.20
60	20	-	+	32.3	2.0	2.94	40.7	1.1	2.98
40	40	+	-	32.3	1.5	2.80	38.1	1.8	3.39
40	40	-	-	31.4	4.1	3.15	42.1	1.3	3.08
		LSD 5%		NS	1.4	NS	5.1	1.4	0.38

*Side-dress "Between" = center between the twin rows; Outside = 5-6 inches outside of each row; H-2653 planted on 5/18 and O-7870 planted on 6/1/84, twin rows 18 in. apart and plants 18 in. apart; 800 lbs/A of 0-26-26 applied pre-bed formation. Ethrel applied and machine harvested at appropriate times; Leaf samples collected on 7/19/84.

These results indicate that apparently timing of side-dressing of N had no influence on yield of H-2653 in 1984. This is contrary to results from previous years where a side-dressing of N, about 3 weeks after transplanting was beneficial. It appears that the excellent growing conditions during June of 1984 negated the influence of N side-dressing on this cultivar. There were some apparent treatment effects on the O-7870 cultivar. The side-dressing only treatment resulted in a higher yield than the pre-plant only treatment and the 40 + 40 treatment. It should also be noted that the leaf N content was higher from the higher amounts of side-dress N.

The location of N side-dressing had no apparent influence on yield of either cultivar.

III. Growth Regulator Studies

A. Use of Excessive Rates of, or Additives With, Ethephon

Growers have tended to use excessive rates of ethephon for fruit ripening or added other compounds, usually herbicides for innumerable "reasons". Studies were designed to evaluate these practices on yield and certain quality factors.

In 1981, the treatments included the recommended rate of ethephon 3 1/4 pts./A, 2 gal/A of ethephon and these rates were then combined with metribuzin (Sencor/Lexone). Leaves were also removed by hand--50% or 90% at the same date to obtain data on leaf injury effects. The experiment was repeated in 1983, except metribuzin was omitted. The 1981 season was characterized by below normal temperatures from time of treatment to harvest, whereas, temperatures were much above normal during this period in 1983.

Results varied between the two seasons and some inconsistencies occurred (Tables 18 & 19). Nevertheless, there was no advantage to using excessive rates of ethephon either year and data suggest that excessive rates can reduce yield and raise pH and reduce acidity in the fruits. Data also indicate that severe leaf removal can also reduce yields and fruit quality.

TABLE 18. Influence of high rates of ethephon, metribuzin and leaf removal on yield and fruit quality of tomatoes, 1981

	Yield-Tons/A			Fruit Quality		
Treatment	Ripe	Green	Total	SS (%)	pH	TA (%)
Check	16.4	9.9	26.3	4.73	4.36	.458
Ethephon 3 1/4 pts/A	22.6	5.6	28.2	5.10	4.49	.442
Ethephon 2 gal/A	19.9	2.0	21.9	4.95	4.41	.423
Ethephon 3 1/4 pts + 1 lb 50% metribuzin	18.5	4.6	23.1	4.90	4.57	.438
Ethephon 2 gal + 1 lb 50% metribuzin	20.5	2.4	22.9	4.68	4.39	.458
Remove 50% of leaves by hand	18.9	8.9	27.8	4.78	4.35	.449
Remove 90% of leaves by hand	18.8	5.7	24.5	4.60	4.46	.449
	----	1.3	4.1	----	----	----

Cultivar-H-722, transplanted 5/21/81; 5 ft. rows; 12 in. spacing; 20 ft. plots; 6 replications of each treatment. All treatments applied on 8/5/81 under sunny skies at 70-75°F. Plots harvested by hand on 8/18/81. Daily mean temperatures from 8/5 to 8/18/81 ranged from 59-73°F; max. temperature during period was 82°F and minimum was 43°F. The monthly mean temperature averaged 1.2°F below the 90-year means.

TABLE 19. Influence of high rates of ethephon and leaf removal on yield and fruit quality of tomatoes, 1983.

Treatment	Yield-Tons/A Ripe	Green	Total	Fruit Quality SS (%)	pH	TA (%)
Check	19.0	4.1	23.1	5.40	4.32	0.43
Ethephon 3 1/4 pts/A	21.5	2.2	23.7	5.05	4.34	0.42
Ethephon 1 gal/A	21.2	1.1	22.3	4.97	4.42	0.35
Ethephon 2 gal/A	21.4	0.6	22.0	5.00	4.39	0.37
Remove 50% of leaves by hand	20.4	3.8	24.2	5.10	4.29	0.43
Remove 90% of leaves by hand	15.7	1.7	17.4	4.57	4.33	0.39
	3.1	1.1	3.7	----	0.06	0.039

Cultivar-H-722, transplanted 5/21/81; 5 ft. rows; 12 in. spacing; 30 ft. plots; 4 replications of each treatment. All treatments applied on 8/18/83 under partly cloudy skies at 80-85^{o}F. Plots harvested by hand on 9/7/83. Daily mean temperatures from 8/18 to 9/7/83 ranged from 69.5-79.5^{o}F, which was about 3 degrees above; normal; max. temperature during period was 92^{o}F and minimum was 56^{o}F. There were 13 days with maximum temperatures above 85^{o}F during the 21 days from treatment to harvest.

B. Growth Regulators for Plant Development & Fruit Maturity Control

1. Daminozide (Alar)

Published results suggest that applications of daminozide (Alar) will influence plant growth and development and hasten maturity. Results from our studies in 1981 (Tables 20 & 21) indicated that daminozide (Alar 85WP) had no influence on yield or on maturity. Further, an application of Ethrel at 1 pt/A after major fruit set also had no influence on maturity. The principal objective of this treatment plus the hand tipping was to remove or prevent any further fruit set and/or growth, which tends to delay maturity. Curbiset (chloflurenol) also had no influence on yield, but significantly delayed maturity. This was somewhat unexpected because it had increased yield in previous studies.

TABLE 20. Influence of growth regulator treatments on fruit maturity and yield, 1981.

	Yield				
	Ripe		Green		Total
Treatment	Tons/A	%	Tons/A	%	Tons/A
50 lbs/A N Fert. Appl. Pre-plant					
Check	24.9	79.7	6.1	16.3	35.5
Ethrel 1 pt/A after major fruit set	25.7	81.5	4.1	12.9	29.8
Alar 4 lb/A after major fruit set	26.8	77.4	6.7	18.7	33.5
Hand tip prune after major fruit set	29.4	83.1	4.5	12.7	33.9
Curbiset 5 ppm at plant establishment	20.4	62.6	11.6	35.0	32.0
50 lbs/A N pre-plant+50 lbs/A N mid-June					
Check	31.9	80.4	6.6	16.3	38.5
Ethrel 1 pt/A after major fruit set	29.5	82.2	5.3	14.6	34.8
Alar 4 lb/A after major fruit set	30.1	77.4	7.7	19.3	37.8
Hand tip prune after major fruit set	29.3	81.1	5.1	13.9	34.4
Curbiset 5 ppm at plant establishment	24.8	61.9	14.4	35.5	39.2
LSD 5%	5.2	4.8	2.4	5.5	6.0

Cultivar H-722 transplanted 5/21/82; in addition to above fertilizer applications the plants received 800 lbs/A of 6-24-24 pre-plant broadcast; Rows 30 ft. long on 5 ft. centers; plants spaced 12 in.

TABLE 21. Influence of daminozide (Alar) on maturity and yield of tomato, 1981.

Treatment	Yield				
	Ripe		Green		Total
	Tons/A	%	Tons/A	%	Tons/A
Check	25.5	71.0	9.9	27.8	35.4
1 #/A Alar85 1 wk.before 1st flower open	25.3	73.3	8.8	25.1	34.1
1 #/A Alar85 at first flower opening	22.8	65.8	10.9	32.3	33.7
2 #/A Alar85 30 days pre-harvest	25.4	72.9	8.7	25.5	34.1
4 #/A Alar85 30 days pre-harvest	27.4	77.7	7.5	20.9	34.9
1 #/A Alar85 15 days pre-harvest	26.0	73.4	9.2	25.4	35.2
2 #/A Alar85 15 days pre-harvest	22.4	66.4	10.7	31.8	33.1
	No Statistical Difference				

Cultivar: H-722; seeded by fluid drilling with pre-germinated seed on 5/7/81; Rows 30 ft., on 5 ft. centers on beds, harvested by machine on 9/22/81.

Dates treatments applied: 1. Check; 2. 6/18/81, Sunny 72^{o}F, 11:00 a.m.; 3. 6/26/81, Sunny 64^{o}F, 10:30 a.m.; 4.& 5. 8/17/82, Sunny 70^{o}F, 11:00 a.m.; 6.& 7. 9/4/81, Cloudy 68^{o}F, 11:30 a.m. Treatments replicated 4 times.

2. TUBA

TUBA is an experimental growth regulator that is reportedly used in Europe on potatoes to increase yields (produce of Mandops, Inc., West Palm Beach, FL). Treatments and results on tomatoes are given in Table 22. The results indicate that this material had no apparent influence on yield or maturity.

TABLE 22. Influence of Tuba on yield of 28 tomatoes, 1982.

	Yield				
	Marketable		Green		Total
Treatment	T/A	%	T/A	%	T/A
Check	26.29	71.52	8.76	23.82	36.84
1.25 pts/A-10 days after transplanting	29.71	75.93	8.49	21.33	39.28
1.25 pts/A-halfway between transplanting & early bloom	27.45	73.15	9.30	23.88	37.89
1.25 pts/A-early bloom	26.79	74.78	7.07	19.85	35.76
2.5 pts/A-10 days after transplanting	31.95	78.11	8.00	18.62	41.36
2.5 pts/A-halfway between transplanting & early bloom	28.58	74.46	8.05	20.33	38.69
2.5 pts/A-early bloom	29.05	74.74	9.19	23.06	39.11

No Statistically Significant Differences

Cultivar: C-28; Plot rows 20 ft. long; 5 ft. apart, 12 in. spacing of plants; transplanted 5/28/82. Harvested by hand on 8/27/82; treatments replicated 4 times; treatments applied in water at 60 gal/acre.

Dates of application of treatments in sequence: 1. 6/4/82, 2:00 p.m., Sunny 70°F; 2. 6/14/82, 2:00 p.m., Sunny 72°F; 3. 6/24/82, 2:00 p.m., Sunny 68°F.

This material follows a typical pattern of many mixtures of compounds which companies want to sell to growers without adequate scientific evidence that it is effective. The manufacturer would not provide us the chemical composition of the material.

3. Ergostim

Ergostim is another material that has been reported to improve yields of horticultural crops, including tomatoes in Florida. It contains N-acetyl thiazolidin-4-carboxylic acid 5.0%, and folic acid 0.1%. A test was conducted in 1982 to evaluate its potential in Ohio.

Treatments and results are given in Table 23. The material had no apparent influence on yield or maturity. Again, this is a material like TUBA, that may have improved yields under certain undefined conditions, but under good soils and management practices does not appear useful on tomatoes.

TABLE 23. Influence of Ergostim on yield and maturity of tomatoes, 1982.

	Yield				
	Ripe		Green		Total
Ergostim	Tons/A	%	Tons/A	%	Tons/A
Check	28.0	77.5	6.6	18.4	34.6
1 appl. 8 oz/A 3 wks after transplant	27.7	73.9	7.3	19.6	35.0
1 appl. 16 oz/A 3 wks after transplant	27.1	69.9	8.9	21.5	36.0
2 appl. 8 oz/A 3 & 5 wks. after transp.	23.4	69.5	7.1	20.8	30.5
2 appl. 16 oz/A 3 & 5 wks. after transp.	25.8	74.4	6.5	18.5	32.3
3 appl.16 oz/A 3,5 & 7 wks. after transp.	24.8	67.7	8.9	23.2	33.7

No Statistical Difference

Cultivar-C-28; plot rows 20 ft. long, 5 ft. spacing and 12 in. between plants; transplanted 5/25/82; material applied in water at 60 gal/acre; fruits harvested by hand on 8/27/82.

Treatment applied on: 6/15/82, 2:00 p.m., Sunny 72°F; 6/29/82, 2:00 p.m., Sunny 73°F; 7/13/82, 2:00 p.m., Sunny 84°F.

4. Curbiset

A previous study indicated that application of chlorflurenol (Curbiset), a highly active growth regulator, resulted in significant yield increases of transplanted tomatoes in Ohio. Consequently, a study was conducted in 1981 to evaluate this chemical on field seeded tomatoes as well as on transplants.

The treatments and results are given in Table 24. The results indicate that the chemical caused significant delays in maturity from the early application on both seeded and transplanted plants. Total yields of the seeded plants were not affected by treatment. However, treatment of the transplanted plants resulted in significantly greater total yield. The most serious problem resulting from applications of chloflurenol was the great increase in fruits with blossom-end rot. The data probably do not reflect the total amount of fruits so affected because many of the fruits had secondary infection with rotting organisms and were well rotted prior to harvest.

TABLE 24. Influence of chlorflurenol (Curbiset) on yield, maturity and blossom-end rot of tomato, 1981.

	Yield					
	Ripe		Green		Total	BER
Treatment	Tons/A	%	Tons/A	%	Tons/A	%
Field Seeded						
Check	15.5	63.1	9.0	35.5	24.5	0.63
Curbiset 5 ppm 3rd true leaf	11.1	45.6	13.6	53.6	24.7	0.48
Curbiset 5 ppm 6th true leaf	4.8	20.5	17.6	77.7	22.4	1.48
Curbiset first bloom	13.8	64.5	6.9	33.1	20.7	0.50
Transplants						
Curbiset 5 ppm at plant establishment	17.0	51.7	13.6	41.1	30.6	3.58
LSD 5%	3.8	7.4	2.3	7.0	4.9	1.9

Cultivar: H-722; fluid drilled on 5/26/82; transplanted plots on 5/21/81; plot rows 20 ft. long, 5 ft. apart; transplants spaced at 12 in.; seeded as continuous row with plants about 6 in. apart; transplants harvested by hand on 9/1/81; seeded plots harvested on 9/21/81; treatments applied in water at 60 gal/A. Treatments replicated 5 times.

Treatments applied: 6/12/81, 1:30 p.m., Sunny, 79°F, transplants; 6/19/81, 2:30 p.m., Sunny 82°F, 3rd leaf 1-2 in. long; 6/29/82, 2:00 p.m., Sunny 84°, 6th leaf, 1-2 in. long; 7/9/81, 2:00 p.m., Sunny 90°F, first flowers opening.

5. Harvade

Harvade is a foliage dessicant that has been reported to promote tomato fruit ripening in southern Europe, but has not been previously investigated in Ohio. A study was conducted to evaluate its potential for promoting fruit ripening of tomatoes in 1983. There was considerable concern on the use of a material which may kill foliage and the resultant adverse effect on fruit quality.

Treatments and results are given in Table 25. The results indicate that treatment with Harvade did promote the amount of ripe fruit harvested and that the surfactant "Agridex" improved the performance of Harvade. None of the Harvade treatments were superior to the standard treatment of Ethrel at 3 1/4 pts/A. The concern on fruit quality was justified, however, in that the highest rates of Harvade resulted in severe foliage injury and leaf drop, which left the fruit exposed to the sun and considerable sun-scald occurred. The measurements of soluble solids, pH and total acids in expressed juice from the fruits revealed no significant treatment effect on these parameters. No color measurements were taken so these effects cannot be substantiated by data.

TABLE 25. Influence of Harvade on tomato fruit ripening and yield, 1983.

	Yield				
	Ripe		Green		Total
Treatment	Tons/A	%	Tons/A	%	Tons/A
Check	17.4	79.7	3.9	18.2	21.3
21 Days Pre-harvest					
Harvade 1.28 oz/A + Agridex	20.5	88.0	2.3	9.8	22.8
Harvade 2.56 oz/A + Agridex	19.2	86.9	2.2	9.9	21.4
Harvade 3.84 oz/A + Agridex	20.4	90.1	1.4	6.2	21.8
Harvade 5.12 oz/A + Agridex	18.0	90.1	1.3	6.7	19.3
Harvade 2.56 oz/A	20.8	85.8	2.8	11.7	23.6
Ethrel 3 1/4 pts/A	20.0	91.3	1.4	6.0	21.4
14 Days Pre-harvest					
Harvade 1.28 oz/A + Agridex	19.8	86.5	2.7	11.8	22.5
Harvade 2.56 oz/A + Agridex	20.4	87.8	2.1	8.8	22.5
Harvade 3.84 oz/A + Agridex	20.2	86.8	2.6	11.1	22.8
Harvade 5.12 oz/A + Agridex	20.0	86.9	2.5	11.1	22.5
Harvade 2.56 oz/A	19.0	81.9	3.7	15.8	22.7
Ethrel 3 1/4 pts/A	19.9	90.4	1.6	7.0	21.5
LSD 5%	--	5.0	1.1	4.5	--

Cultivar: H-722; plot rows 20 ft. long on 5 ft. centers; transplants on 12 in. spacing; planted on 5/26/83. Harvested by hand on 9/7/83. Treatments applied in water at rate of 40 gal. spray/A.

6. Reward

Reward is a plant extract containing Vitamin B complex compounds and other materials found in plants. Claims of increased plant growth, yield, quality, etc., have been made from applications of this product.

Treatments and results from the experiments at Wooster (OARDC) and Fremont (VCB) are given in Table 26. The results indicate that Reward had no influence on yield at either location and, although the data suggest statistical significance between % ripe at the Fremont location, the differences are of doubtful practical significance.

TABLE 26. Influence of Reward on yield of tomatoes, 1984.

	Yield				
	Ripe		Green		Total
Location & Treatment	Tons/A	%	Tons/A	%	Tons/A
Fremont VCB					
Check	30.7	90.1	1.9	5.6	32.6
Reward 12 oz/A after recovery from transplant shock	33.1	89.7	2.4	6.4	35.5
Reward 24 oz/A after recovery from transplant shock	30.5	87.6	2.5	7.4	33.0
LSD 5%	NS	1.7	NS	NS	NS
Wooster OARDC					
Check	22.4	79.4	4.8	16.8	27.2
Reward 12 oz/A after recovery from transplant shock	21.5	78.7	4.7	17.6	26.2
Reward 24 oz/A after recovery from transplant shock	22.8	77.2	5.7	19.2	28.5
LSD 5%	NS	NS	NS	NS	NS

Cultivar: 0-7870; plot rows 30 ft. long on 5 ft. centers; plants at 12 in. spacing; transplanted at Fremont on 6/2/84 and at Wooster on 5/25/84; Reward treatments made on 6/21/84 at Fremont and 6/13/84 at Wooster. Product applied in water at 60 gal/A rate. Plants were in 5-6 true leaf stage regrowing well and an occasional first flower visible on a few plants. Plots harvested by machine at Fremont on 9/12/84 and at Wooster by hand on 9/6/84.

7. Chemicals to Promote Branching and Flowering

In 1983 an extensive study was conducted by David Frost on the use of some promising compounds to promote early branching of tomatoes and thus increase the potential for flowering and fruiting and subsequent yields. A complete detailed report is available in his M.S. thesis and the work will only be summarized here.

The treatments and results are given in Table 27. The results suggest that dikegulac (sodium salt) at rates of 500 and 250 ppm can indeed induce branching, but it can also delay maturity and at high rates can reduce fruit set and yield. None of the treatments offer promise to increase yield potential of tomatoes in Ohio.

TABLE 27. Influence of branching agents on branching, flowering, and yield of tomatoes, 1983.

Treatment	No.of Branches Primary	No.of Branches Second.	#Flower Clust/ Plant	Fruit Set(%)	Yield Tons/A	Ripe %
Early Applications (6/21/83)						
Control	5.3	5.5	36.2	53.2	19.9	77.3
Hand Pinched	5.6	6.1	35.2	53.4	19.2	76.5
Dikegulac 100 ppm	5.4	6.0	36.8	53.9	20.0	78.4
500 ppm	6.4	7.6	43.6	50.5	21.4	80.0
2500 ppm	12.8	15.7	58.2	34.2	1.1	8.0
Late Applications (7/1/83)						
Fatty Acids 7500 ppm	5.4	6.6	37.9	48.8	18.0	73.0
Dikegulac 500 ppm	7.0	10.6	47.9	47.1	13.8	54.9
LSD 5%	0.9	1.4	5.0	4.4	1.8	3.6

Cultivar: H-722; plot rows 30 ft. long on 5 ft. centers; plants 12 in. apart; transplanted on 5/27/83. At the time of the 7/1/83 application, the plants had 3-4 in. elongated primary branches. The chemicals were applied in water at 60 gal/A rate. The fruits were hand harvested on 9/7-9/83.

8. Treatments to Control Flowering and Fruit Development

The literature suggests that some compounds may influence flowering and fruit development of certain plants. Some of these materials have shown promise in greenhouses or preliminary field trials on tomatoes. Therefore, a field trial was set up on the main campus in Wooster to evaluate the most promising treatments. The treatments and results are summarized in Table 28.

TABLE 28. Influence of several growth regulating chemicals on flowering and fruiting of 0-7870 tomatoes, 1984.

Treatment	No. per plant			Yield-Tons/Acre	
	Clusters	Flowers	Fruit	Ripe	Green
Check (water only)	20	87	51	28.0	3.8
GA_3 50 ppm at 1st bloom	21	86	51	32.5	4.3
GA_3 50 ppm at 1st & full bloom	26	106	61	28.8	5.1
GA_3 50 ppm at full bloom	23	101	56	30.8	4.7
GA_3 50 ppm at 1st fruit set	20	84	50	30.9	4.7
GA_3 50 ppm at 1st bloom + Alar 2500 ppm at full bloom	26	107	58	26.7	4.7
Promalin 50 ppm at 1st bloom	21	96	55	29.9	6.9
Promalin 50 ppm at 1st & full bloom	20	90	54	26.8	4.4
Promalin 50 ppm at full bloom	18	82	49	31.7	3.8
Promalin 50 ppm at 1st fruit set	18	76	38	21.4	4.8
Promalin 50 ppm at 1st bloom + Alar 2500 ppm at full bloom	22	95	53	29.2	4.5
6BA 50 ppm at 1st bloom	18	80	44	24.0	3.9
6BA 50 ppm at 1st & full bloom	27	120	66	30.3	4.8
6BA 50 ppm at full bloom	22	90	49	26.0	4.5
6BA 50 ppm at 1st fruit set	22	98	53	33.4	4.0
6BA 50 ppm at 1st bloom + Alar 2500 ppm at full bloom	20	85	49	27.6	5.6
Alar 2500 ppm at full bloom	29	121	71	30.5	5.4
Sucrose-10% spray at full bloom	22	92	47	32.6	3.9

Transplanted on 5/25/84; treatments applied in 60 gal. water; Ethrel applied on 8/14/84; harvested once over by hand on 8/30 & 31/84.

There was considerable variation in the plots due to some transplanting and mechanical injury problems. Nevertheless, there are some suggestions that GA_3 and Promalin (a mixture of GA_{4+7} plus N-(phenylmethyl)-1H-purine-6-amine) applied at full bloom had a favorable effect on yield. There was also an apparent response to GA_3, 6BA (6-Benzyltadenine) and Alar on fruit set. Much of this study needs to be repeated under more uniform conditions before any meaningful interpretation can be made.

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