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PROCESSING VEGETABLE RESEARCH REPORT - 1997

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INTRODUCTION

This report summarizes the results of several processing vegetable studies conducted during 1997. Weather data for the '97 growing season are included at the end of this report. All cultural practice and spray application information is also listed.

The excellent cooperation of branch/farm managers Ken Scaife and Mark Schmittgen; Jabe Warren, Sean Mueller, and Ken DeWeese; Dr. Winston Bash and Gary Wenneker (OSU Pilot Plant, Columbus); Amy Barr and Mary Akemo, graduate research assistants; Jennifer Smith, student research assistant and many others is greatly appreciated. We hope this information is of benefit to the processing vegetable industry in Ohio and the Great Lakes region. Your comments and suggestions are always welcome.

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THE EFFECT OF NITROGEN LEVELS AND FRUIT MATURITY ON TOMATO PEELING EFFICIENCY - 1997

Co-Investigators: Dr. Winston Bash, Food Industries Center, Ohio State University
Dr. Sheryl Barringer, Food Science and Technology, Ohio State University

Objective: to provide fruit of commercially important processing tomato cultivars grown under standard production practices. Various nitrogen rates and fruit maturities were studied for effects on yield, quality, peeling efficiency, and fundamental fruit/cell structure. In 1995, preliminary research on this study was conducted at the Veg Crops Branch, Fremont, Ohio. Studies in 1996 and '97 were conducted at the OSU Waterman Farm, Columbus.

Materials and Methods: Processing tomatoes (cvs. 'OH8245', 'P696', and 'SO12') were established using transplants (288 cells) in single rows on raised beds at the OSU Waterman Farm. Nitrogen rates of 0, 50, 100, 150 lbs/A were compared for impact on fruit yield, peeling efficiency, and maturity. Soil type in 1997 was a Crosby silt loam. Seedlings were transplanted to the field on June 9 using a carousel transplanter. All N levels were established with ½ the total amount broadcast preplant, and ½ sidedressed approximately 3 weeks after plant establishment. All other production practices (disease/insect management, weed control, etc.) followed standard recommendations for the midwest U.S. Each treatment was planted in three replications. Three-row plots 25 feet long were established in each replication to allow harvest at three stages of fruit maturity: (1) one week early, (2) prime maturity and (3) one week after prime maturity (Table 1). Ethrel applications were not necessary in 1997 due to extensive defoliation caused by Septoria.

Plant tissue analysis (N, P, K, Ca, Mg, Mn, Fe, Cu, Zn, B, Al, Na) was conducted at first fruit set (late July '97) and again prior to the first harvest (Tables 2 & 3). Hand-harvested fruit was graded, weighed and transported to the OSU Pilot Plant, Columbus, for quality assessment (Table 4). Dr. Bash and Dr. Barringer also tested samples for peeling efficiency and fruit/cell structure.

Results: Plant tissue analysis at first fruit set and first harvest show no significant differences between N levels for any of the cultivars and all tissue nitrogen levels are within adequate range for processing tomatoes (Tables 2, 3). Foliar samples at first fruit set indicated low tissue Ca levels for all cultivars and N level treatments (was also seen in 1996). Tissue Ca levels tended to recover to low-normal range for the low N (0-50 lbs/A) treatments by first harvest (Table 3).

Yield results for 1997 showed no significant differences at the 0.05 level across cultivars or N levels. However, differences were present across fruit maturities. Yield and percentage of good red fruit decreased significantly at the late harvest, and rots increased with the second and third harvest dates (Table 4).

Table 6 shows significance levels for yield and quality variables in this study from combined year analysis (1996 and 1997). Nitrogen levels (0-150 lbs/A) had little effect on yield, fruit quality or peeling attributes in our 2 years of study in Columbus. Fruit maturity and cultivar were the important main effects to consider.

Table 1. Harvest dates for peeling study - 1997.

	------- Harvests --------		
Cultivar	**early**	**prime**	**late**
SO12	9/9	9/16	9/25
OH8245	9/15	9/22	10/2
P696	9/11	9/18	9/29

Table 2. The effect of nitrogen levels and fruit maturity on tomato peeling efficiency - 1997 (Columbus, OH)

FOLIAR SAMPLES TAKEN AT FIRST FRUIT SET (July 26, 1997)

Cultivar: 'OH8245'

		Microgram/Gram of Solid										
Treatment	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
0 lbs N/A	5.72	5114	35114	20293	6331	45.25	479.4	40.72	25.44	39.78	628.03	167.4
50 lbs N/A	5.41	4478	32078	20887	6608	47.97	472.2	39.93	19.79	37.08	609.33	181.9
100 lbs N/A	5.61	4833	33235	19024	6557	54.91	451.0	39.95	21.53	44.76	588.43	226.2
150 lbs N/A	5.58	4887	33903	20602	6950	62.34	463.9	44.48	23.85	52.50	580.10	226.0
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
p value	0.574	0.709	0.604	0.723	0.563	0.697	0.995	0.228	0.418	0.154	0.992	0.595
CV	4.5	12.7	7.7	9.6	7.6	33.3	25.1	7.5	18.7	20.7	30.1	30.5

Cultivar: 'Peto 696'

		Microgram/Gram of Solid										
Treatment	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
0 lbs N/A	5.16	4739	31338	22874	7432	47.39	559.6	44.56	19.67	42.09	684.03	254.9
50 lbs N/A	5.27	5036	31445	19847	6371	50.18	591.3	43.36	21.94	42.39	764.47	186.5
100 lbs N/A	5.53	5139	32566	22548	7666	58.54	514.8	46.16	23.39	51.27	627.13	222.7
150 lbs N/A	5.60	4116	26892	16634	5736	49.53	361.0	34.45	18.08	40.36	427.20	178.7
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
p value	0.361	0.724	0.752	0.346	0.243	0.747	0.365	0.269	0.502	0.687	0.391	0.154
CV	6.3	23.0	20.4	22.5	19.3	23.5	32.6	18.5	20.8	25.2	38.0	22.2

Cultivar: 'SO12'

		Microgram/Gram of Solid										
Treatment	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
0 lbs N/A	4.92	5981	31936	16683	5754	43.81	615.0	41.47	19.63	45.04	829.13	166.2
50 lbs N/A	5.36	5890	32315	17770	6152	51.17	541.0	42.72	21.30	52.68	701.87	180.3
100 lbs N/A	5.19	5311	32191	20246	6794	54.36	540.0	42.93	20.38	51.16	700.47	229.2
150 lbs N/A	5.27	4687	30699	20749	7070	54.22	544.8	44.76	19.53	48.28	722.87	240.1
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	42.30
p value	0.490	0.091	0.811	0.483	0.260	0.425	0.958	0.833	0.500	0.463	0.941	0.009
CV	6.7	13.5	6.4	18.6	13.7	16.6	31.3	9.1	7.4	12.1	35.2	18.6

Common nutrient ranges found in mechanically harvested tomatoes:

	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
	3.0-6.0	**5000-8000**	**25000-40000**	**40000-60000**	**6000-9000**	**40-100**	**- -**	**40-80**	**4-8**	**15-30**		

Table 3. The effect of nitrogen levels and fruit maturity on tomato peeling efficiency - 1997 (Columbus, OH).

FOLIAR SAMPLES TAKEN PRIOR TO FIRST HARVEST (early to mid-September)

Cultivar: 'OH8245'

Treatment	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
		Microgram/Gram of Solid										
0 lbs N/A	5.27	4989	32394	37268	7825	65.62	903.7	54.06	25.05	36.44	735.07	356.0
50 lbs N/A	5.19	4333	31817	34953	7973	80.07	1103.0	49.00	23.72	39.71	902.67	339.4
100 lbs N/A	5.24	4200	30091	34000	7755	86.63	1068.8	49.78	24.06	41.24	917.53	440.3
150 lbs N/A	5.54	4395	33156	32234	7396	90.47	939.8	47.25	25.68	44.93	785.07	409.4
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	6.446	NS	NS	NS	NS
p value	0.432	0.709	0.207	0.651	0.688	0.264	0.839		0.783	0.602	0.948	0.707
CV	6.8	7.3	4.5	15.3	11.3	13.4	17.9	10.8	12.4	11.4	22.5	19.8

Cultivar: 'Peto 696'

Treatment	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
		Microgram/Gram of Solid										
0 lbs N/A	4.77	4312	30079	36869	8233	75.34	1333.1	46.65	22.80	40.20	1068.17	455.3
50 lbs N/A	4.73	4809	29803	37724	7564	82.52	1125.2	53.35	23.43	44.73	901.13	402.1
100 lbs N/A	5.02	4534	31996	33238	7725	83.22	1014.1	47.27	22.30	45.82	817.10	398.8
150 lbs N/A	5.15	3950	29620	30499	7924	78.65	986.0	41.22	19.57	39.58	797.57	354.9
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
p value	0.170	0.466	0.835	0.492	0.783	0.993	0.921	0.218	0.611	0.735	0.949	0.580
CV	5.5	14.6	10.5	17.6	9.6	40.3	53.9	14.9	15.9	17.9	61.1	20.3

Cultivar: 'SO12'

Treatment	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
		Microgram/Gram of Solid										
0 lbs N/A	4.66	5276	28310	41040	8144	100.16	1230.7	53.14	23.10	47.81	1005.07	37536
50 lbs N/A	4.86	4780	28103	38242	8073	84.45	912.1	52.02	19.96	42.02	752.83	449.3
100 lbs N/A	4.98	4532	29848	34204	8102	93.13	1186.5	47.50	21.75	48.60	970.00	420.1
150 lbs N/A	5.05	4482	26661	36435	8801	98.65	1328.8	48.00	21.22	46.65	1031.53	393.9
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
p value	0.276	0.151	0.847	0.345	0.348	0.985	0.927	0.639	0.753	0.900	0.964	0.726
CV	5.2	12.1	13.8	12.3	6.7	51.7	60.2	12.0	15.0	22.3	68.4	18.7

Common nutrient ranges found in mechanically harvested tomatoes:

	% Total N	P	K	Ca	Mg	Mn	Fe	B	Cu	Zn	Al	Na
	3.0-6.0	**5000-8000**	**25000-40000**	**40000-60000**	**6000-9000**	**40-100**	**- -**	**40-80**	**4-8**	**15-30**		

Table 4. Effect of nitrogen levels and fruit maturity on processing tomato peeling efficiency; Columbus, OH - 1997.

	----Red Fruit----		Red&Grn	Green	Rots		y		
Main effects	**T/A**	**% red**	**T/A**	**T/A**	**T/A**	**Brix**	**Color**	**% acidity**	**pH**
CULTIVAR									
SO12	9.5	64	10.9	1.4	3.8	2.95	56.9	0.409	4.29
OH8245	10.1	70	11.3	1.2	3.2	3.13	48.6	0.363	4.39
P696	11.6	71	12.6	1.0	3.6	2.97	50.9	0.461	4.34
signif.							* * * z		* * *
LSD (0.05)	NS	NS	NS	NS	NS	NS	3.25	NS	.030
N LEVEL									
0	10.0	71	11.1	1.1	3.0	2.91	54.3	0.388	4.33
50	10.8	67	11.9	1.1	4.1	2.92	52.3	0.381	4.34
100	10.1	66	11.4	1.3	3.8	3.01	52.7	0.486	4.34
150	10.8	70	12.0	1.2	3.3	3.21	49.2	0.389	4.35
signif.									
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
MATURITY									
~ 1 wk early	11.9	75	14.0	2.1	1.7	3.11	56.8	0.432	4.20
Prime	11.9	74	13.1	1.2	3.0	2.98	53.0	0.359	4.37
~ 1 wk late	7.5	56	7.8	0.3	5.9	2.96	46.6	0.442	4.45
signif.	* * *	* * *	* *	* * *	* * *		* *		* * *
LSD (0.05)	1.27	4.4	1.36	0.33	0.82	NS	3.25	NS	.030
CV	37.3	18.6	38.7	93.1	74.0	14.2	18.0	67.2	3.7

z NS, *, * * , * * * Nonsignificant differences, or significant at P = 0.05, 0.01, or 0.001; respectively

y Color determined by Agtron model ME-5M

Table 5. Effect of cultivar, fruit maturity and nitrogen level on tomato fruit quality, peeling and maturity - 1997

	Red T/A	Green T/A	Culls T/A	Percent Red At Harvest	pH	Acidity	Soluble Solids	Agtron	Percent Wt. Loss After Lye Application	Percent Wt. Loss After Disc Peel	Percent Wt. Loss After Hand Peel	Total Weight Loss After Peeling
CV	NS	NS	NS	NS	***	NS	NS	***	NS	NS	NS	NS
MATURITY	***	***	***	***	***	NS	NS	***	NS	NS	*	NS
N LEVEL	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV X MATURITY	NS	NS	NS	NS	***	NS	NS	**	NS	NS	NS	NS
CV X N LEVEL	NS	NS	NS	NS	NS	NS	NS	*	NS	NS	NS	NS
CV X MATURITY X N LEVEL	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
N LEVEL X MATURITY	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

*, * *, * * * = significant at the 0.05, 0.01, and 0.001 probability levels, respectively

Table 6. Significance levels for main effects and various interactions in processing tomato peeling study, Columbus OH, 1996 & 1997.

	Red T/A	% Red	Green T/A	Culls T/A	pH	% Acid	Solids	Agtron	Peeling Losses: Lye	Peeling Losses: Disc	Peeling Losses: Hand	Peeling Losses: Total
YEAR	***	**	***	*	**	**	**	***	*	*	*	*
CV	***	***	***	***	***	***	NS	NS	***	***	**	**
N LEVEL	NS	NS	NS	NS	NS	*	***	*	*	*	NS	*
MATURITY	***	***	***	***	***	***	**	***	**	***	NS	***
CV X YEAR	***	NS	***	***	***	***	**	***	***	NS	NS	NS
N LEVEL X YEAR	NS	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	NS
MATURITY X YEAR	***	***	***	***	***	***	**	*	***	***	***	**
CV X MATURITY	***	***	*	***	***	***	NS	***	***	NS	NS	NS
CV X N LEVEL	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MATURITY X N LEVEL	NS	NS	NS	NS	NS	NS	NS	NS	*	NS	NS	NS
CV X N LEVEL X YEAR	NS	NS	NS	NS	**	NS	NS	NS	NS	NS	NS	NS
CV X MATURITY X YEAR	**	NS	NS	***	NS	*	*	**	***	***	NS	***
MATURITY X N LEVEL X YEAR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV X MATURITY X N LEVEL	NS	NS	NS	NS	NS	*	NS	*	NS	NS	NS	NS
CV X MATURITY X N LEVEL X YEAR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS, *, ** , *** = not significant, significance at the .05, .01, .001 levels; respectively

INFLUENCE OF TRANSPLANT DEPTH ON PROCESSING TOMATO YIELDS, QUALITY AND MATURITY

Objective: Transplanting depth has positively influenced vegetable crop yields and plant maturity in scattered studies on cabbage, peppers, and fresh-market tomatoes. Year 2 of this research will determine whether this simple management practice is of use to processing tomato growers in the Great Lakes region. Standard data collection for yields and fruit quality were collected to compare four transplant depth treatments.

Materials and Methods: Plots were established using 288-cell transplants of 'OH8245'. Plots consisted of twin rows on raised beds 25' long and 5' apart. Plots were established on May 28, 1997 using a carousel transplanter and hand adjusted for specific planting depths. Plants were planted at 4 different depths: (1) rootball just below soil line, (2) transplanted to seed leaf (cotyledon) depth, (3) transplanted to first true leaf, and (4) terminal bud approximately 1 inch above soil line. All treatments were planted in 5 replications, but data from two replications were discarded due to poor location and excessively wet field conditions throughout the growing season. All cultural practices (disease/insect management, etc.) followed standard recommended practices for Ohio.

Plant heights were recorded at 4 and 7 weeks after transplanting (WAT). Plots were hand harvested on September 3. Fruit was graded and yields recorded. Samples were taken to the OSU Pilot Plant for pH, acidity, and soluble solids tests.

Results to Date: Seedling growth data (plant heights at 4 and 7 WAT) were very similar to results from 1996. Setting transplants to at least the cotyledon level is necessary for best early growth (4 WAT data), but above ground plant heights were similar for all depths of transplanting by 7 WAT (Table 7).

Yields were reduced in 1997 due to a cold, wet growing season and heavy disease pressure (Septoria). There were no statistical differences for fruit yields or quality measurements among the four planting depths (Table 7). These results are similar to findings from year 1 when no differences were seen in fruit yields among planting depths.

Table 7. Depth of transplanting study - 1997; Columbus, OH.

Processing tomato
cultivar: 'OH8245'

Transplant Depth	4 WAT* Plant Ht. (inches)	7 WAT* Plant Ht. (inches)	Red T/A	Green T/A	Culls T/A	%Red	pH	Acidity	Soluble Solids
Rootball just below soil	9.2	17.0	14.2	2.3	3.3	71	4.3	0.341	3.1
Transplanted to cotyledon	10.3	16.9	14.0	1.6	3.4	74	4.3	0.348	3.0
Transplanted to 1st true leaf	10.1	17.1	15.2	1.3	2.3	81	4.3	0.332	3.1
Terminal bud 1" above soil	10.6	18.1	14.9	1.5	4.4	71	4.3	0.343	3.2
LSD (0.05)	1.01	NS	NS	NS	NS	NS	NS	NS	NS
p value	0.041	0.494	0.984	0.227	0.480	0.231	0.321	0.710	0.732
CV	7.2	6.0	26.0	40.6	45.4	8.8	1.0	4.4	6.5

* WAT = weeks after transplant

INFLUENCE OF ETHEPHON (ETHREL™) ON PROCESSING TOMATO FRUIT FIRMNESS, COLOR UNIFORMITY AND PEELING

Co-Investigators: Dr. David Francis, Horticulture and Crop Science, Ohio State University
Dr. Winston Bash, Food Industries Center, Ohio State University

Objectives: This study looked at 2 commercial cultivars of processing tomatoes and the effect of Ethrel™ rates on fruit firmness, color uniformity and quality variables. This is year 2 of a three-year study.

Materials and Methods: Processing tomato transplants of cultivars 'OH8245' and 'P696' were established on raised beds in single rows at the OSU/OARDC Veg. Crops Branch in Fremont, Ohio on June 11 . Rows were 30' long spaced 5' apart. Each treatment was planted in 4 replications. Plots were separated by buffer rows to minimize effects of Ethrel drift to neighboring treatments. All production practices followed recommended practices for peeling tomato production in the midwest U.S. Ethrel applications for each cultivar were: 0, 0.5, 0.5 X 2 applications, 1, 1 X 2 application, 1.5, 2, 4, and 6 pts/A. Ethrel applications were applied on September 2 on 'P696' and on September 5 for 'OH8245'. Split applications of 0.5 and 1.0 pts/A received the second ethrel application on September 6 ('P696') and September 11 ('OH8245'). Yield was recorded at the time of mechanical harvest. 'P696' receiving 4 pts/A and 6 pts/A applications were harvested on September 24. All other treatments were harvested on September 30. Fruit from all plots were tested for fruit firmness, color uniformity, and soluble solids. Firmness was measured using an Ametek Force Gauge on 10 fruit/plot. A Minolta 300 Colorimeter was used to measure color on 20 fruit/plot; 3 measurements per individual fruit. Samples from treatments of Ethrel applications of 0, 1X2 applications, 2, 4, and 6 pts/A were taken to the OSU Pilot Plant. Samples were peeled and canned for color inspection in early 1998.

Results to date:

Tomatoes were harvested 22-28 days (322-414 GDD) after initial ethrel applications in 1997 (Table 8). Yields were very good, averaging over 32 tons per acre, and fruit color development was improved compared to the 1996 study (Tables 9, 10, 11). Our planting date was again later than planned due to a wet and cool spring, but the crop ripened well in September with percent red fruit values ranging from 66% (control plots) to ~ 88% (6 pts/A treatment). Best red fruit yields in 1997 were generally seen for plots receiving at least 1 pt/A of ethrel (Table 9). Split application comparisons (0.5 pt X 2 applications vs. 1 pt; 1 pt. X 2 applications vs. 2 pts) showed little influence on yield and fruit quality variables examined in this study (Table 9.). Fruit from 1 and 2 pt/A applications (vs. split comparisons) did tend to be firmer again in 1997. This observation will be added to data from canned samples intended for color and firmness inspection this winter.

Two year data for green fruit yields (Table 10) show an expected response to increasing amounts (0 to 6 pts) of applied ethephon. Red fruit yields statistically exhibit more of a yield plateau for ethrel treatments of 0.5 to 2 pts/A, with top yields at 4 and 6 pts/A (Table 10). These high (4 or 6 pts/A) ethrel treatments also are associated with some of the lowest fruit solids (Tables 9, 10). Hue values indicate that 1997 was a better color development year for our research compared to 1996; and that hue was best for naturally ripened fruit (no ethrel) or lots receiving at least 2 pts/A (Table 11). This field research will be repeated in 1998 for the third and final year.

Table 8. Processing tomato Ethrel treatments, days from Ethrel application(s) to machine harvest,and growing degree days (GDD) to harvest; Fremont, OH - 1997.

Cultivar	Ethrel Rate pts/A	Days from Ethrel applications(s) to harvest	Growing Degree Days* (GDD) from Ethrel to harvest
'P696'	0.5	28	414
	0.5 X 2 applications	28/24	414/366
	1	28	414
	1.0 X 2 applications	28/24	414/366
	1.5	28	414
	2	28	414
	4	22	322
	6	22	322
'OH8245'	0.5	25	366
	0.5 X 2 applications	25/19	366/276
	1	25	366
	1.0 X 2 applications	25/19	366/276
	1.5	25	366
	2	25	366
	4	25	366
	6	25	366

* GDD = Maximum Daily Temperature + Minimum Daily Temperature/2 - Threshold (50)
(Minimum temp is not less than 50 degrees F and max temp is not more than 86 degrees F).

Table 9. Effect of ethrel rates on processing tomato yield and fruit quality, Fremont, OH - 1997

MAIN EFFECTS	Red Fruit T/A	Red Fruit % red	Green T/A	Culls T/A	Solids (Brix)	Fruit Firmness (kg)
Cultivars						
'OH8245'	28.5	73.6	8.4	2.0	3.10	4.28
'P696'	36.1	78.8	7.1	2.7	2.81	4.08
signif.	* *	*	NS	NS	*	* *
Ethrel Trts. (pts/A)						
0	29.6 cd	66.0 c	12.8 a	2.4 abc	3.00 ab	4.08 b
0.5	28.5 d	67.1 c	12.0 ab	2.0 bc	2.92 abc	4.15 b
0.5 (2 applications)	31.0 cd	73.8 b	8.3 cd	2.5 ab	2.92 abc	4.11 b
1.0	32.6 abc	73.9 b	9.7 bc	1.9 c	2.96 abc	4.35 ab
1.0 (2 applications)	31.5 cd	77.2 b	6.4 de	2.8 a	3.00 ab	4.21 ab
1.5	33.3 abc	77.2 b	7.0 d	2.6 ab	3.10 ab	4.05 b
2.0	32.2 bcd	78.6 b	6.2 de	2.4 abc	3.12 ab	4.50 a
4.0	35.7 ab	84.5 a	4.1 ef	2.3 abc	2.75 c	4.09 b
6.0	36.4 a	87.7 a	2.9	2.1 bc	2.77 c	4.06 b
LSD (0.05)	3.90	4.92	2.42	0.61	0.242	0.336
C.V.	17.8	11.5	53.8	31.4	9.9	7.9
avg.	32.3	76.2	7.7	2.3	2.95	4.18

Table 10. Effect of Ethrel rates on processing tomato yield and fruit quality, Fremont, OH - 1996 & 1997.

	- - - - - - - Red fruit - - - - - - -		Green	Culls	Solids
MAIN EFFECTS	T/A	% red	T/A	T/A	(o Brix)
Cultivars					
'OH8245'	32.6	76.7	8.1	1.8	2.97
'P696'	38.9	78.8	8.1	2.4	2.78
signif.	* * *	* *	NS	* *	* *
Year					
1996	39.3	79.3	8.4	1.9	2.80
1997	32.3	76.2	7.7	2.3	2.95
signif.[z]	* * *	NS	NS	* *	*
Ethrel Trts. (pts/A)					
0	32.7 d	69.9 f	11.9 a	2.2 ab	2.85 abcd
0.5	33.3 cd	71.7 ef	11.0 ab	1.9 b	2.76 cd
0.5 (2 applications)	34.7 bcd	74.5 de	9.5 c	2.2 ab	2.88 abcd
1.0	36.8 ab	75.9 cd	9.8 bc	1.9 b	3.01 a
1.0 (2 applications)	35.7 bc	78.8 b	7.3 d	2.2 ab	2.97 ab
1.5	35.5 bc	78.0 bc	7.7 d	2.3 a	2.98 a
2.0	35.4 bc	79.6 b	6.7 d	2.2 ab	2.91 abc
4.0	38.8 a	84.6 a	4.9 e	2.1 ab	2.79 bcd
6.0	39.3 a	86.9 a	3.8 e	2.0 ab	2.72 d
LSD (0.05)	2.62	2.83	1.47	0.38	0.19
avg.	35.8	77.8	8.1	2.1	2.87

z = NS, *, * *, * * * = Nonsignificant differences, or significant at P = 0.05, 0.01, or 0.001; respectively

Table 11. Fruit color variables for Ethrel study on processing tomatoes, Fremont, OH - 1996 & 1997.

MAIN EFFECTS	L[z]	A	B	Hue[y]	Chroma[x]
Cultivars					
'OH8245'	41.65	28.55	26.88	43.42	39.92
'P696'	41.64	27.94	26.43	43.77	39.03
signif.	NS	NS	NS	NS	NS
Year					
1996	43.24	28.28	27.87	45.27	40.56
1997	39.82	28.22	25.27	41.68	38.26
signif.	***	NS	***	**	***
Ethrel Trts. (pts/A)					
0	40.82	28.84	26.19	42.14	39.15
0.5	43.10	26.66	27.24	46.21	39.04
0.5 (2 applications)	42.51	28.19	26.97	44.08	39.57
1.0	42.33	27.80	27.05	44.92	39.51
1.0 (2 applications)	40.83	28.26	26.12	42.71	39.01
1.5	42.12	27.73	26.79	44.06	39.21
2.0	40.67	29.59	26.21	41.74	39.96
4.0	40.90	28.29	26.17	43.09	39.20
6.0	40.53	28.71	26.41	42.40	39.58
signif.	NS	NS	*	**	NS
C.V.	4.3	10.9	1.94	8.4	3.8
avg.	41.64	28.25	26.66	43.59	39.49

z L - measure of lightness (0-100 scale, zero=very dark, 100=very pale)

y Hue - measure of color; correlates well with A/B ratio. Lower values indicate more red vs. orange.

x Chroma - measures color saturation or vividness

Assessing an Integrated Disease Management strategy for processing tomatoes in Ohio.

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The use of organic mulches(cover crops) in vegetable production has gained attention in recent years. Previous research at the Ohio State University evaluating the use of cover crops as a means for weed management in processing tomato production and research at other institutions indicate that cover crops may also suppress soil-borne fungal diseases. This research was done:

i. To characterize and compare disease development in processing tomatoes grown in a chemically or mechanically killed cover crop verses a conventional production method.

Materials & Methods:

In the fall of 1996 a randomized split plot design with bed types as main plots (conventional, chemical kill and mechanical kill cover crop) and fungicide treatments (Bravo Ultrex 2.75 lbs/A & Benlate WP 1 lbs ai/A) as sub-plots (4 reps) was set up at the Waterman Horticulture Farm, Columbus, OH (Franklin Co.). A fall sown cover crop of hairy vetch (*Vicia villosa*) + winter rye (*Secale cereale*) was seeded at ~50 lbs/A each on raised beds. The cover crop was either chemically killed with an application of 2,4-D (2 pts/A) and Round-Up(4 pts/A) on 5/7 or mechanically killed with an undercutter (5/16). Single rows of tomato 'Peto 696' were transplanted into 5' wide x 30' long beds (5/27-30). Each plot consisted of 4 beds on 5' centers with outer 2 beds serving as guard rows and center 2 beds as treatment rows. Sub-plots were randomly assigned one of the five treatments as follows: no spray, 7 day spray, Tom-Cast advised sprays at DSV intervals of 15, 18, and 25. Campbell Scientific (CR-10) was used to measure rainfall, leaf wetness, and air temperature. Two CR10's were used to measure soil temperature and soil moisture at 5 & 15 cm. depths within each main plot (2 reps). DSV's were calculated for the Tom-Cast advised sprays, and all field data were downloaded daily from each of the three CR10 units. Spray treatments were applied using a single row tractor mounted CO-2 powered (60 psi) boom with 5 HC-12 nozzles. Weekly foliar disease ratings for Septoria Leaf Spot(*Septoria lycopersici*) were done for each plot and AUDPC (Area Under Disease Progression Curve's) were calculated. Normal production practices were followed throughout the growing season. Harvest was done on 8/30 for no spray treatments in conventional beds, 9/5 for no sprays in chemically and mechanically killed beds, and on 9/12-13 for all spray treatments.

Results to Date:

The tables on the following page indicate the some of the results of the first year of the study. Data indicate that the use of a cover crop resulted in a significant increase in yield (Table 2). The use of the fungicide, chlorothalonil, did not significantly increase yield in spray plots compared to the no spray control (Table 1). Also, the use of the disease forecasting system Tom-Cast resulted in a reduced amount of fungicide input without a compromise in yield when compared to the 7 day spray treatment (Table 1). Use of the cover crop increased yield in the no spray/cover crop treatments comparable to the 7 day spray/cover crop treatments (Table 2). Incidence of ground rot was significantly lower in mulched beds when compared to conventional beds (Table 5). The use of a cover crop significantly reduced the percent of mold on fruit (Table 4). Percent mold as a percentage of total harvested fruit was comparably lower in the mulched beds when compared to conventional beds (Table 3).

Table 1. Differences in yield among treatments within main plots in 1997.

	Conventional Bed	Chem Kill Bed	Mech Kill Bed
No Spray(0)	11.73	26.95	25.09
7 Day(11)	14.27	25.48	24.66
TC-15(5)	10.15	28.08	27.71
TC-18(4)	14.09	22.72	23.17
TC-25(3)	13.23	26.79	21.96
	NS	NS	NS

Yield = Good Red + Good Green
( ) = Number of Sprays.
Units = Tons/Acre

Table 2. Differences in yield among treatments between main plots in 1997.

	Conventional Bed	Chem Kill Bed	Mech Kill Bed
No Spray(0)	11.73a	26.95b	25.09b
7 Day(11)	14.27b	25.48b	24.66b
TC-15(5)	10.15a	28.08b	27.71b
TC-18(4)	14.09b	22.72b	23.17b
TC-25(3)	13.23a	26.79b	21.96ab

Means with same letter are NOT significantly different.
Yield = Good Red + Good Green.
( ) = Number of Sprays.
Units = Tons/Acre

Table 3. Percent mold as a percentage of total fruit harvested in 1997.

	Conventional Bed	Chem Kill Bed	Mech Kill Bed
No Spray(0)	12.15	1.28	1.3
7 Day(11)	8.65	1.03	0.41
TC-15(5)	12.47	1.89	1.26
TC-18(4)	11.43	1.90	1.30
TC-25(3)	16.94	1.77	1.05

Total Mold = Ground Rot + Anthracnose infected fruit.
%Mold calculated by dividing total mold by total fruit.
%Mold > 4% is unacceptable.

Table 4. Differences in total mold among treatments between main plots in 1997.

	Conventional Bed	Chem Kill Bed	Mech Kill Bed
No Spray(0)	1.69a	0.35b	0.35b
7 Day(11)	1.42a	0.28b	0.10b
TC-15(5)	1.58a	0.53b	0.37b
TC-18(4)	1.89a	0.46b	0.32b
TC-25(3)	2.82a	0.60b	0.24b

Means with the same letter are NOT significantly different.
Mold = Ground Rot + Anthracnose infected fruit.
Units = Kg/10' row

Table 5. Differences in ground rots among treatments between main plots in 1997.

	Conventional Bed	Chem Kill Bed	Mech Kill Bed
No Spray(0)	1.285a	0.235b	0.235b
7 Day(11)	1.01a	0.11b	0.06b
TC-15(5)	1.06a	0.29b	0.11b
TC-18(4)	1.45a	0.27b	0.25b
TC-25(3)	1.89a	0.28b	0.13b

Means with the same letter are NOT significantly different.
( ) = Number of Sprays.
Units = Kg/10' row

Weather Data 1997 (OSU Waterman Farm) Columbus, Ohio

Month	1997 - Average Air Temp °F- Minimum	1997 - Average Air Temp °F- Maximum	Long-Term Averages Average Minimum	Long-Term Averages Average Maximum
May	45.3	66.7	50.2	72.5
June	59.8	80.2	59.4	81.3
July	62.0	84.3	63.2	85.1
August	59.6	79.6	61.7	83.5
September	53.3	76.3	54.7	77.4
October	47.2	73.7	43.2	65.8

Month	'97 Rainfall (inches)	Long-Term Average
May 27-31	1.12	0.76
June	8.09	4.48
July	6.12	4.46
August	6.10	4.65
September	0.46	3.67
October 1-11	0.38	0.98
May 27 to October 11	22.27	19.00

Cultural Practices and Spray Applications for Nitrogen/Peeling Study on Processing Tomatoes - 1997
OSU Waterman Farm, Columbus, OH

Fall, 1996	Chisel plowed
May 20, 1997	Field cultivated; shaped raised beds
May 28	Treflan 1-1/2 pts/A + Sencor ½ lb/A
June 6	Broadcast half rate of nitrogen (ammonium nitrate) treatments with drop spreader (33-0-0)
June 9	Planted tomatoes
June 24	Sevin XLR Plus 2 qt/A
July 7	Second nitrogen (ammonium nitrate) application to tomatoes (1/2 rate)
July 14	Sencor ½ lb/A + Dash 1 qt/A + Poast 1 pt/A
July 25; August 1, 8, 19, 29	Sevin XLR Plus 2 qts/A + Benlate 1 lb/A
July 28	Roundup 1% solution between raised beds

Harvest dates:	Early	Prime	Late
'SO12'	9/9	9/16	9/25
'OH8245'	9/15	9/22	10/2
'P696'	9/11	9/18	9/29

Cultural Practices and Spray Applications for Depth of Planting Study on Processing Tomatoes - 1997 OSU Waterman Farm, Columbus, OH

Fall, 1996	Chisel plowed
May 20, 1997	Field cultivated; shaped raised beds
May 28	Treflan 1-1/2 pts/A + Sencor ½ lb/A Planted tomatoes
June 24	Sevin XLR Plus 2 qt/A
July 2	Sencor ½ lb/A + Dash 1 qt/A + Poast 1 pt/A
July 14	Sencor ½ lb/A + Dash 1 qt/A + Poast 1 pt/A
July 25; August 1, 8, 19, 29	Sevin XLR Plus 2 qts/A + Benlate 1 lb/A
September 3	Plots were hand harvested

Weather Data 1997 (Vegetable Crops Branch) Fremont, Ohio

	1997 - Average Air Temp °F-		Long-Term Averages	
Month	**Minimum**	**Maximum**	**Average Minimum**	**Average Maximum**
May	41.0	63.7	48.1	70.3
June	57.4	78.3	58.0	80.1
July	58.7	81.7	61.7	84.0
August	54.9	77.5	59.4	81.9
September	48.4	74.2	52.1	75.3

Month	**'97 Rainfall (inches)**	**Long-Term Average**
May	5.89	3.64
June	4.64	3.97
July	2.53	3.86
August	4.08	3.39
September	2.69	3.01
May thru September:	19.83	17.87

Cultural Practices and Spray Applications for Ethrel Study - 1997,
Veg. Crops Branch, Fremont, OH

April 10	Chisel plowed
April 21	Field cultivator
May 21	Broadcast 220 lb/A 34-0-0 + 500 lb/A 0-14-42
May 24	1.5 pt/A Treflan MTF and 1/3 lb/A Sencor 75DF
June 11	Transplanted to the field with carousel tranplanter
June 24	Bravo 720 2 pt/A + Champ 2F 1.5 pt/A
July 1	Terranil 6L 2.5 pts/A + Champ 2F 2pt/A
July 11	Sencor 75DF ½ lb/A
July 18, 25	Terranil 6L 3 pts/A + Champ 2F 2pt/A + Warrior 3.5 oz/A
August 1	Terranil 6L 3 pts/A + Champ 2F 2 pt/A + Thiodan 3E 1-1/3 qt/A
August 14	Terranil 6L 3 pts/A + Kocide LF 4 pt/A + Warrior 3.5 oz/A
August 23	Terranil 6L 3 pts/A + Kocide LF 3 pts/A
Sept. 2	Ethrel applied to 'P696' treatments 2-9
Sept. 4	Bravo 720 3 pts/A + Champ 2F 2 pts/A
Sept. 5	Ethrel applied to 'OH8245' treatments 2-9
Sept. 6	2nd Ethrel application for split amounts to 'P696'
Sept. 11	2nd Ethrel application for split amounts to 'OH8245'

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