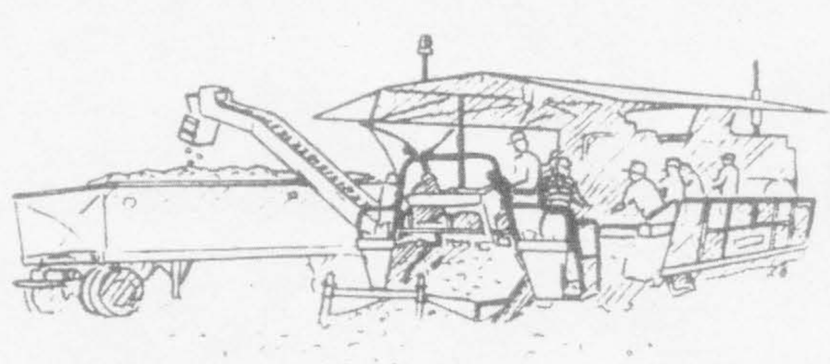
1992 PROCESSING TOMATO MANAGEMENT RESEARCH

AGRICULTURE CANADA RESEARCH STATION HARROW, ONTARIO



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1992 PROCESSING TOMATO MANAGEMENT RESEARCH

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FORWARD

The information contained in this report is a summary of crop management research on processing tomatoes conducted at Harrow Ontario, during the summer of 1992. The trials at Harrow were grown on a Fox sandy loam soil, which is representative of the soil types used for much of the processing tomato crop in this area. Details of cultural practices used, are included in each trial report. Pesticide applications were made according to Ont. Ministry of Agriculture and Food, Publication 363 recommendations.

Climatic conditions for the 1992 season are summarized on pages 3 and 4. Growing conditions for this season were very unusual. April and early May were cold and cloudy, resulting in cool soil temperatures for early crop establishment. A period of warm, sunny weather in mid-May was favorable for planting operations and early growth. Several weeks of relatively cool weather in late May and early June delayed maturity of the processing tomato crop. Throughout the remainder of the summer, temperatures were cooler than normal. May and early June were slightly dry, but during the remainder of the summer rainfall was frequent, and heavier than normal. The tomato crop was never under moisture stress during fruitset and development, and yields in the area were above average.

Thanks to the H.J. Heinz company for the contribution of seed and transplants for the trials. It is hoped that the information contained in this report will be beneficial to the Ontario Tomato industry.

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TEMPERATURE AND PRECIPITATION DATA
Harrow, Ontario
1992

	APRIL				MAY				JUNE		
Date	High (°C)	Low (°C)	Precip. (mm)	Date	High (°C)	Low (°C)	Precip. (mm)	Date	High (°C)	Low (°C)	Precip. (mm)
1	2.4	-2.1	4.0	1	23.0	3.0		1	22.6	9.8	
2	1.4	-5.1		2	24.6	15.1		2	21.6	8.6	
3	6.1	-3.3		3	15.9	7.0		3	24.8	9.6	
4	6.9	1.3		4	10.1	6.1		4	22.5	15.4	3.0
5	8.9	-2.1		5	11.6	0.7		5	22.4	16.5	
6	11.9	-0.2		6	14.1	2.9		6	24.3	13.9	1.8
7	18.7	5.1	2.8	7	16.4	2.0		7	22.5	17.7	0.5
8	11.4	-0.3		8	20.8	3.2	2.8	8	22.7	13.2	
9	11.8	3.1		9	17.8	9.6		9	21.9	12.0	
10	11.9	-0.1	0.8	10	20.0	8.1		10	22.7	5.7	
11	18.6	4.7	10.0	11	25.2	11.3		11	25.1	9.1	
12	7.5	2.5		12	28.1	14.5		12	27.4	9.0	
13	3.4	-3.1		13	22.3	14.7		13	29.9	14.5	
14	6.7	0.2		14	14.5	5.0		14	28.6	18.1	
15	8.6	-1.1	2.3	15	19.8	4.4		15	22.2	13.9	
16	21.3	4.1	8.8	16	22.4	8.4		16	25.5	10.0	
17	9.0	5.1	6.3	17	29.2	14.2	3.8	17	31.1	17.5	18.5
18	9.7	3.8	2.0	18	15.7	10.4		18	27.9	17.9	1.8
19	20.6	5.7	2.5	19	20.2	4.9		19	18.0	13.5	
20	23.0	10.1	9.5	20	24.8	9.7		20	12.3	8.5	
21	18.3	13.3	10.3	21	25.8	11.3		21	15.9	5.5	
22	10.9	7.8	0.3	22	29.0	13.3		22	20.1	5.8	
23	16.2	4.7	12.0	23	27.5	11.9	7.0	23	17.7	12.3	4.0
24	10.0	7.1	10.8	24	8.8	6.4		24	20.2	12.4	
25	6.9	3.6	2.0	25	14.0	1.6		25	21.2	10.4	1.3
26	12.2	5.5		26	13.6	4.4		26	25.3	14.4	0.8
27	12.0	4.5		27	17.5	4.7		27	22.8	11.9	
28	12.0	0.1		28	20.2	5.7		28	23.8	10.6	
29	12.1	6.1	6.3	29	22.0	5.4	6.5	29	27.7	13.8	
30	14.5	8.9		30	14.9	11.3	12.8	30	28.5	13.9	
				31	18.4	12.2					
Mean	11.5	3.0	90.7*		19.6	7.9	32.9*		23.3	12.2	31.7*
Norm	13.4	2.9	74.5**		19.7	8.6	70.0**		25.5	14.3	77.0**

* Monthly total precipitation
** Monthly average precipitation

TEMPERATURE AND PRECIPITATION DATA
Harrow, Ontario
1992

	JULY				AUGUST				SEPTEMBER		
Date	High (°C)	Low (°C)	Precip. (mm)	Date	High (°C)	Low (°C)	Precip. (mm)	Date	High (°C)	Low (°C)	Precip. (mm)
1	26.6	14.5		1	24.9	12.2		1	22.0	10.9	
2	26.5	18.0		2	25.0	17.3		2	21.3	13.1	6.5
3	28.9	20.3		3	25.3	18.6	0.3	3	26.5	19.2	0.3
4	27.0	15.4	10.8	4	22.7	13.8		4	22.6	12.7	
5	24.8	18.0		5	22.8	10.7		5	25.9	11.2	10.8
6	22.4	12.5		6	23.9	10.5		6	26.8	19.2	14.0
7	24.8	14.1		7	25.9	13.6	15.8	7	24.6	19.6	8.3
8	25.8	19.1	2.0	8	28.0	20.7		8	24.6	19.4	
9	28.8	21.8	1.8	9	29.0	17.2		9	22.8	10.6	57.3
10	28.0	19.5	0.3	10	32.4	19.2	12.3	10	22.0	17.0	
11	27.3	17.5		11	26.1	15.7		11	18.2	9.1	
12	27.4	20.9	11.0	12	21.8	13.1	32.5	12	19.0	7.4	
13	23.9	18.2	7.3	13	20.6	13.7		13	20.8	9.5	
14	29.8	17.8	43.5	14	18.3	13.1		14	25.2	14.8	
15	20.9	15.9	5.8	15	20.4	13.1		15	27.0	19.3	26.3
16	25.1	18.3	8.5	16	22.3	14.6		16	26.5	19.8	
17	23.9	18.9	2.8	17	22.7	12.9		17	27.0	19.9	2.0
18	27.2	20.0		18	24.6	13.8	0.5	18	23.4	19.6	5.0
19	25.6	14.7		19	22.6	11.5		19	17.7	8.2	
20	25.1	20.6	3.8	20	22.2	10.3		20	20.0	7.2	29.0
21	21.0	14.1		21	22.7	9.9		21	22.2	15.7	26.5
22	22.1	10.6	7.5	22	24.6	11.4		22	20.1	16.8	
23	20.0	13.5	7.5	23	27.4	15.7		23	13.6	2.8	
24	21.6	15.6		24	25.9	20.8	7.0	24	17.5	5.4	
25	24.7	14.9	3.3	25	28.1	21.4		25	17.9	8.8	
26	28.3	21.2	0.8	26	28.8	20.6	7.5	26	20.6	10.5	0.5
27	24.9	15.6		27	23.0	17.5	31.3	27	20.9	14.8	
28	26.0	10.4		28	17.0	14.9	0.8	28	20.3	5.7	
29	28.2	20.0		29	21.6	10.0		29	13.2	2.8	
30	21.1	15.4	9.8	30	25.0	18.4		30	14.9	3.6	
31	19.6	13.5		31	22.7	13.2					
Mean	25.1	16.8	126.5*		24.1	14.8	108.0*		21.5	12.5	186.5*
Norm	27.8	16.9	71.5**		26.7	15.9	70.8**		22.0	12.4	68.3**

* Monthly total precipitation
** Monthly average precipitation

FIELD PERFORMANCE OF 406 CELL TOMATO TRANSPLANTS

Over the past several years 288 cell plug transplants have become the preferred method of establishing processing tomato crops in Ontario. Growers have become very competent at handling plug plants, and should be able to make the transition to using a smaller sized transplant relatively easily. A smaller cell size, such as a 406 plug tray, would allow seedling growers to produce more transplants per unit of greenhouse space, thus reducing transplant cost. However, more information is needed on field performance of 406 plug plants, and cultural practices to grow these transplants.

This was the second year of this trial in which the field performance of 406 plug transplants was compared with that of 288 plugs. Last year's trial indicated that 406's can perform as well as 288's, when planted under favorable field conditions. However plant stand was reduced when 406's were planted in more stressful conditions early in the season.

In this trial, 288 and 406 cell transplants were planted in early and late-season planting dates to evaluate plant establishment under different environmental conditions. Within each plug size, seedings were scheduled to produce 5 and 7 week old transplants for field planting. Four fertility programs and two plant conditioning programs were also evaluated.

TREATMENTS:

1) Planting Dates: early planting - May 11
   late planting - June 1

2) Transplant size: 406 plug (3.0 cc. cell volume)
   288 plug (6.5 cc. cell volume)

3) Transplant Age: 7 week (Early planting @ 7 week seeded March 23)
   (Late planting @ 7 week seeded April 13)

   5 week (Early planting @ 5 week seeded April 3)
   (Late planting @ 5 week seeded April 27)

4) Fertility program in greenhouse:
   Four greenhouse fertility programs which have been used by transplant growers in Ontario, were tested. The seedlings were fertilized daily with the following nutrient solutions (solutions in parts/million of N, P and K)

   a) 100N 47P 216K: Peter's 5-11-26 fertilizer (1 gram per litre of solution)
   + Magnesium Nitrate (.45 gram per litre of solution)

   b) 100N 4P 30K: Magnesium Nitrate (.86 gram per litre of solution)
   + Potassium Sulfate (.07 gram per litre of solution)
   + Plant Product's 15-30-15 (.03 gram per litre of solution)

   c) 100N 0P 83K: Plant Products 14-0-14 (.72 gram per litre of solution)

   d) 100N 17P 83K: Plant Products 20-8-20 (.5 gram per litre of solution)

5) Pre-transplant conditioning:

+ conditioning:	transplants were moved outside for 7 days prior to planting for hardening off
- conditioning:	transplants were planted directly from the greenhouse.

CULTURAL PRACTICES:

Soil type:	Fox sandy loam
Soil management:	spring mouldboard plowed, spring bedded
Fertilizer:	100 kg/ha actual nitrogen and 200 kg/ha potash broadcast and incorporated in the beds. Starter fertilizer (10-30-20) used in the transplant water.
Herbicide:	Metolachlor @ 2.0 kg/ha + Metribuzin @ 0.3 kg/ha preplant incorp.
Cultivar:	HY 9478
Plant Population:	twin rows on 1.5 m beds with 40 cm between plants in the row (13,000 plants/acre)
Harvest:	Ethrel applied at 1.5 l/acre rate approx 14 days before harvest. Machine harvested when the crop reached 90% ripe fruit stage. Early planting was harvested on August 27. Late planting was harvested on September 15.

FIELD PERFORMANCE OF 406 CELL TOMATO TRANSPLANTS
Research Station, Harrow, ON

Results 1992

Table 1. EARLY PLANTING: Influence of plug size and transplant age, on seedling height, plant stand and fruit yield (averaged over 4 fertility and 2 conditioning programs)

Treatment	Height at Planting (cm)	Final Plant Stand (%)	Fruit Yield (tons/acre)
288, 5 week	10.2	94.1	27.17
288, 7 week	16.4	96.3	25.18
406, 5 week	9.1	87.1	25.25
406, 7 week	15.7	89.9	23.96
LSD .05	1.5	3.1	1.80

Table 2. EARLY PLANTING: Influence of plug size and greenhouse fertility program on seedling height, final plant stand and fruit yield (averaged over 2 seedling ages and 2 conditioning programs)

Treatment	Height at Planting (cm)	Final Plant Stand (%)	Fruit Yield (tons/acre)
288; 100N 47P 216K	14.8	95.6	25.19
288; 100N 4P 30K	12.0	95.0	26.42
288; 100N 0P 83K	13.3	94.6	27.18
288; 100N 17P 83K	13.3	95.4	25.92
406; 100N 47P 216K	14.3	90.6	24.00
406; 100N 4P 30K	10.9	87.3	24.37
406; 100N 0P 83K	11.9	88.3	25.30
406; 100N 17P 83K	12.5	87.7	24.74
LSD .05	ns	4.4	2.50

Table 3. EARLY PLANTING: Influence of plug size and pre-plant conditioning on seedling height, final plant stand and fruit yield (averaged over 4 fertility programs and 2 seedling ages)

Treatment	Height at Planting (cm)	Final Plant Stand (%)	Fruit Yield (tons/acre)
288 + conditioning	13.0	95.5	26.32
288, no conditioning	13.6	94.8	26.03
406 + conditioning	11.8	87.3	24.44
406, no conditioning	12.9	89.6	24.77
LSD .05	1.5	3.1	1.80

Table 4. LATE PLANTING: Influence of plug size and transplant age, on seedling height, plant stand and fruit yield (averaged over 4 fertility and 2 conditioning programs)

Treatment	Height at Planting (cm)	Final Plant Stand (%)	Fruit Yield (tons/acre)
288, 5 week	13.3	95.2	31.97
288, 7 week	15.1	96.3	28.99
406, 5 week	11.9	94.5	31.35
406, 7 week	13.3	95.4	29.22
LSD .05	1.6	ns	ns

Table 5. LATE PLANTING: Influence of plug size and greenhouse fertility program on seedling height, final plant stand and fruit yield (averaged over 2 seedling ages and 2 conditioning programs)

Treatment	Height at Planting (cm)	Final Plant Stand (%)	Fruit Yield (tons/acre)
288; 100N 47P 216K	16.0	95.4	27.14
288; 100N 4P 30K	13.0	97.3	31.15
288; 100N 0P 83K	13.4	95.6	31.96
288; 100N 17P 83K	14.3	94.6	31.68
406; 100N 47P 216K	14.8	96.9	26.81
406; 100N 4P 30K	11.3	94.8	31.94
406; 100N 0P 83K	11.6	94.0	31.56
406; 100N 17P 83K	12.6	94.2	30.82
LSD .05	1.8	2.7	4.82

Table 6. LATE PLANTING: Influence of plug size and pre-plant conditioning on seedling height, final plant stand and fruit yield (averaged over 4 fertility programs and 2 seedling ages)

Treatment	Height at Planting (cm)	Final Plant Stand (%)	Fruit Yield (tons/acre)
288 + conditioning	14.0	96.4	30.83
288, no conditioning	14.3	95.1	30.14
406 + conditioning	12.1	95.0	31.64
406, no conditioning	13.0	94.9	28.93
LSD .05	1.6	ns	ns

FIELD PERFORMANCE OF 406 CELL TOMATO TRANSPLANTS

DISCUSSION:

Weather conditions in the early part of this season were not very favorable for transplant establishment. Even with these conditions, plant survival of the 288 plugs was very good. The 406 plug transplants were shorter at the time of transplanting, and survival was reduced, compared to the 288's. The 7 week old transplants were slightly taller than desirable and had reduced yields compared to the 5 week old plants (Table 1). The 100N, 47P, 216K fertility treatment resulted in slightly taller plants in both cell sizes, but did not have a significant influence on plant survival or yield (Table 2). Low phosphorus fertility programs (0 or 4 ppm P) generally resulted in shorter transplants, but did not reduce plant establishment.

In the late-season planting, soil temperature was warmer and conditions more favorable for transplant establishment. In this planting, there were no differences in plant stand or yield between the 406 and 288 plugs. The 5 week old seedlings tended to produce higher yields in both cell sizes (Table 4). The seedlings which were fertilized with 100N, 47P, 216K were taller, and produced lower yields than the other fertility treatments (Table 5). Outside conditioning of the transplants did not improve stand or yield in either planting (Table 3 and 6).

The results of this years trial were consistent with those of the 1991 trial. In both years, the 406 transplants had reduced plant survival in the early-season planting but performed as well as the 288's in the later planting. Practices which resulted in very tall seedlings tended to reduce crop yield. It is important to have good environmental control in the greenhouse to prevent transplants from becoming elongated. The low phosphorus fertility program reduced seedling height. However, if a low P program is used it is important to use starter fertilizer in the transplant water for early-season plantings.

These results indicate that 288 cell transplants are the best method of establishing early processing tomato crops in this area. For midseason and late planting dates, where establishment conditions are normally good, the use of 406 cell transplants may be a method to reduce production costs.

EVALUATION OF BIOLOGICAL CATALYST IN FERTILITY PROGRAMS

This trial was conducted to evaluate a group of products referred to as the biological catalyst, for use as a fertilizer supplement for tomatoes. This product is currently being recommended by the Christian Agriculture Stewardship Institute (CASI), and used by a number of tomato growers in Ontario. This group of products consists of a 9-18-9 liquid fertilizer (Formula 71-B); Agri-Kelp (Biological Catalyst Concentrate); and a Molasses solution. Various combinations of these products are recommended as a soil application to be sprayed on the cover crop; as a starter solution in the transplant water; and as foliar sprays through the growing season.

In these trials, the biological catalyst was tested in a planting water treatment (Trial #1), and as the complete soil, planting water, foliar program (Trial #2).

TREATMENTS - TRIAL # 1

1. Check - starter fertilizer solution of 10-34-0 liquid fertilizer at 1 litre per 150 litres of transplant water (a total of 1137 litres of transplant water (250 imp. gallons) applied per acre).

2. CASI - 1 litre of Formula 71-B (9-18-9) + 25 ml of AgriKelp + 200 ml of Molasses per 100 litres of transplant water (a total of 1137 litres of transplant water (250 imp. gal) applied per acre).

TREATMENTS - TRIAL # 2

1. Check
   - 100 kg/ha actual N + 200 kg/ha potash broadcast prior to planting.
   - 10-34-0 starter fertilizer.
   - no foliar fertilizer application.

2. CASI
   - 100 kg/ha actual N + 200kg/ha potash broadcast prior to planting.
   - soil application:
     Molasses @ 4.5 L/acre + AgriKelp @ 142 ml/acre sprayed on soil surface and incorporated with fertilizer
   - starter solution:
     1 litre of Formula 71-B (9-18-9) + 25 ml of AgriKelp + 200 ml of Molasses per 100 litres of transplant water. 1137 litres of starter solution (250 imp. gal) applied per acre.
   - foliar fertilizer:
     Molasses @ 500 ml/acre + Agrikelp @ 142 ml/acre + Formula 71-B @ 4.5 L/acre (foliar fertilizer solution applied 4 times: June 22, July 9, July 27, and August 11).

Soil Type:	Fox Sandy Loam
Tomato Cultivar:	HY 9478
Transplants:	288 plug transplants, planted May 14, with a Holland plug transplanter
Plant Population:	twin rows on 1.5 m wide beds, 40 cm between the twin rows, 40 cm between plants in rows. (13,000 plants/acre)
Herbicide:	Metolachlor @ 2.0 kg/ha + Metribuzin @ 0.3 kg/ha
Harvest:	all plots sprayed with Ethrel at 1.5 L/acre rate on August 14. - machine harvested on August 27.

Results - Trial # 1

Influence of Biological Catalyst in starter solution on tomato plant stand and fruit yield

Treatment	Plant Stand (%)	Yield (tons/acre)		
		Marketable	Green	Cull
CASI	92.0	26.41	0.5	0.5
Check	95.6	25.77	0.3	0.5
LSD .05	NS	NS	NS	NS

Results - Trial # 2

Influence of Biological Catalyst in soil, planting water and foliar application on tomato plant stand and fruit yield.

Treatment	Plant Stand (%)	Yield (tons/acre)		
		Marketable	Green	Cull
Check	99.0	26.82	0.4	0.5
CASI	97.2	25.59	0.4	0.5
LSD .05	NS	NS	NS	NS

DISCUSSION:

The use of the CASI biological catalyst materials in starter solution and in foliar sprays did not produce significant improvements in plant stand or tomato yield in these trials. The use of this program would be an increased cost, and an increased amount of handling and mixing of materials for the grower. These results are consistent with many other trials on processing tomatoes in which foliar fertilizer applications did not increase yields.

CONSERVATION TILLAGE PRACTICES FOR PROCESSING TOMATOES

In Southern Ontario, processing tomatoes are usually grown on sands and sandy loam soils which are prone to wind erosion and relatively low in organic matter. Tomatoes are usually grown in rotation with other vegetable and field crops, and there is little rotation to soil improving crops such as alfalfa. These factors have resulted in a decline in soil quality in tomato producing areas. Conservation tillage practices have been developed for production of field crops. If growers could use these practices in tomatoes and field crops in rotation, they may be able to reduce the detrimental effects of intensive cropping on soil structure. However, it would not be economical to use conservation tillage systems if tomato yield was reduced.

Trials have been conducted in 1991 and 1992 to develop a conservation tillage system for producing processing tomatoes. The objective is to identify cultural practices which will allow growers to reduce the amount of tillage, and maintain more residue on the soil surface while maintaining or increasing tomato yield.

METHODS:

Trial # 1 was conducted to compare conservation tillage and conventional tillage practices, with and without raised beds. Trial # 2 was conducted to determine the effect of cover crop height at burn-down on growth of the tomato crop. The field trials were grown on a Fox sandy loam soil at the Harrow Research Station. The field was prepared in early October 1991. Beds for the conservation till + raised bed treatments were made with a sled bedder. The rye cover crop was drilled at a 1.5 bu/ac rate on all treatments. In the spring of 1992 the tillage treatments were applied as follows:

TRIAL # 1

a) spring plow + raised bed
- mouldboard plowed on April 15.
- beds made with a sled bedder.
- fertilizer broadcast and herbicide sprayed on beds.
- fertilizer and herbicide incorporated with a power bedder.

b) spring plow; flat
- mouldboard plowed on April 15.
- soil worked to 15 cm depth with Triple-K field cultivator.
- fertilizer broadcast and herbicide sprayed on soil.
- fertilizer and herbicide incorporated with field cultivator.

c) conservation tillage + raised bed
- fall beds made in October 1991; rye cover crop drilled on beds
- beds sprayed with Roundup herbicide when rye at 20 cm tall (April 28)
- fertilizer broadcast and herbicide sprayed on beds
- beds worked with coulter bar* to loosen soil for planting.

d) conservation tillage; flat
- rye cover crop drilled in October 1991.
- cover crop sprayed with Roundup herbicide when 20 cm tall (April 28).
- fertilizer broadcast and herbicide sprayed.
- soil worked with coulter bar* to loosen soil for planting.

TRIAL # 2

- fall beds made in October 1991; rye cover crop drilled on beds
- Roundup applied when rye at 20 cm tall (April 28) or at 40 cm tall (May 5)
- fertilizer broadcast and herbicide sprayed on beds.
- beds worked with coulter bar* to loosen soil for planting.

CULTURAL PRACTICES:

Burndown Herbicide	-	Roundup (Glyphosate 356 g/L)was applied at a rate of .75 L/acre (.65 kg/ha active) to burn down the cover crop.
Coulter Tillage	-	All conservation tillage treatments were worked with a coulter tillage implement after the rye was burned-off, prior to planting. This implement consisted of two toolbars on which five 2" wavy coulters were mounted. These coulters were spaced 10 cm apart, to work a strip about 50 cm wide in the center of each bed. The coulters cut the rye straw, but left most of the rye residue on the soil surface. This operation loosened the soil slightly which allowed better placement of the transplants.
Preplant Herbicide	-	Metolachlor (2.0 kg/ha) + Metribuzin (.3 kg/ha)
Fertilizer	-	100 kg/ha actual nitrogen + 200 kg/ha potash broadcast and incorporated prior to planting.
Tomato Cultivar	-	HY 9478 (H.J. Heinz)
Transplants	-	288 cell plug transplants planted with a Holland plug transplanter on May 19. Starter fertilizer (10-30-20) used in the planter water.
Planting Arrangement	-	twin rows on 1.5 m beds, with 45 cm between rows and 45 cm between plants within the row (13,000 plants/acre).
Harvest	-	Plots were sprayed with Ethrel at 1.5 L/acre rate on August 14 and machine harvested on August 31.

Results - Trial # 1

Influence of conservation tillage practices on raised beds and flat beds, on tomato plant stand and fruit yield.

Treatment	Final Plant Stand (%)	Yield (tons/acre)		
		Marketable	Green	Cull
Spring plow; spring bed	94.4	25.4	.30	.28
Spring plow; flat	89.2	24.0	.36	.47
Conservation till; flat	81.0	23.3	.36	.31
Conservation till; bed	82.5	22.9	.36	.31
LSD .05	8.0	NS	NS	NS

Results - Trial # 2

Influence of cover crop height at time of burn-down on tomato plant stand and fruit yield

Treatment (Rye height)	Final Plant Stand (%)	Yield (tons/acre)		
		Marketable	Green	Cull
20 cm	93.6	22.8	0.5	0.2
40 cm	89.1	19.4	0.5	0.2
LSD .05	NS	NS	NS	NS

CONSERVATION TILLAGE PRACTICES FOR PROCESSING TOMATOES

DISCUSSION:

In the conservation tillage treatments, the soil surface was well covered with rye residue at the time of planting. This cover is desirable to reduce wind erosion and sandblasting of transplants. However the residue interfered with the closing of the planter furrow, and some transplants were not set properly, resulting in a reduced stand. When the rye was allowed to grow to a 40 cm height before burndown (Trial # 2), stand was further reduced. Further testing will be needed to identify better methods of managing the cover crop residue to prevent planting problems. The rye residue broke down over the course of the season and did not interfere with the harvester operation.

In last year's trial, the rye cover crop died down slowly, and appeared to reduce the early growth of the tomato transplants. This year, a higher rate of Glyphosate was used to kill the rye faster, and the coulter tillage implement was used loosen the soil in the planting zone. With these modifications, the transplants in the conservation tillage treatments were as vigorous as those with conventional tillage.

The conventional tillage (spring plow) treatments again produced higher yields than the conservation tillage treatments, mostly due to the improved plant stands. However conservation tillage yields were improved compared to the 1991 trial. When the cover crop was killed at 20 cm height, yield was improved compared to the 40 cm height (Trial # 2).

Conservation tillage may be a viable practice for processing tomatoes, when proper cultural practices are developed. The time of cover crop burn-off will be critical, to obtain enough residue to hold the soil but not interfere with the planting operation.

INTEGRATED CROP MANAGEMENT OF PROCESSING TOMATOES

INTRODUCTION:

In some tomato producing areas of southwestern Ontario, processing tomatoes have been grown in a limited crop rotation, or in rotation with other field crops. Also, a large amount of tillage is involved in growing the tomato crop. The long-term effects of tomato production on soil productivity are not well understood. The objectives of this experiment are:

1) to evaluate the influence of continuous tomato production and conventional tillage practices on soil quality and tomato productivity.
2) to evaluate crop rotations with soybeans and grain crops in tomato production systems.
3) to evaluate a permanent bed tillage system for production of tomatoes and rotation crops. With this system, the number of tillage operations are reduced and wheel traffic is confined to a controlled area to reduce soil compaction.
4) to evaluate drip irrigation as a method of preventing water stress and improving tomato yield on sandy soils.

This was the third year of this experiment. The yield results of the 1992 trial are presented here.

CROP ROTATIONS:

1)	Continuous Tomatoes:	tomatoes planted in 1990, '91 and '92
2)	Soybean-Tomato:	tomatoes in 1990, soybean in '91, tomatoes in '92
3)	Grain/Clover-Tomato:	tomatoes in 1990, oats underseeded to red clover in 1991, tomatoes in 1992.

PRODUCTION SYSTEMS:

A) Conventional:
- rye cover crop,
- spring mouldboard plowed
- spring bedded

B) Permanent bed:
- beds reworked in fall after previous crop
- rye cover crop broadcast on beds
- cover crop burned off with Glyphosate herbicide
- fertilizer broadcast and herbicide sprayed on beds
- beds worked with power bedder

C) Permanent bed + drip irrigation:
- beds tilled as in permanent bed treatment
- drip irrigation tape (Netafim Typhoon 16) buried 8-10 cm deep in center of bed
- irrigation applied twice weekly for 4 hours, to maintain approx 80% available soil moisture. No irrigation was required after July 9 due to frequent rainfall.

Soil Type:	Fox Sandy Loam
Tomato Variety:	HY 9478 (H.J. Heinz)
Transplants:	288 plug transplants, planted May 21 with a Holland plug transplanter.
Plant Population:	twin rows on 1.5 m beds with 40 cm between plants in row (13,000 plants/acre).
Herbicide:	Metolachlor @ 2.0 kg/ha + Metribuzin @ .3 kg/ha pre-plant incorporated.
Harvest:	Ethrel applied at 1.5 L/acre rate on August 20. Machine harvested on September 8.

Table 1. The influence of crop rotation, permanent beds and drip irrigation on tomato yield

Production System	Marketable Yield (tons/acre)		
	Continuous Tomato	Grain/clover-Tomato	Soybean-Tomato
Spring Plow/Spring Bed	25.47	33.53	33.40
Permanent Bed + Drip Irrig.	23.30	24.76	26.43
Permanent Bed	22.67	25.63	25.97

Table 2. The influence of crop rotation on tomato yield (averaged over 3 production systems)

Crop Rotation	Marketable Yield (tons/acre)
Soybean - Tomato	28.60
Grain/clover - Tomato	27.97
Continuous Tomato	23.81
LSD .05	2.30

Table 3. The influence of tillage system and drip irrigation on tomato yield (averaged over 3 crop rotations)

Treatment	Marketable Yield (tons/acre)
Spring Plow/Spring Bed	30.80
Permanent Bed + Drip Irrig.	24.83
Permanent Bed	24.76
LSD .05	2.29

DISCUSSION:

In this trial, yield in the continuous tomato rotation was reduced compared to the other crop rotations. This yield reduction occurred in only the third year of continuous tomato production. In 1991 the yield was not reduced in the continuous tomato rotation. There was no significant difference in yield between the soybean-tomato and grain/clover-tomato rotations.

The permanent bed treatments produced lower yields than the conventional tillage (spring plowed, spring bedded) treatment. Growth was reduced in these treatments through the season. It appears that the soil in these treatments was compacted from tillage, even though there was no traffic on these beds. The yield increase due to crop rotation was greater in the conventional tillage treatment than in permanent beds. If the permanent bed system is to be successful, some deeper tillage will likely be necessary.

Drip irrigation did not increase tomato yield. Due to the frequent rainfall this season, the tomato crop was never under drought stress during fruitset and sizing.

NITROGEN SOIL TEST DEVELOPMENT FOR PROCESSING TOMATOES

Nitrogen fertility is one of the most important aspects in processing tomato production. Recent research and grower experience has indicated that the new processing tomato hybrids grown in Ontario respond well to relatively high rates of nitrogen. However, if a reliable test was available for soil nitrate levels, growers may be able to fine-tune application, and eliminate unnecessarily high nitrogen rates. A nitrate soil test has been developed for field corn. The purpose of these trials was to determine whether the nitrate soil test for corn could be calibrated for use in processing tomatoes.

Trials were established at four different sites, with different soil types and tomato cultivars. The Harrow Research Station site is on a Fox sandy loam soil with approximately 2 percent organic matter. The Bradley Farms sites were a Clyde loam soil which is a dark, high organic matter soil. The Smyth and Wilson site is a Brookston silt loam which is a lighter soil with medium-high organic matter and good moisture retention. The cultivars HY9478 and HY 9230 are Heinz machine harvest product hybrids. Peto 696 is a midseason hybrid for wholepack or product, and Ohio 7983 is an early open-pollinated wholepack variety.

Soil samples were taken in early May, late May and at harvest time and analyzed for soil nitrate. In the field trials, nitrogen was broadcast prior to planting and incorporated. No nitrogen was sidedressed. Ammonium nitrate was used as the nitrogen source. The plots were harvested in a once-over hand harvest, and yields are given in tons per acre of marketable, green and cull fruit. Samples were taken at harvest time for the Agtron color reading and wholepack recovery test (Ohio 7983 only).

** The trials at the Bradley and Smyth & Wilson sites were set up by Ed Tomecek and Pat Shaver from the Ont. Ministry of Agriculture and Food, Ridgetown Ont.

Thanks to Jim Brimner at Ridgetown College who performed the soil nitrate analyses, and to Steve Loewen at Ridgetown college who provided the Agtron and wholepack recovery data.

Thanks to the grower cooperators: Jay Bradley, Rob Smyth and Jeff Wilson

NITROGEN SOIL TEST DEVELOPMENT FOR PROCESSING TOMATOES

Site #1: Agriculture Canada, Research Station, Harrow, ON

Soil Type: Fox Sandy Loam
Tomato Cultivar: HY 9478
Nitrate Soil Test: May 5 = 0 ppm
May 25 = 5.1 ppm
Sept 9 = 4.9 ppm

N rate (kg/ha)	Yield (tons/acre) Marketable	Green	Cull	Agtron Color Grade
225	33.4	.35	.58	26
180	32.1	.30	.67	26
135	31.7	.24	.93	25
90	29.4	.30	.77	24
45	26.0	.26	.49	24
0	22.0	.28	.42	24
LSD .05	6.0	ns	.26	

Site #2: Bradley Farms, RR # 1, Paincourt, ON

Soil Type: Clyde Loam
Tomato Cultivar: HY 9230
Nitrogen Soil Test: May 11 = 10.3 ppm
May 25 = 14.2 ppm
Sept 1 = 5.3 ppm

N rate (kg/ha)	Yield (tons/acre) Marketable	Green	Cull	Agtron Color Grade
225	45.2	5.4	0.4	46
180	38.8	3.4	0.6	38
135	41.9	3.6	0.3	45
90	41.3	1.9	0.3	42
45	37.5	1.7	0.5	41
0	31.5	0.9	1.0	43
LSD .05	7.1	1.6	0.5	

Site #3: Bradley Farms, RR # 1, Paincourt, ON

Soil Type: Clyde Loam
Tomato Cultivar: Ohio 7983
Nitrogen Soil Test: May 11 = 12.7 ppm
May 25 = 20.2 ppm
Sept 14 = 7.6 ppm

N rate (kg/ha)	Yield (tons/acre) Marketable	Green	Cull	Agtron Color Grade	Wholepack % cannable
225	40.8	4.4	0.8	32	67.6
180	46.9	6.8	1.3	28	65.3
135	42.6	2.4	1.7	29	65.7
90	43.2	3.0	1.4	31	63.8
45	39.9	4.6	1.7	30	57.5
0	38.6	9.0	1.2	31	57.8
LSD .05	7.0	3.7	0.8		

Site #4: Rob Smyth and Jeff Wilson, Chatham, ON

Soil Type: Brookston Silt Loam
Tomato Cultivar: Peto 696
Nitrogen Soil Test: May 14 = 5.0 ppm
May 29 = 18.0 ppm
Sept 23 = 1.5 ppm

N rate (kg/ha)	Yield (tons/acre) Marketable	Green	Cull	Agtron Color Grade
225	60.3	4.8	2.1	32
180	56.8	2.2	2.0	32
135	59.8	2.8	2.1	32
90	53.7	1.1	2.6	36
45	51.2	1.1	2.2	33
0	45.1	0.8	1.8	33
LSD .05	8.4	2.8	ns	

NITROGEN SOIL TEST DEVELOPMENT FOR PROCESSING TOMATOES

DISCUSSION:

As in past years, the tomato varieties in this trial generally responded well to relatively high rates of nitrogen. On the sandy loam soil at Harrow, there was a linear increase in yield from 0 to 225 kg/ha of actual nitrogen. The high N rates did not appear to delay maturity at this site as there was no real difference in yield of green fruit between treatments. The Agtron color grade was slightly higher at the high N rates but still well within acceptable levels. At Bradley Farms the soil tests indicated much more nitrate available at planting than on the Harrow soil. Even with the higher soil N level, yield of the HY 9230 variety increased up to the 225 kg/ha N level. The 180 kg/ha treatment fell in low areas in the field in two reps, and was hurt by water, which accounted for the dip in yield. In this variety, high nitrogen increased the yield of green fruit, but did not have a great effect on the color reading of the ripe fruit. The Ohio 7983 variety increased in yield up to 180 kg/ha. This location had slightly higher initial soil nitrate levels than in the 9230 trial. Nitrogen had little effect on green or cull yield, Agtron or wholepack recovery in this variety. At the Smyth and Wilson site, preplant nitrate levels were relatively high. Tomato yield increased from 0 to 135 kg/ha of nitrogen applied, then levelled off. Yield of green fruit increased with increasing nitrogen. This field had not been used for tomato production in the past and crop vigor was very good even in the 0 nitrogen plots.

In this year's trials, yields increased at nitrogen rates up to 225 kg/ha on soils with pre-plant nitrate levels of 14 ppm or less. On sites with 18 and 20 ppm of nitrate, highest yields were achieved with 135 and 180 kg/ha respectively. Further testing will be required to determine what soil nitrate levels are sufficient to allow growers to reduce nitrogen application. Tomato yield is influenced by many factors, including nitrogen nutrition. It is likely that response to N fertility varies greatly depending on other environmental and cultural factors.