2003 Tomato Research Progress Report

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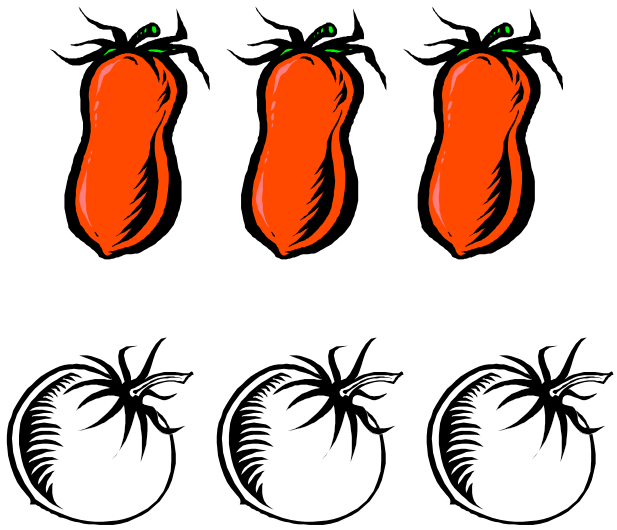

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2003 PROCESS TOMATO VARIETY TRIAL

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OBJECTIVE: Evaluation of commercially available process tomato varieties as a part of the statewide process tomato variety trial.

LOCATION: Field L-17 at San Juan Ranch, north of Dos Palos. Soil type: Palazzo sandy loam grading to Bolfar clay loam. Dan Burns, cooperator.

Seeded: 3/3/2003 LaBar's Greenhouse, Gustine
Transplant: 5/5/2003 using RJH cone planters on 12" spacing, 60" beds. 500 gpa water with a little 12-5-5 mixed in as a starter. Plot size was 1 bed by 100 feet long.
Irrigation: furrow
Fertilizer: UAN32 sidedressed, water-run CAN17.
Pest control: worm spray for Western Yellowstripe Armyworm.
Harvest: Aug. 25, 2003 with Johnson mechanical harvester with auto sorters.

Varieties:

Plot	Replicated	Company		Plot	Observation		
1	AB 2	AB	VFFP	21	AGT 210	Orsetti	VFFN
2	AB 5	AB	VFFNP	22	Halley 3155 (std)	Orsetti	VFF
3	CPL155 (15-58)	CTRI/CPLTS	VFFNP	23	BOS 39422	Orsetti	VFFNP
4	CXD 221	Campbells	VFFF3NP	24	BOS 47579	Orsetti	VFFNP
5	CXD 222	Campbells	VFFNP	25	BOS 52295	Orsetti	VFFNP
6	H 2501	Heinz	VFFNP	26	CPL 1056	CTRI/CPLTS	VFFNP
7	H 2601	Heinz	VFFNP	27	CPL 4863	CTRI/CPLTS	VFFN
8	H 8892 (std)	Heinz	VFFN	28	CXD 223	Campbells	VFFNP
9	H 9780	Heinz	VFFNP	29	H 2401	Heinz	VFFNP
10	H 2801	Heinz	VFFNP	30	H 8892 (std)	Heinz	VFFN
11	Halley 3155 (std)	Orsetti	VFF	31	HM 1852	Harris Moran	VFFN
12	HM 0830	Harris Moran	VFFN	32	HMX 2855	Harris Moran	VFFNP
13	La Rossa (std)	Rogers	VFF	33	La Rossa (std)	Rogers	VFF
14	NDM 0098	Del Monte	VFFNT	34	PX 607	Seminis	VFFN
15	PS 296	Seminis	VFFNP	35	SUN 6324	Sunseeds	VFFNP
16	PX 849	Seminis	VFFNP	36	SUN 6360	Sunseeds	VFFNP
17	SUN 6119	Sunseeds	VFFN	37	U 729	Unilever	VFFN
18	U 941	Unilever	VFFN	38	U 886	Unilever	VFFN
				39	UG 151	United Genetics	VFFN

Std = standard

NOTES: vine and fruit evaluations 6/27 and 8/12/2003. Greenhouse germination and growth problems with SUN 6119 from blind seedling disease. Replaced with new plants from Woodland. Nematode problems with 3155 & LaRossa, especially in the Palazzo soil series. Early yellowing and sunburn with H2501 and CPL1056.

RESULTS:
This trial was located near the San Joaquin River on a Palazzo sandy loam soil grading into Bolfar clay loam. Nematode pressure was high in the sandy loam soil, and the differences between varieties that had nematode resistance (most) and those that did not (3155, LaRossa) were striking. LaRossa and 3155 completely turned yellow and the plant canopy collapsed, whereas the other lines were still green and healthy. Overall, this was an excellent trial, with average yields of 32 tons per acre and low weed and pest pressure.

In the observation trial, highest yields occurred with SUN 6324, H 8892, and CPL 4863, and highest °Brix with PX 607, U886, and SUN 6324 (Table 1). H 8892 had a relatively low soluble solids content of only 4.7%. Because SUN 6324 had high yields matched with high °Brix, it had the highest Brix yield of 2.36 tons per acre. LED color and fruit pH are also shown in Table 1. Because there was no replication in this test, no statistics could be performed.

In the replicated trial, highest yields occurred with H8892, AB 5, NDM 0098, H 2801, and U 941, all with over 35 tons/A (Table 2). There were no significant differences between the varieties for °Brix or color. Highest Brix yield occurred with AB 5 at nearly 2 tons/A, followed closely by NDM 0098 and H 2801. While H 8892 yielded well, it had a relatively low °Brix of 4.4, which reduced its Brix yield to 1.81 tons/A. Yield and soluble solids % are shown in Figure 1.

Statewide Results. The results from all participating counties are shown in the report UCCE Statewide Processing Tomato Variety Evaluation Trials 2003 following Figure 1.

ACKNOWLEDGEMENTS
Thanks to Mr. Dan Burns, San Juan Ranching Company, for his help and cooperation with this test, and to CTRI and participating seed companies for their financial support. The help of Larry Burrow, Field Technician, is greatly appreciated.

Table 1. 2003 Processing Tomato Variety Trial observation results, Merced County

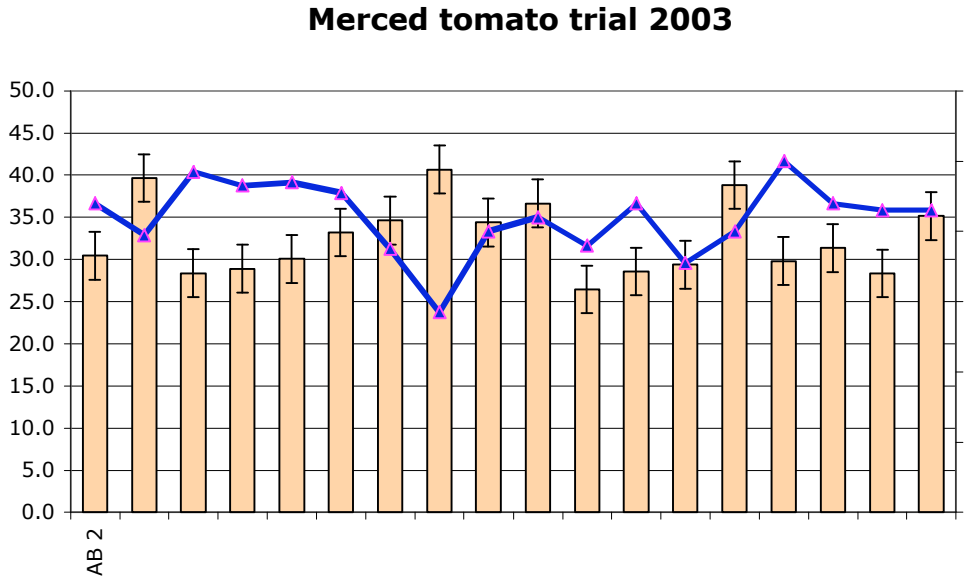
#	Variety	Company	disease resistance	Yield tons/A	Brix (% ss)	Brix Yield tons/A	LED Color	pH
35	SUN 6324	Sunseeds	VFFNP	40.69	5.8	2.36	25	4.45
30	H 8892	Heinz	VFFN	39.38	4.7	1.85	25	4.4
27	CPL 4863	CPLTS	VFFN	38.33	5.0	1.92	27	4.41
36	SUN 6360	Sunseeds	VFFNP	37.90	4.9	1.86	25	4.38
31	HM 1852	Harris Moran	VFFN	36.37	4.9	1.78	25	4.37
28	CXD 223	Campbell's	VFFNP	35.72	5.2	1.86	24	4.41
32	HMX 2855	Harris Moran	VFFNP	34.37	5.0	1.72	26	4.49
24	BOS 47579	Orsetti	VFFNP	33.76	5.6	1.89	27	4.36
29	H 2401	Heinz	VFFNP	33.67	5.0	1.68	28	4.25
25	BOS 52295	Orsetti	VFFNP	33.19	5.1	1.69	28	4.36
23	BOS 39422	Orsetti	VFFNP	33.11	5.3	1.75	30	4.31
37	U 729	Unilever	VFFN	33.02	5.8	1.92	23	4.38
39	UG 151	United Genetics	VFFN	32.63	5.2	1.70	24	4.48
22	Halley 3155	Orsetti	VFF	30.27	5.0	1.51	33	4.42
21	AGT 210	Asgrow	VFFN	29.27	5.3	1.55	33	4.42
34	PX 607	Seminis	VFFN	28.79	6.1	1.76	29	4.36
26	CPL 1056	CPLTS	VFFNP	27.14	5.1	1.38	25	4.39
33	La Rossa	Rogers	VFF	23.30	5.7	1.33	28	4.36
38	U 886	Unilever	VFFN	21.13	6.0	1.27	23	4.37
field	HM 830	Harris Moran		35.46	----	----	-----	-----
	Plot Average			32.74	5.30	1.73	26.74	4.39

Table 2. 2003 Processing Tomato Variety Trial replicated results, Merced County

#	Variety	Company	disease resistance	Yield tons/A									Brix (% ss)	brix Yield tons/A	LED Color	pH
8	H 8892	Heinz	VFFN	40.674	a								4.4	1.806	28.8	4.39
2	AB 5	AB Seeds	VFNP	39.683	a	b							5.0	1.990	27.3	4.37
14	NDM 0098	Nippon DelMonte	VFFNT	38.834	a	b	c						5.0	1.946	25.0	4.43
10	H 2801	Heinz	VFFNP	36.634	a	b	c	d					5.1	1.867	28.0	4.49
18	U 941	Unilever	VFFN	35.153	a	b	c	d	e				5.2	1.771	30.0	4.40
7	H 2601	Heinz	VFFNP	34.641		b	c	d	e	f			4.9	1.693	29.0	4.45
9	H 9780	Heinz	VFFNP	34.397		b	c	d	e	f	g		5.0	1.723	29.5	4.37
6	H 2501	Heinz	VFFNP	33.215			c	d	e	f	g	h	5.3	1.743	28.5	4.40
16	PX 849	Seminis	VFFNBsk	31.374				d	e	f	g	h	I	5.2	1.638	30.3	4.38
1	AB 2	AB Seeds	VFFP	30.470					e	f	g	h	I	5.2	1.589	24.8	4.33
5	CXD 222	Campbells	VFFNP	30.056					e	f	g	h	I	5.4	1.617	29.0	4.36
15	PS 296	Seminis	VFFNBsk	29.828					e	f	g	h	I	5.5	1.648	28.0	4.35
13	La Rossa	Rogers	VFF	29.392						f	g	h	I	4.8	1.386	28.0	4.44
4	CXD 221	Campbells	VFFFNP	28.924							g	h	I	5.3	1.541	28.5	4.44
12	HM 0830	Harris Moran	VFFN	28.586								h	I	5.2	1.484	26.5	4.46
3	CPL 155 (15-58)	CPLTS	VFFNP	28.379								h	I	5.4	1.531	27.5	4.42
17	SUN 6119	Sunseeds	VFFN	28.358								h	I	5.2	1.437	31.5	4.41
11	Halley 3155	Orsetti	VFF	26.484									I	4.9	1.297	28.8	4.40
	average			32.505										5.1	1.650	28.3	4.40
	LSD 0.05			5.6										NS	0.36	NS	0.08
	CV, %			12.2										9.5	15.3	11.5	1.3

LSD 0.05 = least significant difference at the 95% probability level.
Means followed by the same letter are not significantly different

CV% = Coefficient of variation, a measure of the variability in the experiment



Project Title: UCCE Statewide Processing Tomato Variety Evaluation Trials, 2003

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Joe Nunez, Farm Advisor, Kern County

Summary:

Four early and 8 mid-maturity variety tests were conducted throughout the major processing tomato production regions of California during the 2003 season. All of the major production areas had at least one test to identify tomato cultivars appropriate for that specific region. As in the past, both replicated and observational lines were evaluated.

Transplants presently account for about half the production acreage in the state—with a greater percentage in the northern and central production areas (Merced County northward). In three of the mid-maturity tests transplants were used based on grower preference (Colusa, Yolo, and Merced); in Colusa and Yolo counties, both mid-maturity transplant and direct seeded trials were evaluated (in separate fields). All of the early-maturity tests were direct seeded.

When averaged across all four locations, there were no significant differences among the early-maturing observation varieties for yield, °Brix, Brix yield, color, or pH. Greatest yields occurred with UG 8168, HyPeel 45, and H 9280. For the replicated early lines, highest yields occurred with AP 957, H9997, and H9280 (52.5, 48.7, and 48.0 tons per acre, respectively). AP 957 had a relatively low °Brix of 4.9, well below the group average of 5.2.

The overall highest yielding lines for the mid-maturity observation test were CXD 223, H 8892, U 729, Sun 6360, HMX 2855, Sun 6324, H 2401, and U 886 ranging from 43.4 to 38 tons per acre. There were no significant differences with °Brix, which averaged 5.4 across all locations. In the replicated mid-maturity trials, highest yields occurred with H 8892, U 941, and AB 5 at 43.3, 41.8, and 41.7 tons per acre. The lines with the best °Brix were CPL 155, CXD 221, and H 2801, which all averaged more than 5.5% soluble solids.

Introduction:
In 2003, the UCCE Statewide Farm Advisor Processing Tomato Variety Trial celebrates its 30th year of providing regional, unbiased variety information for the process tomato industry. The project began in 1973 with three counties, and as the industry has expanded in the state, so has the variety evaluation. Trials with both early and mid-season cultivars are performed in 6 – 8 counties. As in the past, the major objective of this statewide trial is to conduct processing tomato variety field tests that evaluate fruit yield, °Brix (a measure of the soluble solids content), color, and pH in various statewide locations. The data from all test locations are used to analyze variety adaptability under a wide range of growing conditions. These tests are designed and conducted with input from seed companies, processors, and other allied industry and are intended to provide unbiased information on which to make variety decisions.

Procedures:
Four early-maturity variety tests and 8 mid-maturity tests were conducted in 2003, each with an observation and replicated component. Participating counties and Farm Advisors are listed in Table 1. Variety entries and their disease resistances are listed in Tables 2a and 2b.

Early maturity tests were planted in February or early March and mid-maturity lines were planted from March to May. New varieties are typically screened one or more years in non-replicated observational trials before being included in the replicated trials. Tests were primarily conducted in commercial production fields with grower cooperators (the Fresno trials were located at the West Side Research and Extension Center [WSREC] near Five Points).

Each variety was usually planted in one-bed wide by 100 foot long plots (Fresno used 75 foot long plots), and was assigned to either a replicated or observational trial (Figure 1). All cultural operations, with the exception of planting and harvest, were done by the grower cooperator using the same equipment and techniques as the rest of the field. All test locations were primarily furrow irrigated. A field day was arranged at many of the test plots.

Shortly before harvest, fruit samples were collected from all plots and submitted to an area PTAB station for soluble solids (°Brix) color (LED color, lower values indicate redder fruit), and pH determinations. The plots were harvested with commercial harvest equipment, conveyed to a GT wagon equipped with weigh cells, and weighed before going to the trailers for processing (Figure 2). Because of planting problems with SUN 6119, it was not harvested in each county, and therefore was not included in the combined-location analyses.

Results:
Only the combined results are presented here. A copy of the entire state report and summaries for individual counties can be found on the UC Vegetable Research and Information Center webpage at http://www.vric.ucdavis.edu. Click on the Issues, News, and Events link to access the report.

Early observational. Results averaged across counties are presented in Table 3. There were no significant differences between any of the varieties for any of the parameters measured in this test. Average yield in the early observational trials was 42.5 tons/A with an average °Brix of 5.2. The best yielding variety was UG 8168 at 48.4 tons/A at 5.4 °Brix. APT 410 had the highest °Brix at 5.7%. Brix yield was highest in UG 8168 at 2.6 tons/A, but this was not significantly different from any of the other varieties even though this was 0.63 ton improvement (32%) over the lowest yielder, HA 3523. Average color and pH were 24.7 and 4.42 respectively.

Early replicated. Early replicated results are presented in Table 4. Significant yield and °Brix differences were found between varieties, with the highest yields occurring with AP 957 at 52.5 tons/A. HyPeel 45, CXD 224, SUN 6358, H1400, APT 410, H 1100 had significantly better °Brix than the other varieties, ranging from 5.5 to 5.3. Because AP 957 had a relatively low °Brix of only 4.9, however, Brix yield was not significantly different between it and five other varieties. Large differences were found for color, with H9997 having significantly redder fruit than all other varieties (23.1). Average pH was 4.40 and ranged from 4.35 for H 1400 to 4.48 for Calista (Table 4f).

Significant variety by location interactions occurred for yield, Brix yield, and color. This indicates that some varieties performed better at specific locations. Where significant, the variety by location LSD can be used to compare the performance of the same variety at one location to the other.

Mid observational. Mid-maturity observational results combining all locations are shown in Table 5. When all counties were combined, significant differences were observed between varieties for yield, Brix yield, color, and pH. The highest yields occurred with CXD 223, H 8892, U729, and SUN 6360, all exceeding 40 tons/A. No significant differences were found for °Brix, which was good for all lines, ranging between 5.1 to 5.6. Brix yield ranged from 2.21 tons/A for CXD 223 to 1.59 tons/A for CPL 1056, a 39% difference. Twelve varieties were in the top Brix yield group. Best color (23.1) was held by UG151, while fruit pH ranged for 4.30 to 4.47.

Mid replicated. Combined mid-maturity replicated variety results are reported in Table 6. Significant differences occurred for all parameters measured, though individual counties may not have had significant differences for yield, °Brix, and color. Highest yields occurred with H 8892, U 941, and AB 5, at > 40 tons/A. SUN 6119 yielded well with an average 39.3 tons/A, but because it was not tested in every location it is not included in the combined statistical analysis in Table 6; however, it was included in the individual counties where data were collected.

°Brix was significantly higher in CPL 155, CXD 221, and H 2801 compared to the other varieties, at 5.6, 5.6, and 5.5 respectively. Lowest °Brix occurred with H 8892, at 4.8. AB5 had the highest Brix yield of 2.16 tons/A, followed closely by U 941 and H8892 in the same high Brix yield group. Lowest Brix yield was with LaRossa at 1.60 tons/A—a reduction of 35% compared to the top yielding varieties. H2801, NDM0098, H2501, and AB2 had the best fruit color with an LED rating of 23.8 to 24.3. Average pH ranged from 4.28 to 4.42.

Significant variety by location interactions occurred for yield, °Brix, Brix yield, and pH. This suggests that certain varieties performed differently at different locations. H 8892, for example, yielded significantly better in Stanislaus than all other locations except Yolo. Kern and Colusa often had significantly higher °Brix for the same variety at the other locations.

Acknowledgements:
Many thanks to CTRI, participating seed companies, and PTAB for their continued support for this project. Thanks to Gail Nishimoto for her help with the statistical analyses. And lastly, this project would not be possible without the many excellent grower cooperators who were involved with this project: Dan Burns with Live Oak Farms, Paul Simoni and Anthony Massoni with Simoni & Massoni Farms, Bill and Chuck Cox with Cox & Perez Farms, Louie Crettol, Button and Turkovich, J.H. Meek and Sons, Joe Muller and Sons, Emerald Farms, Poundstone Bros, and the field crew at WSREC.

Table 1. Location, Advisor, planting method (DS = direct seed, TR = transplant), planting and harvest dates for the 2003 Regional Processing Tomato Variety Trials.

County	Advisor	Plant method	Plant Date	Harvest date	Comments
Early Maturity					
Yolo	Gene Miyao	DS	2/10	7/30	Field day held
Colusa	Mike Murray	DS	2/11	8/1	Opportunity to view
Contra Costa	Janet Caprile & Bob Mullen	DS	3/6	8/12	
Fresno	Jesus Valencia	DS	2/20	7/22	Field day held
Mid-Maturity					
Colusa	Mike Murray	DS	3/11	8/18	No SUN 6119
		TR	5/9	9/16	Opportunity to view
Yolo	Gene Miyao	DS	3/28	8/21	Field day held.
		TR	4/23	8/28	Field day held
Stanislaus	Jan Mickler & Bob Mullen	DS	3/19	9/23	Field day. Ethephon used
Merced	Scott Stoddard	TR	5/5	8/25	Ethephon used
Fresno	Jesus Valencia	DS	3/13	8/22	Field day held
Kern	Joe Nunez	DS	3/19	8/15	No SUN 6119

Table 2a. Early maturing test varieties, company, and disease resistance for 2003. Varieties followed by STD are standards.

Early Season Obs				Early Rep			
UC#	**Variety**	**Company**	**disease**	**UC#**	**Variety**	**Company**	**disease**
887	AGT 771	Orsetti	VFFNP				
732	APT 410 STD	Asgrow	VFFNBsk	861	AP 957	Seminis	VFFNBsk
886	BOS 40809	Orsetti	VFFN	732	APT 410 STD	Asgrow	VFFNBsk
637	H 9280 STD	Heinz	VFFNP	860	Calista (HA3303)	Hazera	VFF
890	HA 3523	Hazera	VFFN	850	CXD 224	Campbells	VFFNP
884	HMX 2853	Harris Moran	VFFNP	844	H 1100	Heinz	VFFNP-D
645	Hypeel 45 STD	Peto	VFFNBsk	859	H 1400	Heinz	VFFNP-D
885	U205	Unilever	VFFNP	637	H 9280 STD	Heinz	VFFNP
842	UG 8168	United Genetics	VFFNP	839	H 9997	Heinz	VFFNP
				645	Hypeel 45 STD	Peto	VFFNBsk
				862	SUN 6358	Sunseeds	VFFNP
HA 3523: plus Spotted Wilt and TMV							

See footnotes at end of Table 2b.

Table 2b. Mid-maturity test varieties, company, and disease resistance for 2003. Varieties followed by STD are standards.

Mid Season Obs				Mid Season Replicated			
UC#	Variety	Company	disease	UC#	Variety	Company	disease
896	AGT 210	Orsetti	VFFN	868	AB 2	AB	VFFP
897	BOS 39422	Orsetti	VFFNP	869	AB 5	AB	VFFNP
898	BOS 47579	Orsetti	VFFNP	888	CPL 155 (15-58)	CTRI/CPLTS	VFFNP
899	BOS 52295	Orsetti	VFFNP	858	CXD 221	Campbell	VFFF3NP
843	CPL 1056	CTRI/CPLTS	VFFNP	863	CXD 222	Campbell	VFFNP
892	CPL 4863	CTRI/CPLTS	VFFN	864	H 2501	Heinz	VFFNP
891	CXD 223	Campbells	VFFNP	865	H 2601	Heinz	VFFNP
894	H 2401	Heinz	VFFNP	873	H 2801	Heinz	VFFNP
540	H 8892 STD	Heinz	VFFN	540	H 8892 STD	Heinz	VFFN
448	Halley 3155 STD	Orsetti	VFF	866	H 9780	Heinz	VFFNP
871	HM 1852	Harris Moran	VFFN	448	Halley 3155 STD	Orsetti	VFF
893	HMX 2855	Harris Moran	VFFNP	847	HM 0830	Harris Moran	VFFN
418	La Rossa STD	Rogers	VFF	418	La Rossa STD	Rogers	VFF
900	PX 607	Seminis	VFFN	877	NDM 0098	Del Monte	VFFNT
833	SUN 6324	Sunseeds	VFFNP	878	PS 296	Seminis	VFFNBsk
901	SUN 6360	Sunseeds	VFFNP	836	PX 849	Seminis	VFFNBsk
880	U 729	Unilever	VFFN	879	SUN 6119	Sunseeds	VFFN
895	U 886	Unilever	VFFN	889	U 941	Unilever	VFFN
902	UG 151	United Genetics	VFFN				

V = Verticillium Wilt Race 1
FFF3 = Fusarium wilt Race 1, 2, and 3 resistance
N = root knot nematode resistance
P = bacterial speck resistance
Bsk = bacterial speck resistance
D = Dodder tolerant

Check with respective seed companies to confirm disease resistance information.

Table 3. 2003 early maturity observational varieties combined county data.

VARIETY	Yield tons/A	Brix %	Brix Yield tons/A	Color LED	pH
842 UG 8168	48.4 (01)	5.4 (04)	2.60 (01)	25.3 (06)	4.42 (04)
645 HYPEEL 45	44.5 (02)	5.0 (07)	2.25 (03)	24.5 (05)	4.47 (09)
637 H 9280	44.0 (03)	4.8 (09)	2.09 (07)	24.3 (04)	4.44 (08)
732 APT 410	43.3 (04)	5.7 (01)	2.45 (02)	23.5 (02)	4.42 (05)
886 BOS 40809	41.7 (05)	4.9 (08)	2.04 (08)	26.5 (09)	4.43 (06)
884 HMX 2853	41.1 (06)	5.5 (03)	2.24 (04)	23.3 (01)	4.43 (06)
885 U205	40.2 (07)	5.3 (05)	2.12 (06)	25.5 (07)	4.37 (01)
887 AGT 771	40.1 (08)	5.5 (02)	2.21 (05)	24.0 (03)	4.40 (03)
890 HA 3523	39.0 (09)	5.1 (06)	1.97 (09)	25.5 (07)	4.38 (02)
MEAN	42.5	5.2	2.22	24.7	4.42
LSD @ 0.05=	N.S.	N.S.	N.S.	N.S.	N.S.
C.V.=	17.0	9.3	18.5	6.4	1.2

Variety ranking indicated in parentheses ( ).
LSD = Least significant difference at the 95% confidence level. Means followed by the same letter are not significantly different.
NS = not significant.
CV = coefficient of variation (%), a measure of the variability in the experiment.
LED color: lower values indicate redder fruit.

Table 4. 2003 processing tomato early maturity replicated varieties combined county data.

VARIETY	Yield tons/A		°Brix (%SS)	Brix Yield T/A	Color	pH
861 AP 957	52.5(01)	A	4.9(08)	2.57(01)	24.8(04)	4.37(03)
839 H 9997	48.7(02)	B	5.0(07)	2.41(06)	23.1(01)	4.42(08)
637 H 9280	48.0(03)	B	4.8(10)	2.28(08)	25.3(06)	4.40(05)
859 H 1400	46.9(04)	B C	5.4(04)	2.52(02)	25.9(09)	4.35(01)
732 APT 410	46.3(05)	B C	5.3(05)	2.45(04)	24.6(03)	4.38(04)
844 H 1100	46.3(06)	B C	5.3(06)	2.49(03)	26.2(10)	4.40(07)
862 SUN 6358	45.4(07)	B C	5.4(03)	2.43(05)	25.5(07)	4.40(06)
645 HYPEEL 45	43.8(08)	C D	5.5(01)	2.40(07)	25.7(08)	4.36(02)
860 CALISTA (HA3	41.1(09)	D E	4.9(09)	1.99(10)	24.8(04)	4.48(10)
850 CXD 224	39.4(10)	E	5.4(02)	2.12(09)	24.1(02)	4.43(09)
MEAN	45.9		5.2	2.36	25.0	4.40
LSD @ 0.05=	3.7		0.2	0.18	0.7	0.04
C.V.=	11.5		6.1	10.5	3.7	1.1
VARIETY X LOCATION LSD @ 0.05=	7.4	N.S.		0.35	1.3	N.S.

Variety ranking indicated in parentheses ( ).
LED color: lower values indicate redder fruit.
LSD = Least significant difference at the 95% confidence level. Means followed by the same letter are not significantly different. NS = not significant.
CV = coefficient of variation (%), a measure of the variability in the experiment.
Variety x location LSD = LSD when comparing the same variety at different locations.

Table 5. 2003 processing tomato mid-maturity observed varieties combined county data.

VARIETY	Yield tons/acre									Brix %	Brix Yield T/A	Color ag-tron	pH
891 CXD 223	43.4 (01)	A								5.3 (13)	2.21 (01)	24.5 (10)	4.40 (13)
540 H 8892	42.4 (02)	A	B							5.2 (17)	2.12 (02)	23.6 (05)	4.39 (11)
880 U 729	41.2 (03)	A	B	C						5.3 (14)	2.11 (03)	23.9 (08)	4.42 (16)
901 SUN 6360	40.6 (04)	A	B	C	D					5.1 (18)	2.01 (09)	23.3 (02)	4.40 (12)
892 CPL 4863	40.0 (05)	A	B	C	D	E				5.4 (11)	2.04 (05)	24.1 (09)	4.37 (07)
833 SUN 6324	39.5 (06)	A	B	C	D	E	F			5.4 (08)	2.08 (04)	23.4 (03)	4.42 (17)
894 H 2401	39.1 (07)	A	B	C	D	E	F	G		5.3 (15)	1.97 (11)	24.5 (10)	4.30 (01)
895 U 886	38.7 (08)	A	B	C	D	E	F	G		5.4 (09)	2.02 (07)	23.9 (07)	4.38 (10)
893 HMX 2855	38.4 (09)	A	B	C	D	E	F	G		5.5 (06)	2.00 (10)	24.8 (12)	4.47 (19)
898 BOS 47579	37.4 (10)		B	C	D	E	F	G		5.5 (03)	2.03 (06)	24.9 (14)	4.33 (02)
899 BOS 52295	37.3 (11)		B	C	D	E	F	G		5.6 (01)	2.02 (08)	25.3 (18)	4.35 (04)
902 UG 151	36.8 (12)			C	D	E	F	G		5.1 (19)	1.83 (16)	23.1 (01)	4.46 (18)
871 HM 1852	35.9 (13)			C	D	E	F	G	H	5.3 (15)	1.84 (14)	23.5 (04)	4.41 (15)
448 Halley 3155	35.5 (14)				D	E	F	G	H	I	5.5 (03)	1.92 (12)	25.3 (19)	4.38 (09)
897 BOS 39422	35.2 (15)					E	F	G	H	I	5.4 (12)	1.84 (15)	24.8 (12)	4.33 (03)
900 PX 607	34.2 (16)						F	G	H	I	5.6 (01)	1.87 (13)	24.9 (15)	4.37 (08)
418 La Rossa	33.9 (17)							G	H	I	5.4 (07)	1.76 (17)	24.9 (15)	4.41 (14)
896 AGT 210	31.0 (18)								H	I	5.5 (03)	1.67 (18)	24.9 (15)	4.36 (05)
843 CPL 1056	30.4 (19)									I	5.4 (10)	1.59 (19)	23.8 (06)	4.36 (06)
MEAN	37.4										5.4	1.94	24.3	4.38
LSD @ 0.05=	5.7										N.S.	0.30	1.5	0.06
C.V.=	14.6										6.2	14.5	6.1	1.3

Variety ranking indicated in parentheses ( ).
LSD = Least significant difference at the 95% confidence level. Means followed by the same letter are not significantly different.
NS = not significant.
CV = coefficient of variation (%), a measure of the variability in the experiment.

Table 6. 2003 processing tomato mid-maturity replicated varieties combined county data.

VARIETY	Yield tons/acre									Brix %		Brix Yield T/A		Color		pH	
540 H 8892	43.3	(01)	A							4.8	(17)	2.06	(03)	24.6	(05)	4.37	(09)
889 U 941	41.8	(02)	A	B						5.1	(15)	2.06	(02)	25.5	(12)	4.39	(11)
869 AB 5	41.7	(03)	A	B						5.3	(09)	2.16	(01)	25.2	(09)	4.32	(03)
877 NDM 0098	39.8	(04)		B	C					5.1	(13)	1.98	(08)	23.8	(02)	4.39	(12)
864 H 2501	38.8	(05)			C	D				5.3	(08)	2.00	(04)	23.9	(03)	4.32	(04)
868 AB 2	38.1	(06)			C	D	E			5.4	(05)	1.99	(05)	24.3	(04)	4.30	(02)
878 PS 296	37.8	(07)			C	D	E			5.3	(06)	1.98	(07)	25.6	(14)	4.28	(01)
836 PX 849	37.1	(08)				D	E			5.2	(12)	1.90	(09)	26.4	(17)	4.32	(05)
873 H 2801	37.1	(09)				D	E			5.5	(03)	1.99	(06)	23.8	(01)	4.41	(16)
865 H 2601	36.7	(10)				D	E	F		5.0	(16)	1.77	(14)	25.3	(11)	4.40	(13)
866 H 9780	36.2	(11)					E	F	G	5.3	(10)	1.86	(10)	25.7	(15)	4.32	(05)
863 CXD 222	34.8	(12)						F	G	H	5.2	(11)	1.80	(12)	24.8	(06)	4.36	(08)
448 Halley 3155	34.7	(13)						F	G	H	5.3	(06)	1.80	(13)	25.6	(13)	4.34	(07)
847 HM 0830	34.5	(14)							G	H	5.4	(04)	1.83	(11)	25.1	(08)	4.42	(17)
418 La Rossa	32.8	(15)								H	5.1	(14)	1.60	(17)	25.0	(07)	4.41	(14)
858 CXD 221	30.6	(16)								I	5.6	(02)	1.66	(16)	25.2	(10)	4.41	(15)
888 CPL 155 (15-	30.6	(17)								I	5.6	(01)	1.66	(15)	25.7	(16)	4.37	(10)
879 SUN 6119	39.3										5.1		1.72		26.9		4.35	
MEAN	37.0										5.3		1.89		25.1		4.36	
LSD @ 0.05=	2.1										0.2		0.12		0.8		0.02	
C.V.=	11.6										6.1		13.0		6.4		1.1	
VARIETY X LOCATION LSD @ 0.05=	6.0										0.4		0.34		N.S.		0.07	

Variety ranking indicated in parentheses ( ).
LSD = Least significant difference at the 95% confidence level. Means followed by the same letter are not significantly different.
NS = not significant.
CV = coefficient of variation (%), a measure of the variability in the experiment.
Variety x location LSD = LSD when comparing the same variety at different locations.

Figure 1. The processing tomato variety trial in Merced County, 2003. The plots are 1-bed by 100 feet long, with a different variety in each. At this stage in crop development, notes are made on vine growth characteristics for each variety.

Figure 2. Harvested tomatoes are conveyed to a gondola equipped with a scale to measure yields. Once full, the tomatoes are dumped into trailers for transport to the cannery.

University of California Cooperative Extension
Regional Fresh Market Tomato Variety Trial, 2003

Scott Stoddard
Assistant Farm Advisor, Merced and Madera Counties
2145 Wardrobe Ave
Merced, CA 95340

OBJECTIVE: Evaluation of commercially available fresh market tomato varieties as a part of a 3-county fresh market tomato variety trial.

Cooperators: Bob Giampaoli, Live Oak Farms, LeGrand
Daniel Acevedo, Labar Greenhouses, Gustine
Various seed companies (see below)

Seeded: March 19, 2003
Transplant: May 13, 2003. 3-row planter, 16" spacing.
Irrigation: buried drip in 2nd year
Fertilizer: about 200-150-200 NPK, most N and K_2O through the drip tube
IPM: 2 worm sprays (Avaunt) for armyworm and western yellowstripe armyworm
Harvest: Aug. 1, 4, and 5, 2003. One time hand pick (destructive harvest).
Plot Design: Randomized block with 4 reps. 1 row by 50 ft plots.
Location: SE corner of Voorhees and Athlone Rds, in Merced County
Soil Type: Landlow silt loam. Imperfectly drained, slight salt build up in some places.

FIELD DAY JULY 31, 2003
Continuing Education Credits: 3 hrs OTHER. ID CODE: A-1226-03.

METHODS
Seed selection took place in January, with the participating Farm Advisors making recommendations to the seed companies. Once received, the seed was hand planted at LaBar's Greenhouse in Gustine. Plants were transplanted into a commercial field using a 3-row finger planter on 16" centers. Plants were drip irrigated throughout the season and fertilized with the drip system as well. Fruit and vine characteristics were evaluated one day prior to harvest. Varieties submitted and the field plot layout are shown in Tables 1 & 2.

Plants were harvested when the field was approximately 15% red (about 83 days after transplanting. The plants were cut from a 12 ft section within each plot and the fruit were shook onto the top of the bed. All fruit that were size small or larger were harvested. Red and cull fruit were weighed separately from the green; red fruit were added back to the sorter to get a final weight for each size category. CTC standard grade sizes were used.

This year we sorted in the field by making a portable wooden sorter with grates set at the respective fruit sizes to sort the fruit. The picked tomatoes were brought to the sorter in a bucket, dumped at one end, and rolled by gravity to the other end. The fruit fell through the slots into boxes placed under each sizing area. Extra large fruit and larger (Jumbos) rolled to the end of the sorter. This new tool greatly increased the speed at which we could sort fruit, and allowed us to keep the fruit in the field to be returned to the grower.

At harvest, mature green and breaker fruit samples were taken by Dr. Marita Cantwell for post harvest quality determinations.

Yield data for the replicated trial were analyzed using CoStat statistical software using standard analysis of variance procedures. The observational trial had no replication and was not analyzed. Small fruit were weighed but not included in the marketable yield.

RESULTS

This was a very good trial this year, with overall excellent yields. Disease and pest pressure were very low, though there was some curly top and spotted wilt strikes scattered throughout the plots.

Replicated trial yield and fruit characteristics are shown in Tables 3 and 4, while the observational trial results are shown in Tables 5 and 6. In the replicated trial, there was no significant difference in marketable yields, which ranged from 3000 boxes per acre for Q-23 to 2200 boxes for BHN 464. Significant differences did occur for the sizes between varieties, with L-312 having the most XL fruit (50%) and least medium fruit (11%). Cull tonnage for all lines was low this year, averaging 8.5 tons/A, and may reflect our new sorting method. Shady Lady once again had the most red fruit at harvest (27%), showing that it matures early relative to the other varieties in this test.

In the observation trial, yields ranged from 2900 boxes to 1047 boxes per acre (Table 5). Highest yields were obtained with XTM 0230, BHN 581, and BHN 611, all in excess of 2800 boxes per acre. Fruit size was good for these varieties (~75%), though not quite as high as the replicated lines. In general, BHN and Sakata did well in this trial, though some of Sakata's lines were very early and had more than 40% fruit at harvest.

A summary of the statewide yield results is shown in Table 7. The high yields we observe in our trials mainly occur because we pick all fruit. The relative differences are what is important.

The post harvest evaluation report follows Table 7. In general, fruit from the trial this year were slightly softer and had less soluble solids and acidity than the same varieties at the other locations (Kings, San Joaquin).

ACKNOWLEDGEMENTS:

Many thanks to Bob Giampaoli, Daniel Acevedo, Dr. Jeff Mitchell, California Tomato Commission, Seed Companies, Ed Bright, Larry Burrow, Jan Mickler, and especially Michelle LeStrange for helping put this thing together.

Table 1. 2003 FM Tomato Varieties:

Replicated		*Observation*	
BHN Seed	1. BHN 464	BHN Seed	21. BHN 502
	2. BHN 499		22. BHN 526
LSL Plant Science	3. L-312		23. BHN 581
Seminis	4. Sun King		24. BHN 611
Sunseeds	5. Shady Lady (std)		25. BHN 623
Syngenta	6. Quali T-21	D. Palmer	26. SDT 01-6
	7. Quali T-23		27. SDT 01-7
	8. Bobcat		28. DT 03-70
			29. DT 03-71
		Golden Valley Seed	30. GVS 51-182
			31. GVS 51-178
			32. GVS 51-193
			33. GVS 51-993
			34. GVS 51-992
			35. GVS 51-644
			36. GVS 51-643
		Harris Moran	37. HMX 2807
		LSL Plant Science	38. L-310
			39. L-311
			40. B-807
		Sakata	41. XTM 0113
			42. XTM 0115
			43. XTM 0230
			44. XTM 0231
		Southwestern	45. SW 100 101
			46. SW 100 102
			47. SW 100 103
		Syngenta	48. RFT 6047

Table 2. Field plot lay-out:

5	1	8	4	2	3	6	7	42	43	44	45	46	47	48
1	7	4	2	3	5	8	6	35	36	37	38	39	40	41
4	7	3	5	6	1	8	2	28	29	30	31	32	33	34
1	2	3	4	5	6	7	8	21	22	23	24	25	26	27

Table 3. Fresh market tomato variety trial yield and grade results, 2003.
Replicated varieties, Merced County.

			Market Yield		XL	L	M	S	Culls	total	Red
Var #	Variety	Company	Tons/A	Boxes/A	% of marketable yield			tons/A	tons/A	tons/A	%
7	Q-23	Syngenta	37.45	2996	39.1%	44.5%	16.4%	4.94	8.5	50.93	23.4%
6	Q-21	Syngenta	34.59	2768	36.1%	42.6%	21.3%	7.57	6.2	48.40	14.5%
2	BHN 499	BHN Seed	32.81	2625	34.3%	35.8%	29.8%	8.74	12.3	53.85	20.4%
4	Sun King	Seminis	31.71	2537	22.9%	44.0%	33.1%	8.43	6.6	46.75	20.1%
8	Bobcat	Syngenta	31.59	2527	34.6%	41.7%	23.8%	7.76	7.3	46.60	18.2%
5	Shady Lady	Sun Seeds	31.05	2484	28.1%	41.6%	30.3%	8.09	7.4	46.56	27.4%
3	L-312	LSL	29.09	2327	50.3%	38.8%	10.9%	2.59	12.9	44.53	15.5%
1	BHN 464	BHN Seed	27.49	2199	27.9%	38.6%	33.5%	9.96	6.6	44.05	13.0%
	Average			2558	34%	41%	25%	7.3	8.5	47.7	19%
	LSD 0.05			NS	9.5	5.3	8.2	1.9	3.5	NS	8.2
	CV, %			14.2	18.9	8.7	22.3	17.7	27.9	11.6	29.2

Market yield = XL + L + M size fruit, average of four replications. One box = 25 lbs.
XL, L, M% = weight of respective fruit sizes divided by marketable yield.
Red% = weight of all red fruit divided by total yield. Indicates relative maturity among tested varieties.
Culls, tons per acre: Any fruit so disfigured (due to rot, cat facing, insect damage, etc.) as to be unmarketable.

XL = 3 inches and larger in diameter
L = 2.5 to 3"
M = 2.25 to 2.5"
S = 2 to 2.25" Fruit smaller than 2" were not harvested.

LSD 0.05 = least significant difference at the 95% probablility level.
Yields followed by the same letter are not significantly different.
NS = not significant at the 95% probability level.
CV = coefficient of variation, a measure of the variability in the experiment.

Table 4. Fresh market tomato fruit and vine characteristics. Merced County, 2003.
REPLICATED varieities.

Var #	Variety	Vine Size	Leaf cover	Leaf roll	Fruit shape	Rough-ness	Blossom end	Cat-facing	Growth Cracks	Sun-burn	Zip-pers	Disease	Stem	Comments
1	BHN 464	L	G	N	G	S	T	N	N	N	N	N	SJ	
2	BHN 499	L	G	SL	G	M	SL	N	N	SL	N	N	SJ	
3	Sun King	VL	OK	N	G	S	T	N	N	SL	N	N	J	vine open late
4	L-312	M	G	S	G, FG	MR	T	S	N	SL	N	Y	J	catfacing, TSWV
5	Shady Lady	L	G	N	G, FG	M	T	SL	N	SL	N	N	J	
6	Q-21	VL	G	N	G, FG	M	T	N	N	N	SL	N	J	vine sprawl
7	Q-23	L	G	N	G, FG	M	SL	N	N	SL	N	N	J	
8	Bobcat	ML	G	S	G, FG	MR	T	N	N	N	SL	N	J	

Vine Size:	M = medium	ML = medium large	L = large	VL = very large
Leaf Cover:	P = poor	OK = adequate	G = good	
Leaf Roll:	N = none	SL = slight	S = some	
Fruit Shape:	DG = deep globe	G = globe	FG = flat globe	
Shoulder roughness:	S = smooth	M = medium	MR = medium rou	R = rough
Blossom End:	T = tight	SL = slight scar	M = medium size scar	
Cat Facing:	N = none	SL = slight	S = some	
Growth Cracks:	N = none	SL = slight	S = some	
Sunburn:	N = none	SL = slight	S = some	
Zippers:	N = none	SL = slight	S = some	
Stem:	J = joint	NJ = no joint	SJ = semi joint	
Disease:	N = none	Y = some symptoms seen		

Table 5. Fresh market tomato variety trial yield and grade results, 2003.

Observational varieties, Merced County.

			Market Yield		XL	L	M	S	Culls	total	Red
Var #	Variety	Company	Tons/A	Boxes/A	% of marketable yield			tons/A	tons/A	tons/A	%
43	XTM 0230	Sakata	36.445	2916	28%	36%	36%	15.8	5.0	57.154	20.3%
23	BHN 581	BHN Seed	36.209	2897	31%	42%	27%	9.3	12.9	58.370	15.7%
24	BHN 611	BHN Seed	35.701	2856	30%	45%	25%	7.5	3.4	46.646	8.2%
22	BHN 526	BHN Seed	34.031	2723	40%	41%	19%	2.7	12.9	49.658	6.5%
21	BHN 502	BHN Seed	33.650	2692	14%	44%	41%	6.8	6.8	47.172	6.6%
48	RFT 6047	Seminis	31.781	2542	39%	43%	18%	9.7	8.7	50.167	11.3%
42	XTM 0115	Sakata	30.801	2464	24%	42%	34%	14.3	3.0	48.152	40.9%
39	L-311	LSL Plant Science	28.169	2254	22%	54%	24%	5.0	12.8	45.956	22.6%
28	DT 03-70	D. Palmer	27.679	2214	16%	56%	28%	8.3	9.7	45.647	41.7%
38	L-310	LSL Plant Science	27.497	2200	13%	58%	30%	3.7	9.6	40.747	32.2%
30	GVS 51-182	Golden Valley Seed	26.789	2143	42%	47%	11%	5.0	3.8	35.610	37.9%
26	SDT 01-6	D. Palmer	26.771	2142	22%	39%	38%	10.8	7.4	44.958	18.2%
25	BHN 623	BHN Seed	26.717	2137	26%	31%	43%	13.9	7.4	48.043	14.4%
41	XTM 0113	Sakata	24.666	1973	8%	37%	55%	13.8	4.7	43.161	41.0%
44	XTM 0230	Sakata	24.448	1956	29%	34%	37%	12.0	6.4	42.907	14.9%
40	B-807	LSL Plant Science	24.248	1940	10%	48%	43%	6.4	6.9	37.552	33.5%
27	SDT 01-7	D. Palmer	24.067	1925	17%	47%	36%	12.4	10.6	47.099	23.1%
37	HMX 2807	Harris Moran	21.943	1755	6%	42%	53%	11.6	2.7	36.264	6.9%
29	DT 03-71	D. Palmer	21.199	1696	8%	26%	66%	19.9	4.4	45.538	48.6%
45	SW 100 101	Southwestern	20.364	1629	16%	47%	37%	12.3	11.3	44.014	20.7%
33	GVS 51-993	Golden Valley Seed	20.292	1623	9%	38%	53%	17.6	9.8	47.735	16.0%
46	SW 100 102	Southwestern	20.201	1616	15%	35%	50%	16.0	10.1	46.283	15.4%
34	GVS 51-992	Golden Valley Seed	19.003	1520	4%	33%	64%	25.3	5.3	49.550	5.1%
32	GVS 51-193	Golden Valley Seed	18.894	1512	31%	32%	37%	9.7	5.2	33.795	23.6%
35	GVS 51-644	Golden Valley Seed	18.223	1458	3%	31%	66%	17.8	3.6	39.621	19.6%
47	SW 100 103	Southwestern	17.769	1422	20%	41%	40%	12.2	8.1	38.079	19.9%
31	GVS 51-178	Golden Valley Seed	14.683	1175	24%	57%	19%	5.5	10.9	31.073	18.9%
36	GVS 51-643	Golden Valley Seed	13.086	1047	0%	18%	82%	18.5	8.0	39.603	4.8%
	Average		25.448	2036	20%	41%	39%	11.338	7.692	44.479	21%

Market yield = XL + L + M size fruit, average of four replications. One box = 25 lbs.

XL, L, M% = weight of respective fruit sizes divided by marketable yield.

Red% = weight of all red fruit divided by total yield. Indicates relative maturity among tested varieties.

Culls, tons per acre: Any fruit so disfigured (due to rot, cat facing, insect damage, etc.) as to be unmarketable.

XL = 3 inches and larger in diameter

L = 2.5 to 3"

M = 2.25 to 2.5"

S = 2 to 2.25" Fruit smaller than 2" were not harvested.

Table 6. Fresh market tomato fruit and vine characteristics. Merced County, 2003.

OBSERVATIONAL varieities.

Var #	Variety	Vine Size	Leaf cover	Leaf roll	Fruit shape	Rough-ness	Blossom end	Cat-facing	Growth Cracks	Sun-burn	Zip-pers	Stem	Disease	Comments
21	BHN 502	L	OK	S	G, FG	S	SL	N	N	SL	SL	J	N	
22	BHN 526	L	G	N	G	S	SL	S	SL	N	SL	SJ	N	late, many smalls, misshapen
23	BHN 581	L	G	N	G	M	SL	SL	N	N	N	SJ	N	early
24	BHN 611	L	G	N	G	M	T	N	N	N	N	J	N	
25	BHN 623	M	OK	SL	G	S	T	N	N	N	N	J	N	
26	SDT 01-6	L, sprawl	OK	N	G, FG	M	SL	N	N	SL	N	J	N	small, early
27	SDT 01-7	L	G	SL	FG	R	M	S	N	SL	N	NJ	N	
28	DT 03-70	ML	OK	Y	G	S	T	SL	S	N	N	J	N	
29	DT 03-71	ML	G	S	FG	S	T	SL	SL	SL	N	SJ	N	fruit streaking
30	GVS 51-182	VL, sprawl	OK	N	G	MR	T	SL	SL	SL	SL	SJ	N	many smalls, uneven ripening
31	GVS 51-178	VL, sprawl	G	N	DG	S	M	N	N	SL	SL	J	BER	
32	GVS 51-193	VL, sprawl	OK	N	G	M	SL	N	S	S	N	J	N	
33	GVS 51-993	VL	OK	N	FG	M	SL	SL	SL	SL	SL	J	BER	
34	GVS 51-992	L	OK	N	G, FG	R	M	N	N	N	N	NJ	Y	curly top, gr shoulders
35	GVS 51-644	VL	OK	N	g	R	M	N	S	SL	SL	J	N	fruit streaking
36	GVS 51-643	VL, sprawl	G	N	FG	MR	M	S	N	N	N	J	Y	curly top, all vine no tomatoes
37	HMX 2807	VL	G	N	G	R	M	S	N	N	N	SJ	Y	curly top
38	L-310	L	OK	N	G	M	SL	N	N	S	N	J	Y	curly top
39	L-311	ML	G	Y	FG	S	T	SL	N	S	N	J	Y	curly top
40	B-807	ML	OK	Y	FG	MR	T	S	N	S	N	J	Y	curly top
41	XTM 0113	L	G	N	FG	MR	T	N	N	N	SL	J	N	good color
42	XTM 0115	M	G	Y	G	M	SL	N	N	N	SL	J	N	good color
43	XTM 0230	L, sprawl	OK	N	G, FG	M	T	N	N	S	N	J	N	
44	XTM 0230	L, sprawl	OK	N	G, FG	M	SL	N	N	S	S	J	N	
45	SW 100 101	L	OK	Y	G	S	T	SL	N	S	SL	J	N	
46	SW 100 102	L, sprawl	G	N	G	M	SL	SL	SL	SL	SL	J	N	
47	SW 100 103	L	OK	N	FG	MR	SL	SL	N	S	N	J	Y	curly top
48	RFT 6047	L	G	N	G	MR	SL	SL	N	N	N	J	Y	curly top, deep shoulders

Vine Size:	M = medium	ML = medium large	L = large	VL = very large
Leaf Cover:	P = poor	OK = adequate	G = good	
Leaf Roll:	N = none	SL = slight	S = some	
Fruit Shape:	DG = deep globe	G = globe	FG = flat globe	R = Roma
Shoulder roughness:	S = smooth	M = medium	MR = medium rough	R = rough
Blossom End:	T = tight	SL = slight scar	M = medium size scar	
Cat Facing:	N = none	SL = slight	S = some	
Growth Cracks:	N = none	SL = slight	S = some	
Sunburn:	N = none	SL = slight	S = some	
Zippers:	N = none	SL = slight	S = some	
Stem:	J = joint	NJ = no joint	SJ = semi joint	
Disease:	N = none	Y = some symptoms seen		BER = blossom end rot

Table 7. Statewide combined results, replicated varieties.

YIELD & MATURITY* of Fresh Market Tomatoes - REPLICATED Varieties
Results Summary of Three Fresh Market Tomato Trials - 2003
SORTED BY MARKETABLE YIELD

		Combined Results			Kings Co. (early season)			Merced Co. (midseason)			San Joaquin Co. (late season)		
		Yield T/A		%	Yield T/A		%	Yield T/A		%	Yield T/A		%
Variety	**Company**	**Market**	**Total**	**Reds**	**Market**	**Total**	**Reds**	**Market**	**Total**	**Reds**	**Market**	**Total**	**Reds**
BHN 499	BHN Seed	**28.1**	**39.7**	**24.0**	40.9	49.0	34.1	32.8	53.9	20.4	10.6	16.3	17.5
Sun King	Seminis	**26.7**	**36.3**	**16.0**	36.3	42.8	13.1	31.7	46.8	20.1	12.0	19.4	14.6
QualiT 23	Syngenta	**25.4**	**32.9**	**16.2**	26.7	30.9	15.3	37.4	50.9	23.4	11.9	16.9	9.8
L-312	LSL Plant Sci.	**25.0**	**35.5**	**16.0**	31.8	41.6	12.6	29.1	44.5	15.5	14.0	20.3	19.9
Bobcat	Syngenta	**24.5**	**33.4**	**17.3**	27.4	32.5	18.8	31.6	46.6	18.2	14.6	20.9	15.1
QualiT 21	Syngenta	**23.9**	**31.7**	**8.2**	22.8	28.2	4.0	34.6	48.4	14.5	14.2	18.5	6.0
BHN 464	BHN Seed	**20.8**	**30.8**	**13.1**	25.2	31.6	20.0	27.5	44.1	13.0	9.7	16.8	6.3
Average		**24.9**	**34.3**	**15.8**	**30.2**	**36.7**	**16.8**	**32.1**	**47.9**	**17.9**	**12.4**	**18.4**	**12.7**
LSD .05		1.8	2.1	1.9									
CV %		24.3	20.8	41.7									
Shady Lady**					33.0	39.4	44.9	31.0	46.6	27.4			
Variety x Location Interaction		S	NS	S									

Variety by Location Interaction - When this statistic is significant, it means that the varieties did not behave consistently at each location.
S = significant difference NS = not significantly different

* Market Yield = average weight in pounds of four replications converted to tons and boxes per acre of all marketable extra large, large, and medium sized fruit. Small fruit were considered unmarketable this year.
TOTAL Yield = Marketable Yield plus small sized and cull fruit.
Percent Red = % reds by weight of TOTAL yield including culls to indicate maturity relative to all tested varieties.

** Shady Lady was not replicated in the San Joaquin County trial.

26 November 2003

Tomato Variety Trial #2
Postharvest Evaluations of Round Tomatoes

Responsible:

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Objectives of Research:
To evaluate the most important quality characteristics of ripened fresh market round tomatoes from known varieties and new experimental lines.

Experimental Procedures

Fruit Sampling and ripening

We harvested mature-green (MG) and vine-ripe (VR) fruit from the 2nd round tomato variety trial for 8 replicated varieties and VR harvested fruit from 6 observational lines. Vine-ripe (VR) fruit had 30-50% color at harvest and about 50 fruit per cultivar were harvested. About 80 MG fruit or more were harvested in buckets, placed in plastic trays for transport to the lab, and well-formed large (5x5 or 5x6) fruit were selected for ripening and evaluation. A minimum of 24 fruit (3 reps of 8 each) from the VR harvested fruit and a minimum of 45 (3 reps x 15 fruit) of MG harvested fruit were ripened under standard conditions. MG fruit were of high maturity and were not treated with ethylene in this trial. Fruit were placed on plastic-wrapped trays to complete ripening at 20°C. Fruit were evaluated when they reached the **table-ripe stage** or color stage 6 on the USDA scale ± 1-2 days.

Quality Measurements

The minimum quality evaluation of different tomato varieties should include data on firmness, color and composition at the table-ripe stage (**Table 1**). Flavor can be estimated measuring soluble solids (sugars) and acid contents. Table 1 describes the measurements useful to assess the postharvest potential of different fresh market tomato varieties. Typical values for color and firmness measurements are described in **Table 2** and **Table 3**.

Table 1. Ripe tomato quality measurements for 2002 variety trials.

Attribute	Measurement	Additional Information
1. Color	Objective color values using a Minolta Color meter	Data reported as "Hue"; this is a calculated color value and the most useful single value to compare tomato color; see **Table 2** for typical values for a range of tomato stages. Hue values from 35-40 usually indicate good red color.
2. Texture	2b. Compression test: the force to compress the fruit a distance of 5 mm is measured	Computerized texture analyzer equipped with a 25 mm flat cylinder moving at 0.5 mm/sec ; value is inversely related to values in 2a. Data expressed in Newtons (1 N =9.81 kg-force or 4.45 lb.-force) ; typical range 15-25 N (**Table 3**).
3. Composition	3a. Soluble solids (SS) are measured on a refractometer	Fruit are quartered, blended. The juice is filtered and used. 5 min per fruit for sample preparation and measurements of SS and TA. Values can range from 3.5-7.0%.
	3b. Titratable acidity (TA); 10 mL juice are titrated with NaOH	pH of the juice is taken as a part of these measurements. Generally there is an inverse relationship between pH and T.A. Values can range from 0.2-0.6%.

Table 2. Example of color changes during the ripening of fresh market tomato fruits.

Stage of Development/Color	USDA Color Chart Stage	L*	a*	b*	chroma	hue
Mature-Green	1	62.7	-16.0	34.4	37.9	115.0
Breaker	2	55.8	-3.5	33.0	33.2	83.9
Pink-Orange	4	49.6	16.6	30.9	35.0	61.8
Orange-Red	5	46.2	24.3	27.0	36.3	48.0
Bright Red; Table-ripe	6	41.8	26.4	23.1	35.1	41.3
Dark Red	6+	39.6	27.5	20.7	34.4	37.0

L* indicates lightness (high value) to darkness (low value); a* changes from green (negative value) to red, b* changes from blue to yellow (high value). Chroma and hue are calculated [$(a^{*2} + b^{*2})^{1/2}$ and $\tan^{-1}$ (b*/a*)] and

indicate intensity and color, respectively. The lower the hue value, the redder the tomato. Hue is the single most useful color value.

Table 3. Textural characteristics of tomatoes based on subjective and objective tests.

Firmness Class	Description based on hand and finger pressure	Manual Firmness (mm compression)[1]	Texture Analyzer Newtons Force[2]
Very Firm	Fruit yields only slight to considerable pressure	0.5-1.0	>25
Firm	Fruit yields slightly to moderate pressure	1.0-1.5	18-25
Moderately Firm	--	1.5-2.0	15-18
Moderately Soft	--	2.0-2.5	12-15
Soft	Fruit yields readily to slight pressure	2.5-3.0	8-12
Very Soft	Fruits yields very readily to slight pressure	>3.0	<8

[1]Measured by placing a 500 g weight for 10 seconds on the equator of the fruit; see 2a in Table 1.

[2] Measured by compressing fruit at the equator with a 25 mm flat cylindrical probe to a distance of 5 mm on a computerized texture analyzer. 1 Newton force = 9.81 kg-force or 4.45 pound-force.

Results

Replicated Trial. Eight cultivars from the replicated trial were evaluated from MG and VR harvested fruit (**Table 4**). Final red color was generally good but there were several cultivars (BHN 464, BHN 499, Sun King) harvested VR had hue color values higher than 40 (higher values indicate less red color development). The MG harvested L-312 also had red color values higher than 40. Firmness of the VR harvested fruit averaged 16.4 N vs 19.6 for all cultivars except L-312. The MG harvested L-312 was very hard at the table-ripe stage (35.9 N). Fruit from cv Shady Lady averaged the lowest firmness values for both the MG and VR harvested fruit. The % soluble solids varied from 3.90 to 4.37% for MG harvested fruit and from 3.93 to 4.63% for VR harvested fruit. VR harvested L-312 fruit had the highest % soluble solids. The % titratable acidity was significantly higher for the VR harvested fruit compared to the MG harvested fruit (0.31 vs 0.27%). VR harvested fruit from cv. BHN 464 had the highest % titratable acidity (0.36%) while MG harvested fruit from cv. Sun King had the lowest % (0.23%).

Observational Trial. In the fruit from the 6 cultivars harvested VR from the observation trial (**Table 5**), all had excellent red color development at the table-ripe stage. Firmness values averaged the same as VR harvested fruit from the replicated trial. Fruit of cv GVS 51-193 were notably softer than fruit from other cultivars. Average % soluble solids were higher than for fruit from the replicated trial (4.51% vs 4.25%). HMX2807 fruit had the highest % soluble solids (4.63%) and fruit from RFT 6047 has the lowest (4.03%). The % titratable acidity varied from 0.285 to 0.358% and was on average higher than for fruit from the replicated trial. Fruit from RFT 6047 had the lowest acidity (0.285%) while fruit from BHN 623 had the highest acidity (0.358%). Based on the low

soluble solids and acidity contents, fruit of RFT 6047 likely would have less flavor than fruit of the other cultivars evaluated.

Three Trial Summaries:

Quality results were generally similar for a given cultivar between the Kings County and San Joaquin County Trials, but the results for the Merced trial were often considerably different. In general MG-harvested fruit from the Merced trial were softer (lower firmness value), had lower % soluble solids and lower % titratable acidity. Color development was similar in fruit from the Merced and San Joaquin trials, but was sometimes better developed in fruit from the Kings trial (lower hue value). These results are similar to those summarized in **Table 13**, which included varieties present in the 3 locations, but only in the replicated trial.

Nine cultivars were harvested as VR fruit in the Merced and San Joaquin replicated or observational trials. The differences are similar to those of the MG-harvested fruit. Fruit from the Merced trial were generally softer, had lower % soluble solids and lower % titratable acidity than fruit from the San Joaquin trial. On average, red color development was slightly better in fruit from the San Joaquin trial. These results are also similar to the summary from the varieties in the replicated trial only (**Table 13**).

Table 14 summarizes average values for color, firmness, % soluble solids and titratable acidity for 9 varieties that were evaluated on at least 4 occasions. Tomatoes were evaluated from MG- or VR-harvested fruit. **Table 15** provides an overall ranking of the varieties based on color, firmness and composition values for 2003 evaluations. Cultivar HMX 2807 was ranked the highest in overall quality, and BHN 464 ranked the lowest. HMX 2807 ranked the best in flavor score and QualiT 23 ranked the lowest in overall flavor score. Bobcat, QualiT 21 and Shady Lady ranked top in overall red color score and L-312 ranked the lowest. Overall firmness score was highest for L-312 and lowest for Shady Lady. In 2003, the fruit generally had higher contents of soluble solids and titratable acidity than the fruit harvested in 2002.

Table 4. Quality characteristics of fresh market tomatoes harvested **MG** and **VR** from the 2003 Merced County replicated trial and ripened at 20°C (68°F). Fruit were evaluated at the table-ripe stage. See Tables 1-3 for explanation of measurements; lower hue color values indicate redder fruits, lower firmness values indicate softer fruits.

Cultivar	Stage at Harvest	Red Color Intensity, Chroma	Red Color, Hue	Firmness, Newtons	% Soluble solids	pH	% Titratable acidity
BHN 464	MG	34.2	38.7	19.3	4.37	4.44	0.291
	VR	39.4	43.7	16.2	4.33	4.43	0.363
BHN 499	MG	32.9	36.6	20.0	4.20	4.55	0.294
	VR	38.0	41.7	16.8	4.50	4.50	0.327
L-312	MG	36.1	41.1	35.9	4.27	4.54	0.266
	VR	--	--	--	4.63	4.52	0.284
Sun King	MG	33.5	37.1	20.9	4.17	4.65	0.229
	VR	40.4	41.9	16.9	4.30	4.56	0.263
Shady Lady	MG	34.3	34.7	16.6	4.23	4.57	0.277
	VR	33.0	37.4	13.6	4.13	4.53	0.309
QualiT 21	MG	33.8	37.2	20.6	4.13	4.51	0.279
	VR	30.6	37.2	15.5	4.17	4.51	0.311
QualiT 23	MG	34.8	36.7	19.3	3.97	4.50	0.264
	VR	32.9	37.9	17.7	4.03	4.39	0.291
Bobcat	MG	32.6	34.9	19.8	3.90	4.55	0.263
	VR	32.3	36.8	18.0	3.93	4.54	0.299
Average	**MG**	**34.0**	**37.1**	**21.6**	**4.16**	**4.54**	**0.270**
Average	**VR**	**35.2**	**39.5**	**16.4**	**4.25**	**4.50**	**0.306**
LSD.05		1.6	1.4	1.6	0.25	0.07	0.031

Color and firmness data are from 3 reps of 15 fruits for MG or VR fruits; composition data are from 3 reps of composite samples of 15 fruit for MG or VR.

Table 5. Quality characteristics of fresh market tomatoes harvested **VR** from the 2003 Merced observational trial and ripened at 20°C (68°F). Fruit were evaluated at the table-ripe stage. See Tables 1-3 for explanation of measurements; lower hue color values indicate redder fruits, lower firmness values indicate softer fruits.

Cultivar	Red Color Intensity, Chroma	Red Color, Hue	Firmness, Newtons	% Soluble solids	pH	% Titratable acidity
BHN 623	32.2	35.1	17.2	4.40	4.46	0.358
SDT 01-7	32.1	32.7	16.6	4.37	4.48	0.345
GVS 51-193	29.8	34.7	13.8	4.63	4.49	0.380
HMX 2807	31.1	35.8	15.2	4.63	4.58	0.298
SW 100 103	31.4	34.9	17.3	4.57	4.52	0.308
RFT 6047	32.1	37.8	18.7	4.03	4.53	0.285
Average	**31.4**	**35.2**	**16.5**	**4.44**	**4.51**	**0.329**
LSD.05	1.8	1.3	1.4	0.28	0.08	0.034

Color and firmness data are from 3 reps of 8; composition data are from 3 reps of composite samples of 7 fruits.

Summary Table 13. Average quality characteristics of fresh market tomatoes harvested **MG** or **VR** from three replicated trials in 2003. Fruit were ripened at 20°C (68°F) and evaluated at the table-ripe stage (USDA Color Chart stage 6). See Tables 1-3 for explanation of measurements.

Trial	# cultivars evaluated	Red Color, Hue	Firmness, Newtons	% Soluble solids	pH	% Titratable acidity
Harvested MG						
Kings Co.	10	32.4	19.0	4.91	4.50	0.38
Merced Co.	8	37.1	21.6	4.16	4.54	0.27
San Joaquin Co.	9	36.2	22.1	5.35	4.34	0.35
Average		**35.2 ± 2.5**	**20. 9± 1.7**	**4.8 ± 0.6**	**4.46 ± .10**	**0.33 ± .06**
Harvested VR						
Kings Co.	0	--	--	--	--	--
Merced Co.	8	39.5	16.4	4.25	4.50	0.31
San Joaq.Co.	11	36.0	19.4	5.38	4.28	0.41
Average		**37.8 ± 2.5**	**17.9 ± 2.1**	**4.7 ± 0.4**	**4.39 ± .16**	**0.36 ± .07**

Summary Table 14. Average color, firmness and composition values for 9 varieties harvested as **MG** or **VR** from at least 4 harvests from at least 2 locations. Fruit completed ripening at 20°C (68°F) and evaluated at the table-ripe stage. See Tables 1-3 for explanation of measurements. Varieties are listed in order of their final ranking in Summary Table 15.

Variety	No. evaluations	Red Color, Hue	Firmness, Newtons	% Soluble solids	% Titratable acidity
HMX 2807	4	34.3 ± 2.4	19.4 ± 3.1	5.2 ± 0.4	0.37 ± 0.06
QualiT 21	5	36.1 ± 2.0	18.7 ± 2.2	4.8 ± 0.6	0.34 ± 0.04
Bobcat	5	35.0 ± 2.2	20.4 ± 2.1	4.5 ± 0.5	0.34 ± 0.06
QualiT 23	5	35.9 ± 1.4	18.8 ± 1.1	4.7 ± 0.7	0.34 ± 0.07
Sun King	5	36.3 ± 3.6	20.1 ± 2.1	4.8 ± 0.6	0.33 ± 0.08
BHN 499	5	36.3 ± 3.5	18.9 ± 1.3	5.0 ± 0.6	0.37 ± 0.06
L-312	5	38.7 ± 4.2	26.3 ± 7.6	4.9 ± 0.4	0.32 ± 0.04
Shady Lady	5	34.8 ± 2.4	16.0 ± 1.6	4.7 ± 0.5	0.34 ± 0.05
BHN 464	4	38.0 ± 4.7	19.1 ± 2.2	4.8 ± 0.6	0.36 ± 0.05

Summary Table 15. Overall scores of ripe round tomato varieties (includes **MG-** and **VR**- harvested fruits for which there were evaluations from at least 4 harvests from at least 2 locations) evaluated in 2003.

Variety	Number Evaluations	% SS Score	% TA Score	Flavor Score (Max = 3)	Red Color Score (Max = 3)	Firmness Score (Max = 3)	Total Quality Score (Max =9)
HMX 2807	4	2.75	2.25	**2.5**	**2.25**	**2.5**	**7.25**
QualiT 21	5	2.2	1.8	**2.0**	**2.2**	**2.4**	**6.60**
Bobcat	5	1.6	1.8	**1.7**	**2.4**	**2.4**	**6.50**
QualiT 23	5	2.0	1.8	**1.9**	**2.4**	**2.2**	**6.50**
Sun King	5	2.0	1.8	**1.9**	**2.0**	**2.6**	**6.50**
BHN 499	5	2.4	2.0	**2.25**	**2.0**	**2.2**	**6.45**
L-312	5	2.0	1.6	**1.8**	**1.6**	**2.8**	**6.20**
Shady Lady	5	2.0	1.6	**1.8**	**2.4**	**1.8**	**6.00**
BHN 464	4	1.75	1.75	**1.75**	**2.0**	**2.0**	**5.75**

Varieties are scored for each characteristic on a 3 point scale, where 1=low, 2=intermediate, and 3=high.

Red color: score 1 = poor, with hue >40 score 2 = hue 35-40 score 3 = high with hue <35

Firmness: score 1 = <15N force score 2 = 15-18 score 3 = >18

Soluble solids: score 1 = < 4.2 %SS score 2 = 4.2-4.6 %SS score 3 = >4.6 %SS

Acidity: score 1 = < 0.28 %T.A. score 2 = .28-.30 %TA score 3 = >0.30 %T.A.

Flavor Score is the average of the soluble solids and titratable acidity scores.

Total score is based on the sum of the flavor, red color and firmness scores, and the higher the total score, the better the overall quality. Varieties are ordered based on total quality score (right column).

Evaluation of herbicide and adjuvant combinations for the control of yellow nutsedge in a processing tomato/cotton production system in salty soil.

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SUMMARY:
A herbicide trial was conducted in a commercial processing tomato field in Merced county in 2003 to evaluate the effect of six different herbicides on controlling yellow nutsedge (*Cyperus esculentus*) and nightshade (both hairy and black, *Solanum sarrachoides* and *Solanum nigrum*). The herbicides included pre-plant incorporated (PPI) products that suppress weed germination (Tillam, Eptam, Dual Magnum) as well as post-emergence products (Matrix, Sencor, Sandea). Some of the post-emergence herbicides were combined with or without a non-ionic surfactant (NIS). The field site had a history of nightshade and nutsedge infestation and was located adjacent to a cotton field. Soil pH = 6.3 and E.C. = 2.86 dS/m in the surface 6". All of the PPI herbicides significantly reduced both nightshade and nutsedge as compared to the untreated control, however, control was better earlier in the season. Sandea significantly reduced nutsedge and Matrix significantly reduced nightshade pressure better than any of the other treatments. The addition of a NIS only slightly improved weed control. Best overall weed control was obtained with a Matrix + Sandea + NIS tank mix. Yields were improved when a herbicide was used, with Sencor and the Matrix+Sandea tank mix having significantly better tonnage than the untreated control (56 vs 37 tons/A). No phytotoxicity was seen on the tomato plants or the adjacent cotton crop.

INTRODUCTION
Yellow nutsedge and nightshade are two dominant weed problems for processing tomato growers in Merced County. Some of the main herbicides that offer control or suppression of these weeds in tomatoes in California include Dual Magnum (metalochlor), Tillam (pebulate), Eptam (EPTC), Sencor (metribuzin), Matrix (rimsulfuron), and Sandea (halosulfuron). Of these, Matrix targets nightshades, while Sandea is almost exclusively a nutsedge material. In 2003, Dual Magnum and Sandea received full registration for use on tomatoes in California.

Post-emergence sprays of Matrix target nightshades. Efficacy is improved if it can be water incorporated within 5 days of application. As more of the processing industry uses transplants rather than direct seed, however, sprinkle irrigation is no longer a necessary practice, which may reduce both use and effectiveness of Matrix.

Sandea is a new nutsedge control material that has shown good control of yellow nutsedge in several UCCE trials. Its main drawbacks are that some tomato varieties are more tolerant to it than others, and cotton is also very sensitive and there could be problems with drift or plant-back. Tomato sensitivity may be related to soil conditions that reduce crop vigor. In Merced County, tomato/cotton rotations are very common, and the main production areas are also in salty soil. Thus, Sandea needs to be evaluated in this area.

To address these issues, a herbicide trial was conducted to evaluate control of nightshade and yellow nutsedge. The objectives were:

- To evaluate tomato tolerance to the herbicide treatments.
- To evaluate herbicide efficacy.
- To evaluate persistence or spray drift problems in the adjacent cotton crop.

METHODS
The trial was located on San Juan Ranch, near Dos Palos in Merced County in a commercial processing tomato field. Variety was H 2501. The previous crop was cotton, and the 2005 crop is scheduled to be planted to cotton again. The field had not received any herbicide applications prior to this test.

Treatments:

1. Untreated control
2. Tillam 6E 4 qts/A post plant incorporated
3. Eptam 7E 3.5 qts/A post plant incorporated
4. Matrix 2 oz/A alone post plant over-the-top
5. Matrix 2 oz/A + NIS (R11) post plant over-the-top
6. Sencor 75 1 lb/A post plant directed
7. Sandea 1 oz/A post plant directed
8. Sandea 1 oz/A + NIS post plant directed
9. Matrix 2 oz/A + Sandea 1 oz/A + NIS post plant directed
10. Dual Magnum 1.5 pints/A post plant incorporated (std)

Plot size was 3 beds (15 feet) by 50 feet long, replicated 4 times.

Treatments 2, 3, and 10 were applied using a back pack sprayer to a clean bed about 10 days after field had been transplanted, then were incorporated with ranch equipment (power mulcher) that day on May 20. The remaining treatments were applied with a back pack sprayer on June 13, 2003 with 30 gals water equivalent. Weeds were sprayed when most nightshade was at cotyledon to 1 leaf and nutsedge was at 2 – 4 true leaves.

Plots were evaluated on June 13, June 18, July 2, and August 12. All plots were hand harvested September 8, 2003 by cutting 12 feet from the center bed in each plot. Samples were analyzed by PTAB for fruit quality characteristics. Field plots were shown three times to growers and chemical company reps.

Statistical analysis was performed using CoStat 6.2. Weed ratings were transformed using the arcsin transformation as suggested by Little and Hills[1] to assure homogeneity of variances.

RESULTS
Soil sample results are shown in Table 1. E.C. and nitrate levels for the upper 6" were elevated, which probably resulted from the pre-plant fertilizer application. This soil would not necessary be considered salty by Westside San Joaquin standards, but was chosen because of the weed pressure and proximity to cotton.

At the first weed evaluation on June 13, Tillam, Eptam, and Dual Magnum all had significantly less weed pressure than the untreated control or the other treatments (Table 2). (Post emergence applications had not been made at this time). In general, these pre-plant incorporated (PPI) treatments provided good initial suppression of both weeds species, but the control diminished by the last evaluation on August 12. Weed growth in the furrows, where the product had not been incorporated, became troublesome late in the season.

[1] Little, T.M. and F.J. Jackson. 1972. Statistical Methods in Agricultural Research. University of California, Davis CA.

Best control of both weed species was obtained with the Matrix + Sandea combination. Not only did this treatment provide fairly quick burn-down of the weed species, but lasted through the growing season (Table 2). Sandea alone did a good job of controlling nutsedge but had no effect on nightshade, while Matrix did a very good job of controlling nightshade and had a slight suppressive effect on nutsedge. Sencor did a good job of burning down both weed species if they were small, but nightshade larger than the cotyledon stage had renewed growth, and much of the nutsedge recovered. Weed control is shown graphically in Figures 1A, B, and C.

No phytotoxicity problems were seen with any of the Sandea treatments on the tomatoes or the adjacent cotton (tomato variety was H2501).

Significant differences were found for tonnage between the treatments, which best yields occurring in the Sandea+Matrix combination and Sencor plots at about 56 tons/acre. There were no significant differences with the other treatments, but the control plot was almost lowest yielding at 37.2 tons/acre. There were no differences in the fruit quality measurements.

A surprising result of the trial was how effectively Matrix worked even though it was not sprinkler incorporated. Very good nightshade control was obtained both with and without the surfactant with only the over-the-top application. The treatment used the equivalent of 30 gallons per acre when applied. The addition of a surfactant slightly improved weed control for both Sandea and Matrix in this trial (Table 2).

Table 1. Soil analysis results, San Juan Ranch field site May 2003.

Depth	SP	pH	EC	Ca (SP)	Mg (SP)	Na (SP)	Cl (SP)	HCO3 (SP)	CO3 (SP)	NO3-N	Olsen-P	X-K
	%		dS/m	meq/L	meq/L	meq/L	meq/L	meq/L	meq/L	ppm	ppm	ppm
0 – 6”	41	6.3	2.86	11.7	7.4	5.8	3.6	1.2	<0.1	97.0	63.6	158
6 – 12”	41	6.3	1.74	6.8	4.0	5.2	5.6	1.0	<0.1	99.0	34.5	100
12 – 18”	45	6.6	1.62	6.3	3.6	5.1	5.6	1.8	<0.1	32.5	22.3	79

SP = Saturated Paste Extract is the percent water and is approximately twice the field capacity of the soil.
EC = electrical conductivity, a measure of the salt content of the soil.

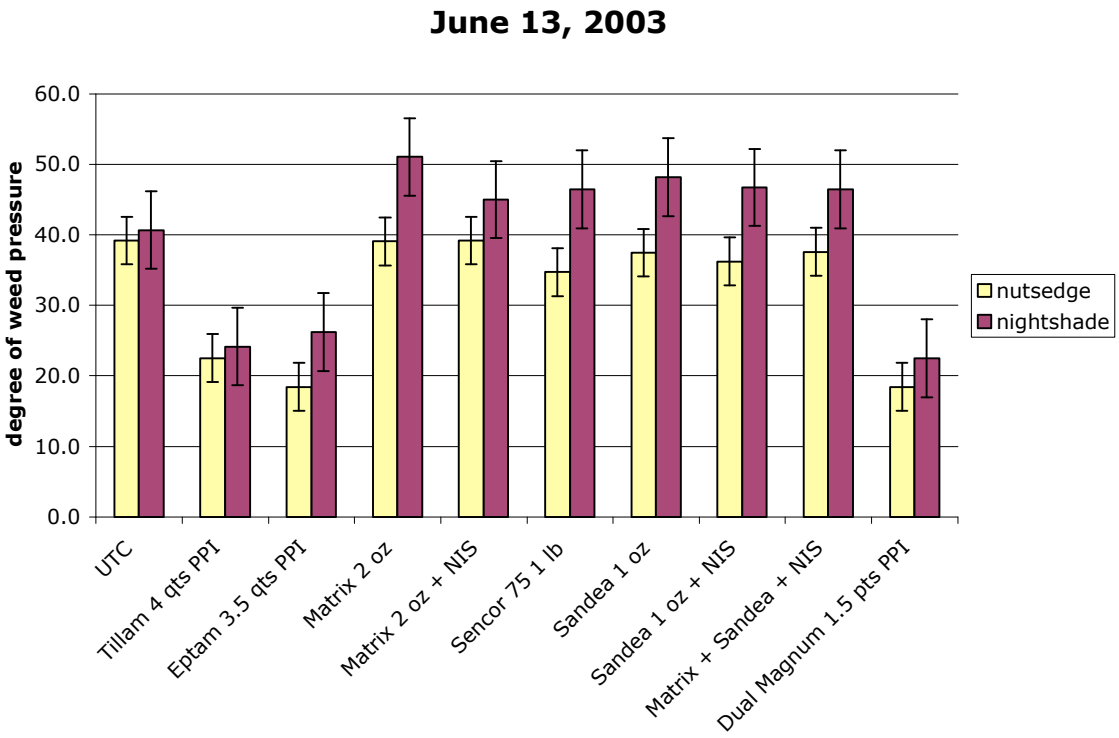


Figure 1A. Degree of weed pressure as affected by herbicide treatment on June 13. Error bars represent LSD 0.05.

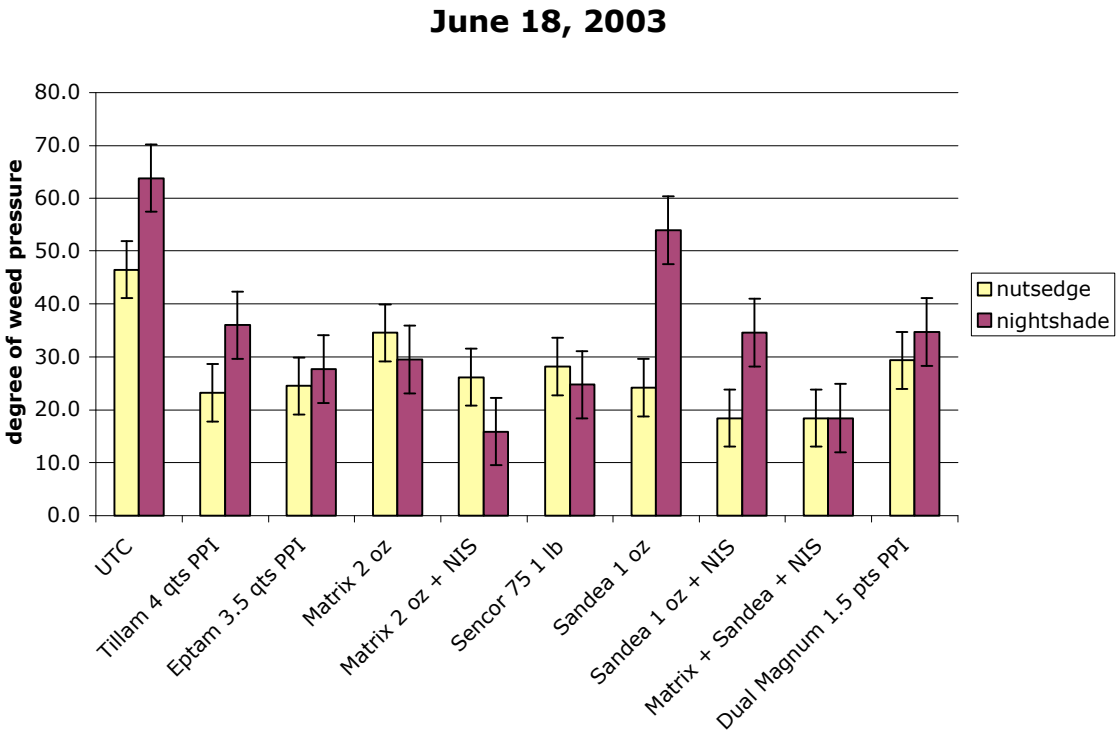


Figure 1B. Degree of weed pressure as affected by herbicide treatment on June 18. Error bars represent LSD 0.05.

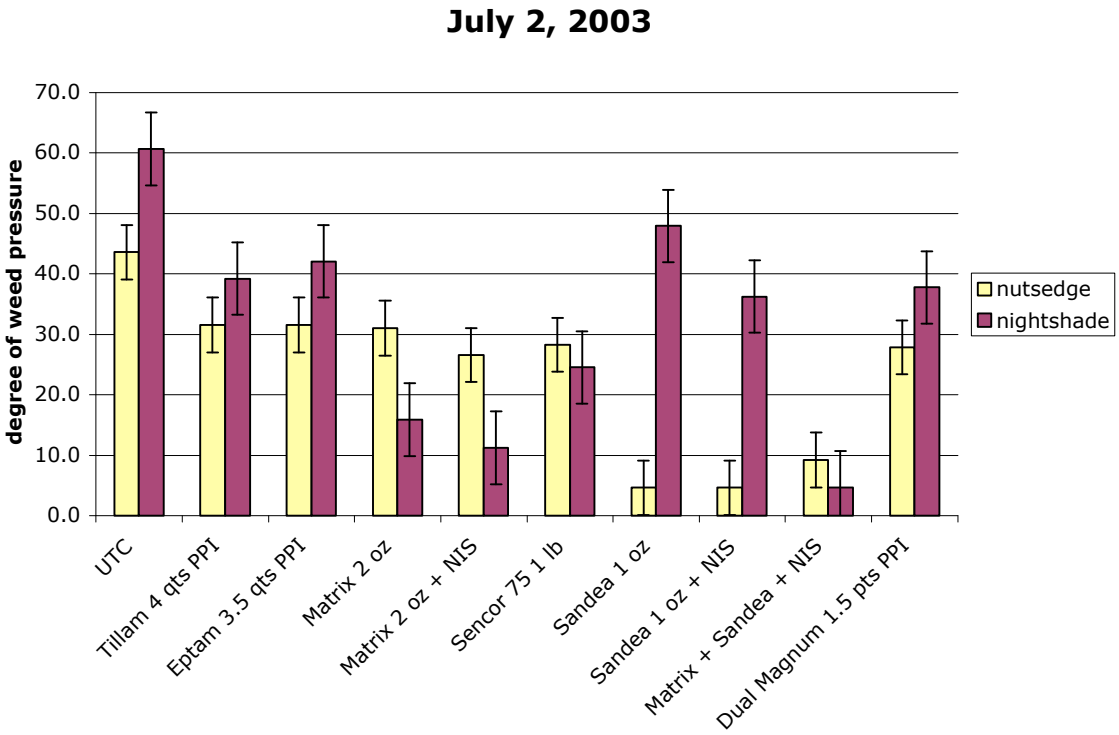


Figure 1C. Degree of weed pressure as affected by herbicide treatment on July 2. Error bars represent LSD 0.05.

Table 2. Efficacy of various herbicide and adjuvant combinations on the control of yellow nutsedge and nightshade in processing tomatoes. Merced County 2003.

		6/13/03		6/18/03		7/2/03		8/12/03					
tr #	treatment	Nut-sedge	Night-shade	Nut-sedge	Night-shade	Nut-sedge	Night-shade	Nut-sedge	Night-shade	red yield tons/A	LED color	SS	pH
1	UTC	39.2	40.7	46.5	63.8	43.6	60.6	56.1	73.1	37.2	24.0	5.2	4.43
2	Tillam 4 qts PPI	22.5	24.2	23.2	36.0	31.5	39.2	39.1	54.1	36.7	22.8	5.2	4.39
3	Eptam 3.5 qts PPI	18.4	26.2	24.5	27.7	31.5	42.1	34.1	51.1	46.4	23.3	5.1	4.47
4	Matrix 2 oz	39.1	51.1	34.6	29.5	31.0	15.9	37.1	31.0	46.1	22.5	5.2	4.44
5	Matrix 2 oz + NIS	39.2	45.0	26.2	15.9	26.6	11.3	34.2	23.9	44.7	23.3	5.2	4.42
6	Sencor 75 1 lb	34.7	46.4	28.2	24.8	28.2	24.5	31.0	23.4	56.0	24.0	5.3	4.44
7	Sandea 1 oz	37.4	48.2	24.2	53.9	4.6	47.9	13.1	40.8	43.7	24.5	5.3	4.42
8	Sandea 1 oz + NIS	36.2	46.7	18.4	34.6	4.6	36.2	21.1	22.1	44.8	23.5	5.2	4.45
9	Matrix + Sandea + NIS	37.6	46.4	18.4	18.4	9.2	4.6	15.0	18.4	56.6	22.8	5.1	4.42
10	Dual Magnum 1.5 pts PPI	18.4	22.5	29.4	34.7	27.9	37.7	30.0	38.1	44.1	22.0	5.6	4.46
	average	32.3	39.7	27.4	33.9	23.9	32.0	31.1	37.6	45.6	23.3	5.2	4.43
	LSD 0.05	6.8	10.9	10.8	12.8	9.0	12.0	NS	28.2	11.1	NS	NS	NS
	CV	14.6	18.9	27.1	25.9	26	25.9	48.4	43.8	14.2	4.5	5.8	1
	with NIS	37.7	46.1	21.0	23.0	13.5	17.4			48.7			
	without NIS	38.3	49.6	29.4	41.7	17.8	31.9			44.9			
	F-test	NS	NS	**	*	NS	NS			NS			
	PPI	19.8	24.3	25.7	32.8	30.3	39.6			42.4			
	UTC	39.2	40.7	46.5	63.8	43.6	60.6			37.2			
	F-test	**	**	**	**	**	**			NS			

Weed ratings reflect weed pressure; lower values indicate less weed growth (better control).
0 = no weeds, 90 = all weeds
On June 13, only treatments 2, 3, and 10 had been applied.

LSD = least significant difference at the 95% confidence level. Means separated by less than this amount are not significantly different. Weed analysis performed on transformed data.
** = significant at 95%, NS = not significant

NIS = non-ionic surfactant
PPI = post plant incorporated

Plastic Mulch on Fresh Market Pole Tomatoes

Scott Stoddard
Assistant Farm Advisor
Merced & Madera Counties

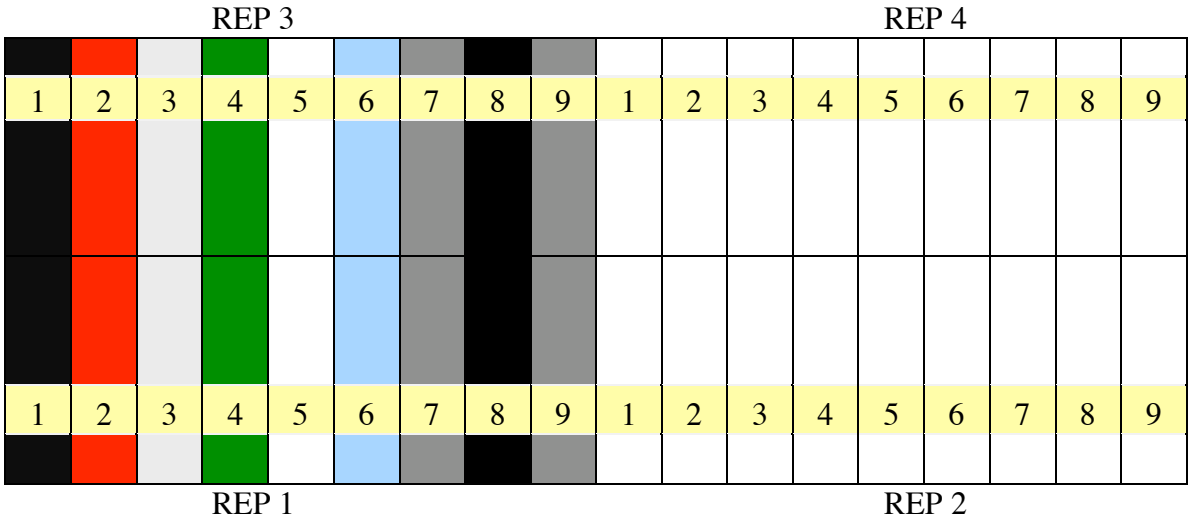
OBJECTIVE: Evaluate different colored plastic mulches by Ampacet Corp. on early and late planted fresh market pole tomato production and quality.

LOCATION: 1 mile west of Minturn Rd and 1/2 mile north of Buchanon Hollow Rd, near LeGrand, CA. Cooperator: Jeff Marchini of J. Marchini and Sons.

TREATMENTS (Mulch color):

1. Grower black (std)
2. Red
3. Silver
4. Olive
5. White
6. Blue
7. White on black
8. Black
9. Grower white on black

PLOT DIAGRAM:



Plot size: 250 ft long x 5 ft (1 bed) wide, replicated 4 times. Total mulch length along bed about 500 ft. Sample size within each plot 12 ft. Early plant date trial shown above with 18 beds total. Late plant trial had only 9 beds (2 replications).

Mulch application date: April 18, 2003. Applied with drip line.
Variety: Bobcat on 16" centers.
Transplant dates: Early: May 1, 3002. Late: June 20, 2003
Harvest dates: Early trial hand harvested pinks and reds on July 28, Aug 1, Aug 7, Aug 15, and Aug 22, 2003. Late trial was not harvested.

RESULTS

Because of the need to keep the plastic mulch intact throughout the length of the bed, it was applied from one field row to the next. There was not enough plastic for four replications along the rows, so the field was split into two sampling areas, one on each side of the field. This gave the equivalent of 4 replications for the early plant trial, however, only one incomplete set of colors was applied for the late planted trial. Mulch application in April is shown in Figure 1.

The early trial was transplanted to variety Bobcat around May 1, about 3 weeks later than originally planned. Poles were added about 4 weeks later to support the plants (Figure 2). Bobcat is bred to be a semi-determinant, bush type plant and not usually staked, but was used in this field because of grower experience with this variety.

Red fruit yield and cull weights by planting date are presented in Table 1. Harvest weights were similar for all mulch colors at the first harvest on July 28, but quickly segregated by the other harvest dates. Yields peaked on August 15 and quickly dropped off (Figure 3). There were significant differences in yield as affected by mulch color for harvests 2, 3, and 4, as well as total fruit yield. Red and grower black had significantly higher total fruit yields as compared to the other colors. Lowest total yields were observed for both white on black mulches, white, and blue.

This field experienced heavy virus pressure (predominantly tomato spotted wilt and alfalfa mosaic), and significant differences were found between the different colors on the number of virus infected fruit. Highest virus cull weights were observed in the white, blue, and white on blue treatments (Figure 4). No differences were observed for culls not from viruses.

In the late planted trial (transplant date of June 20), colors had a large impact on plant stand loss (Figure 5). Black, red, and green all had substantial plant stand loss as compared to the other mulch colors. Soil temperature readings were inconclusive, however, and did not really correlate with plant stand loss. The late planted trial was not harvested because the field was almost 100% infected with spotted wilt and alfalfa mosaic. The silver mulch had 3% of the plants with no symptoms of virus; all the other mulches were 100% infected (Figure 6).

In conclusion, best results in the early planted field were obtained with red and black mulch colors. Lowest yields and highest virus infection occurred with white, blue, and white on black. This is well documented in the literature, as mulch colors heat the soil, improving early season crop growth, and can also deter thrips and aphids that transmit viruses. Conversely, in late planted fields, white and white on black mulches do better, as they help keep the soil cooler. In this trial, the black and red mulches caused substantial stand loss.

ACKNOWLEDGEMENTS

Thanks to Jeff Marchini, cooperator, and Larry Burrow, County Ag Field Tech, for their help with this trial.

Figure 1. Colored plastic mulch test plot, early planting location.

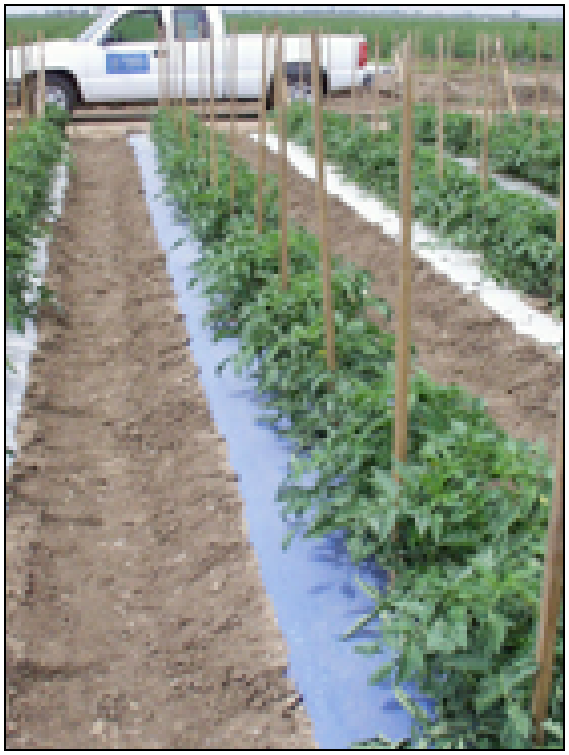


Figure 2. Tranplanted tomatoes showing poles for support.

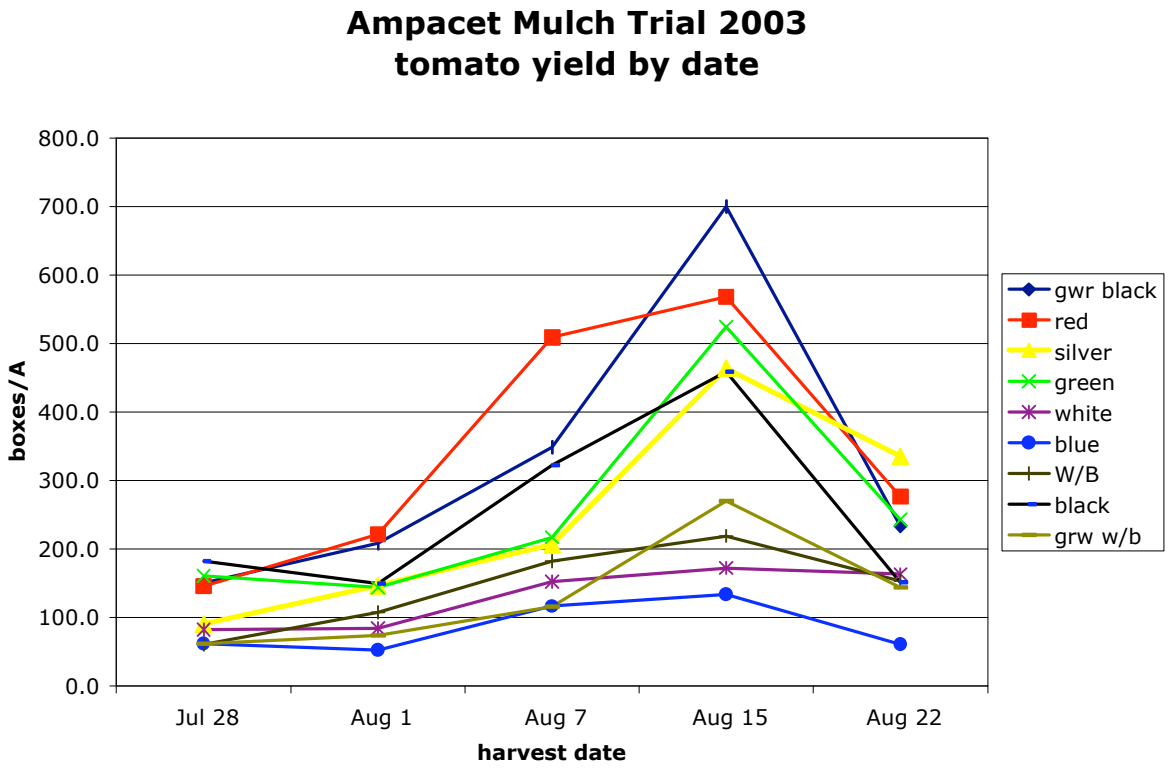


Figure 3. Red fruit yields by treatment and date. Significant differences were found for the Aug 1, 7, and 15 harvest dates.

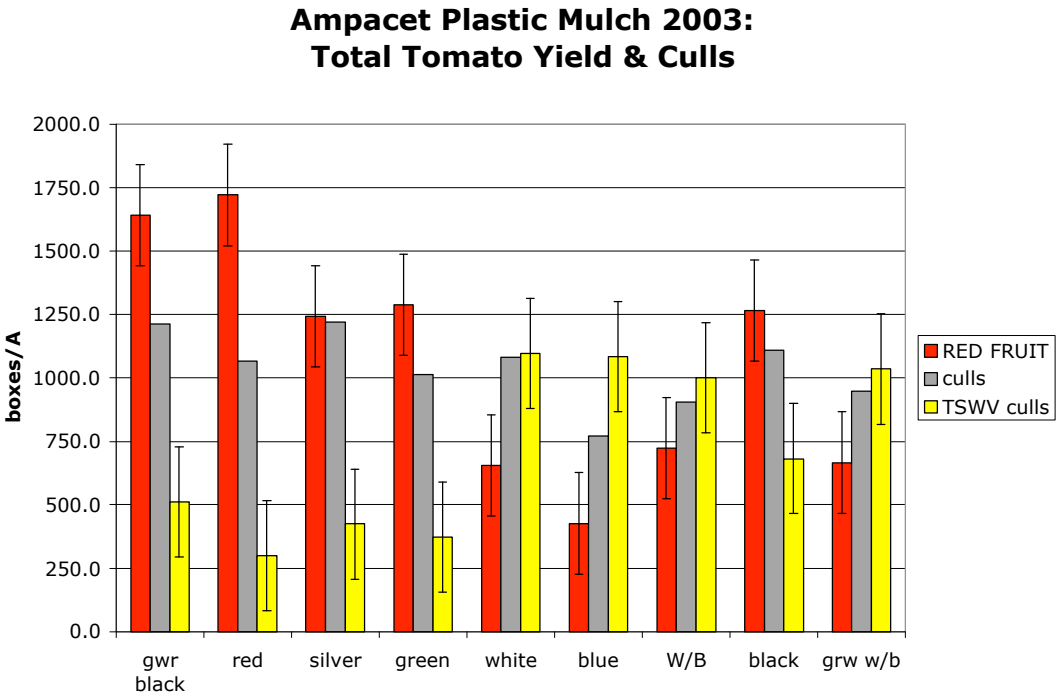


Figure 4. Total fruit weight, culls, and virus culls by treatment.

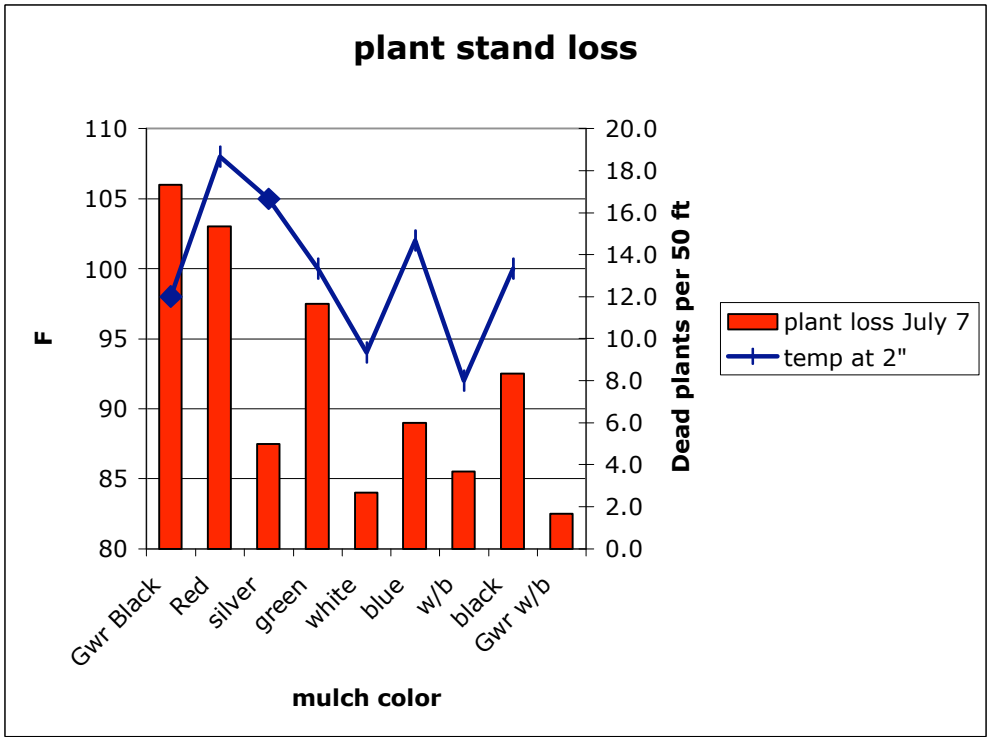


Figure 5. Plant stand loss 2 weeks post-transplant in the late planted field.

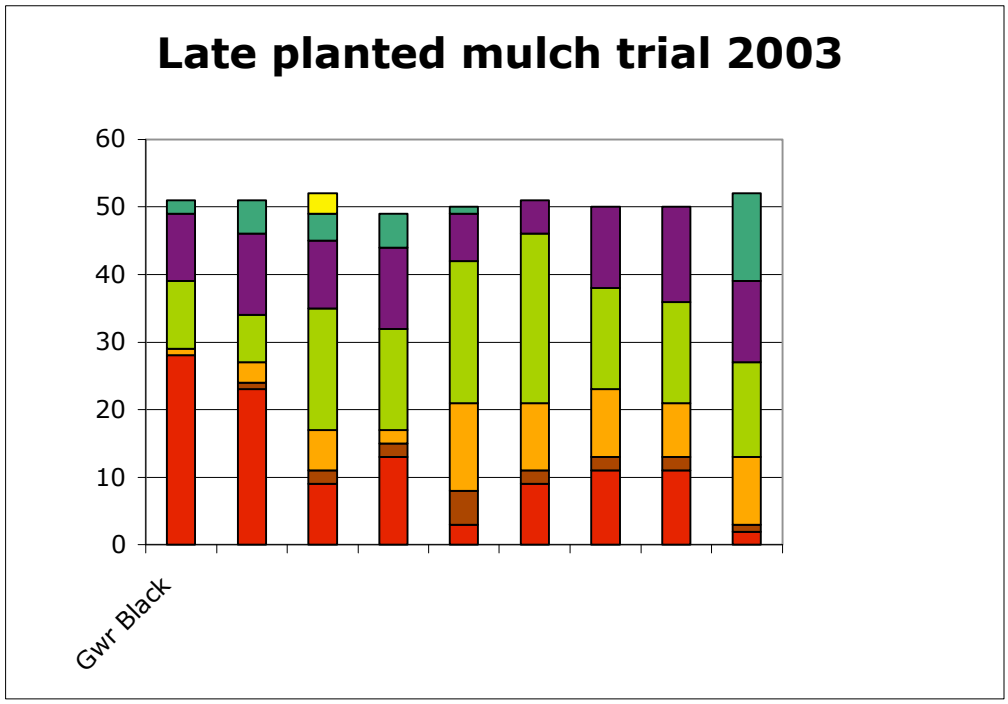


Figure 6. Number of virus infected plants out of 50 in the late planted mulch trial. Skips were caused by early season transplant loss due to heat.

Ampacet Plastic Mulch Trial on Fresh Market tomatoes
Merced County 2003

Table 1. Harvest weights, 25 lb boxes per acre, for the early planted mulch trial.

		28-Jul		1-Aug		7-Aug			15-Aug			22-Aug		
	treatment	red	culls	red	culls	red	culls	TSWV culls	red	culls	TSWV culls	red	culls	TSWV culls
1	gwr black	150.6	31.9	208.7	65.3	348.5	202.2	----	699.9	413.8	170.2	233.8	498.4	340.5
2	red	146.3	41.0	221.4	95.5	508.9	206.9	----	568.1	411.6	51.2	277.0	310.0	248.3
3	silver	90.8	42.1	147.0	70.4	206.2	310.7	15.2	463.6	440.7	160.4	335.0	355.7	263.5
4	green	160.8	60.3	143.4	49.4	217.1	188.8	50.8	524.2	397.1	129.6	242.8	317.6	242.8
5	white	82.0	50.8	84.2	76.6	152.1	306.0	66.1	172.8	408.0	524.9	163.4	238.1	571.0
6	blue	62.1	85.3	52.6	79.5	116.9	276.6	169.9	133.6	195.7	424.7	61.0	133.9	659.2
7	W/B	60.6	51.9	107.4	97.6	182.2	229.4	82.8	218.9	239.9	483.5	153.2	285.7	516.9
8	black	182.6	50.5	149.6	67.5	322.3	193.1	70.4	458.8	445.8	210.2	151.4	351.4	471.5
9	grw w/b	62.1	61.3	73.7	86.4	116.2	286.0	79.1	270.1	275.5	397.1	144.5	239.9	637.4
	average	110.9	52.8	132.0	76.5	241.2	244.4	76.3	390.0	358.7	283.5	195.8	303.4	439.0
	LSD 0.05	NS	NS	104	NS	139	NS	----	196	NS	264	162	157	258
	CV, %	72	59	54	48	39	38	----	34	37	64	57	36	40

		TOTAL boxes/A		
	treatment	RED FRUIT	culls	TSWV culls
1	gwr black	1641.5	1211.7	510.7
2	red	1721.7	1065.0	299.5
3	silver	1242.5	1219.7	424.0
4	green	1288.3	1013.1	372.4
5	white	654.5	1079.6	1095.9
6	blue	426.2	771.0	1083.9
7	W/B	722.4	904.6	1000.4
8	black	1264.7	1108.2	681.7
9	grw w/b	666.5	949.2	1034.6
	average	1069.8	1035.8	722.6
	LSD 0.05	400	NS	435
	CV, %	26	22	41

TSWV culls are culled tomatoes caused by tomato spotted wilt virus (TSWV) and/or alfalfa mosaic. These were not segregated until the 3rd harvest.
LSD 0.05 = least significant difference at the 95% confidence level. Means separated by less than this amount are not significantly different.
NS = not significant.
CV = coefficient of variation, a measure of the variablilty in the experiment.

Worm Control Evaluation on Fresh Market Tomatoes

Scott Stoddard
Assistant Farm Advisor
Merced and Madera Counties

OBJECTIVE: Evaluate the performance of several insecticides on Lepidoptera pests in fresh market tomatoes.

LOCATION: About 1/2 mile south of LeGrand Rd and 1/2 mile east of Athlone Rd in Merced County. Bob Giampaoli and Jim Mueller, cooperators.

TREATMENTS:

1. UTC
2. Entrust (Spinosad, OMRI approved) 1.5 oz/A
3. Success (Spinosad) 4.5 fl oz/A
4. Intrepid (Methoxyfenozide) 4.0 fl oz/A
5. Intrepid 8 fl oz/A
6. Intrepid 12 fl oz/A
7. ProAxis (*gamma*-cyhalothrin) 3.8 fl oz/A
8. Warrior (*lambda*-cyhalothrin*)* 3.8 fl oz/A
9. Avaunt (Indoxocarb) 3.2 oz/A
10. Proclaim (Emamectin benzoate) 2.4 oz/A
11. Dipel 2X (*Bacillus thuringiensis*) 1 lb/A

NOTE: Intrepid has federal but does not have California label. No crop destruct required. ProAxis (proposed name from GF-317) has no label and crop destruct is required.

PLOT DESIGN

- Randomized complete block with 4 replications
- Each plot was 2 beds wide (10 ft) by 35 ft long
- Trial was located at SW corner of 80 acre commercial field.

METHODS:

- Field variety Sunbrite transplanted Aug 3.
- Drip irrigation.
- Field had received one application of Avaunt prior to initiation of this test.
- Treatments applied 9/16/2003 and 9/26/2003 using a backpack CO_2 sprayer at 30 psi with 6 L of water per treatment (~ 50 gpa). Latron B1956 was added to all treatments.
- Field surrounding plot area received second worm spray on 9/20/2003.
- Worm evaluations made 9/23, 10/3, and 10/10 by shaking 12 plants per plot. Fruit damage rating performed on mature green fruit on 10/30/2003. 100 fruit per plot were sampled.

RESULTS:

This field had been sprayed once for beet armyworm prior to the initiation of this experiment. Typically, late season fields such as this face high worm pest pressure, and 3 to 4 insecticide applications are common. This field was scheduled for a second insecticide spray at the onset of the trial on September 16. At that time, we recorded and average of three (3) egg clusters (beet

armyworm) per 10 plants, which the PCA indicated was high enough for treatment. Specific thresholds have not been developed for fresh market tomatoes, but the tolerance for beet armyworms is much lower than in processing tomatoes.

At the first evaluation on September 23, it was obvious there had been considerable egg laying activity after the first treatment spray. Therefore, we sprayed the plots again on September 26. The remainder of the field was sprayed a second time on about September 20, which better coincided with peak egg hatch. The field did not receive a third spray.

We determined efficacy of the treatments by hand shaking 12 plants per plot onto a cafeteria tray one week post application. Live larvae and beneficial insects were totaled for each plot. The predominant larvae were beet armyworm (*Spodoptera exigua*), though we also observed some tomato fruitworm (*Helicoverpa [heliothis] zea*), cabbage loopers, and hornworms. Beneficial insects were predominantly the minute pirate bug, *Orius spp*. Near harvest, 100 mature fruit were picked and scored for worm damage.

Statistical analysis was done using CoStat (Cohort Software). Normal ANOVA procedures were followed, and mean separation procedures were performed using Tukey's HSD. Due to the large variability in the results, the data were transformed before analysis using both the square root and the arcsin transformation.

All treatments significantly reduced worm counts as compared to the untreated check after the first application (Table 1). Control ranged from 31% for Dipel to 71% for Success. After the second application, however, there was no significant difference between the check plots and the ProAxis and Warrior treatments (October 3 evaluation). All the other treatments significantly reduced worm counts. By October 10, the Success, Intrepid, and Proclaim treatments all provided nearly 100% control (Figures 1, 2, and 3). No significant difference was seen between any of the treatments on the number of beneficial insects observed in the plots (Table 1).

The amount of fruit damage was fairly low, ranging from about 2.5% for Entrust to 14% for the untreated check plot (Figure 4). Fruit damage consisted of a combination of both surface scarring and holes into the fruit, symptoms associated with both armyworm and fruitworms. ProAxis and Warrior were not significantly different than the check plot; all other treatments significantly reduced fruit damage (Table 1).

One of the objectives of this trial was to determine if there was a rate response with Intrepid. In this trial with low worm pressure, there was no significant difference in worm control or fruit damage by increasing the rate. The lack of a rate response may have been because there was only light insect pressure in this field, and the low rate was more than adequate for control.

In conclusion, all treatments except for ProAxis and Warrior performed well in this trial, significantly reducing both the number of live larvae per plot and the amount of damaged fruit at harvest. No significant differences were seen between Entrust and Success, or the different rates of Intrepid. ProAxis and Warrior, which are pyrethroid class insecticides and very similar to each other, did not provide adequate control of beet armyworm, and had similar fruit damage ratings as the untreated control.

ACKNOWLEDGEMENTS

Thanks to Bob Giampaoli with Live Oak Farms and Dr. Jim Mueller with Dow AgroScience for their help and cooperation with this test.

Typical fruit damage found to tomato fruitworm (top) and beet armyworm (bottom).

Table 1. Live Lepidoptera larvae counts after treatment application and damaged fruit.
Tomato worm control evaluation, Merced County 2003.

	transformed data/plot (sqrt)									10/30/03	
	9/23/03			10/3/03			10/10/03			fruit damage	fruit damage
Treatment	Lep #	% control	Ben #	Lep #	% control	Ben #	Lep #	% control	Ben #	arcsin (%)	% of UTC
1 UTC	14.57	0.0	8.51	10.55	0.0	2.33	8.79	0.0	3.14	13.61	99.98
2 Entrust 1.5 oz/A	5.77	60.4	5.33	2.71	74.3	1.82	1.45	83.5	4.01	2.49	18.32
3 Success 4.5 fl oz/A	4.17	71.4	6.61	1.29	87.8	1.66	0.71	92.0	2.94	5.96	43.80
4 Intrepid 4.0 fl oz/A	6.77	53.5	5.53	2.56	75.7	1.82	1.29	85.4	3.66	4.67	34.28
5 Intrepid 8.0 fl oz/A	8.22	43.6	6.31	2.82	73.2	1.45	0.71	92.0	4.39	6.35	46.67
6 Intrepid 12.0 fl oz/A	7.62	47.7	5.64	2.49	76.4	1.87	0.71	92.0	2.45	6.81	50.06
7 Pro Axis 3.8 fl oz/A	8.95	38.5	5.63	7.71	26.9	2.54	6.65	24.3	3.28	12.97	95.32
8 Warrior 3.8 fl oz	6.56	55.0	4.73	6.84	35.1	2.40	8.41	4.3	2.61	12.32	90.56
9 Avaunt 3.2 oz	5.63	61.3	5.66	3.88	63.3	2.45	1.45	83.5	3.56	4.07	29.87
10 Proclaim 2.4 oz	7.05	51.6	5.01	1.71	83.8	2.40	0.71	92.0	2.54	6.34	46.56
11 Dipel 1 lb	10.04	31.1	5.22	3.59	65.9	3.21	2.77	68.5	3.40	7.40	54.34
Average	7.76	51.41	5.84	4.19	66.25	2.18	3.06	71.74	3.27	7.54	55.43
LSD 0.05	4.9	33.4	NS	3.9	36.7	NS	3	34.4	NS	6.2	45.2
MSD 0.05	8.3	56.8	----	6.6	62.4	----	5.2	58.7	----	10.5	----
CV, %	44	49	25	64	42	68	69	36	36	57	57

Lep = live lepidoptera larvae per plot based on shake samples (square root transformation).

% control = percent control of larvae for treatment as compared to untreated plot.

Ben = live beneficial insects based on shake samples (predominantly minute pirate bug).

Fruit damage = mature fruit damaged from larvae, % (arcsin transformation) and as a percent of the untreated control (UTC).

LSD 0.05 = Least Significant Difference at the 95% confidence level. Means separated by less than this amount are not significantly different.
Data were transformed to assure homogeniety of variances.

MSD 0.05 = minimum significant difference used in the Tukey's means comparison test, more conservative than LSD.

CV = coefficient of variation, a measure of the variability in the experiment.

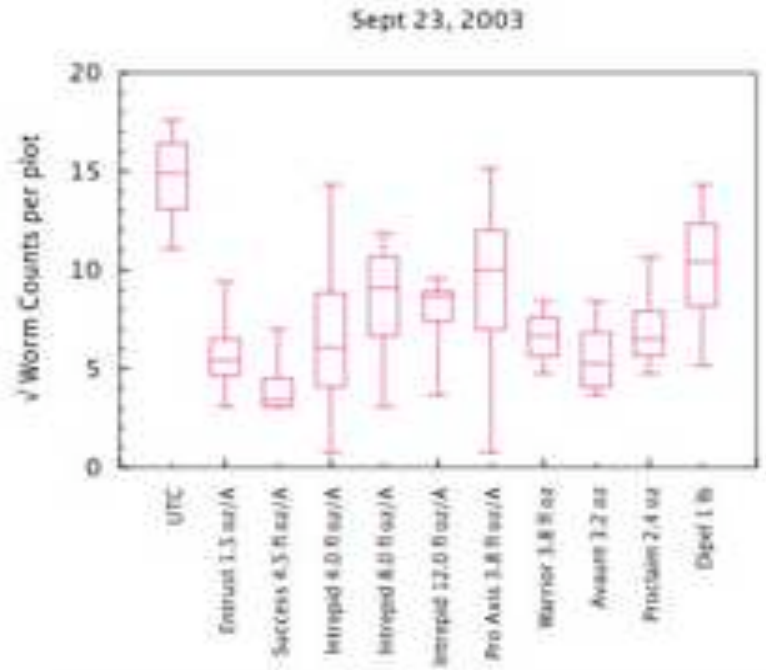


Figure 1. Number of live larvae per plot 1 week after treatment application. Counts were adjusted using the square root transformation.

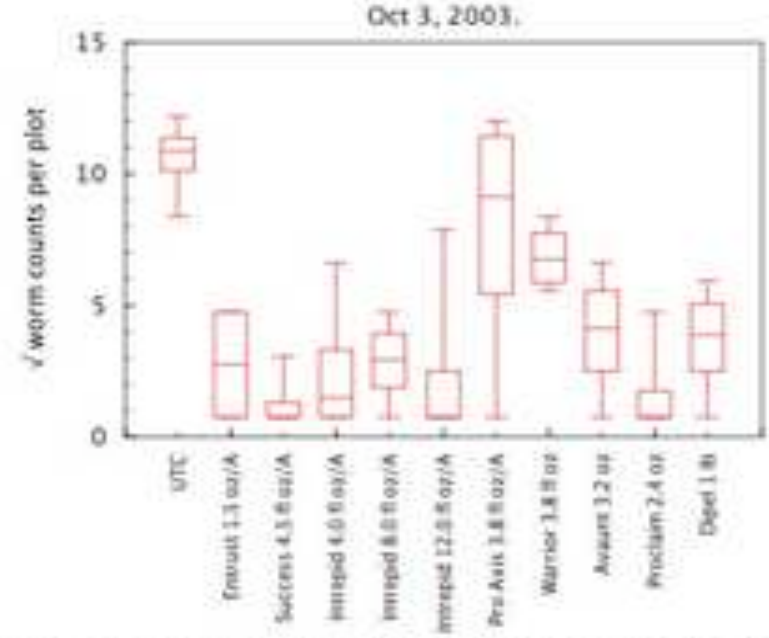


Figure 2. Number of live larvae per plot 2 weeks after treatment application. Counts were adjusted using the square root transformation.

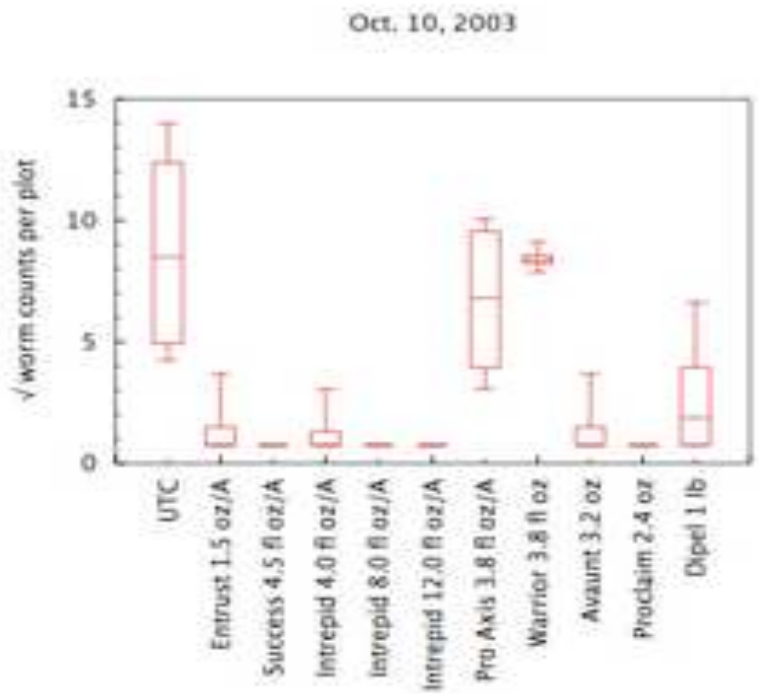


Figure 3. Worm counts per plot 3 weeks after applying treatments. Counts were adjusted by taking their square root.

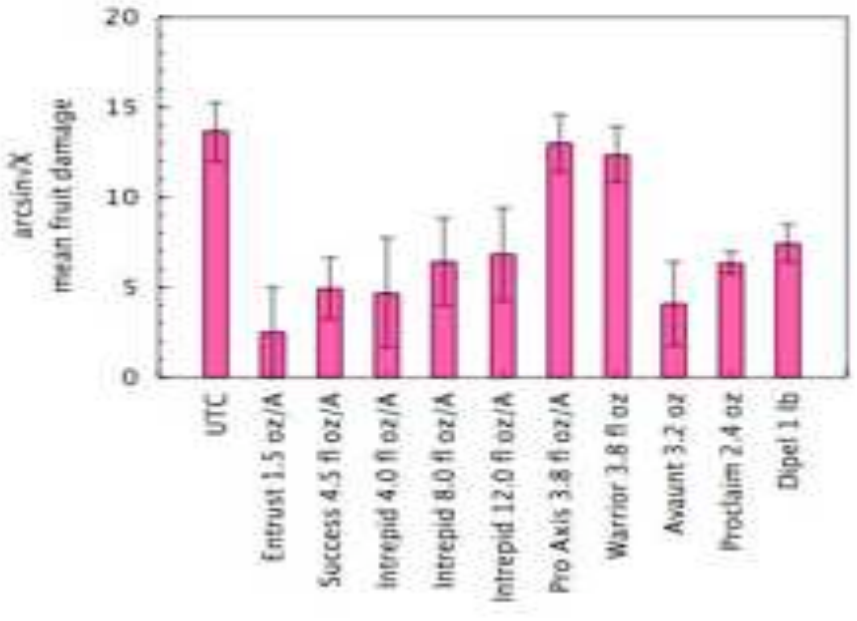


Figure 4. Tomato fruit damage for the various treatments. Worm control trial in freshm market tomatoes, 2003. Data were transformed using the arcsin transfomation. Error bars are +/- one SEM.