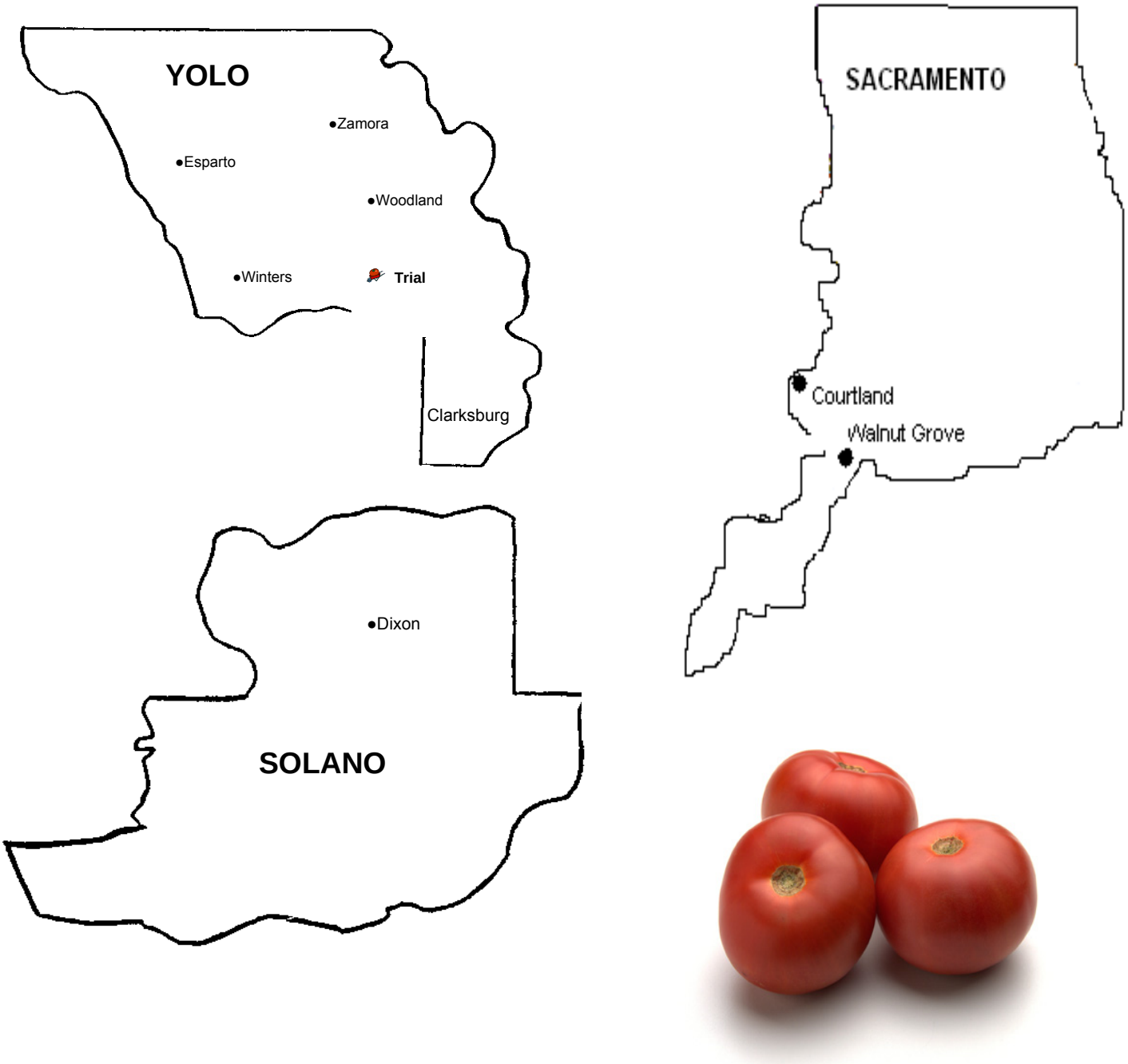
2009 Processing Tomato Variety Trials



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Statewide compile variety report is located on the Internet at:
http://vric.ucdavis.edu/

Local report is also electronically available at UCCE Yolo web site**:**

http://ceyolo.ucdavis.edu/Vegetable_Crops/PROCESSING_TOMATO_VARIETY_TRIALS.htm

2009 Processing Tomato Variety Evaluation Trials
Yolo/Solano/Sacramento Counties

by

Gene Miyao, UC Farm Advisor, and Mark Kochi, Field Assistant, Yolo County

Canning tomato production in 2009 reached a statewide record high of over 13.3 million tons. Environmental conditions with moderate temperatures during the spring and early summer favored good fruit set. Our relatively dry soil conditions helped reduce soil compaction from tillage. Drip irrigation use in the Sacramento Valley may well be approaching over a third of the tomato acreage- a practice further enhancing yields and gaining in popularity.

From Woodland weather station records, we had few 100°F plus days: 2 in mid May, 2 in late June, 8 in July including a string of 6 days, 3 in August, and 6 in September. Rainfall was moderate but extended over many months: 1.4" in January, 5.82" in February, 2.03" in March, 1.04" in April, 0.70" in May and 0.28" in June. The harvest period was dry until a mid September rain with 0.26". A major storm occurred in mid-October with over 3.5" falling while skies were overcast and soils remained wet over a weeklong period.

We continued to have tomato powdery mildew infestations in our area. The incidence generally began late and with varying levels of severity.

Tomato spotted wilt virus was once again widespread, but without substantial crop loss across the vast majority of fields.

The spread of Fusarium wilt continues. Verticillium wilt remains an issue. Root knot nematode damage was more prevalent in a number of fields.

Variety Evaluation Trials

Evaluation of varieties for local adaptation continued to be a part of the University of California farm advisor program. Our objective was to identify dependable, high yielding and high quality variety releases that can be grown over a wide geographic area under varying environmental conditions. The varieties were compared side-by-side in an experimentally sound designed test within local counties in the Central Valley from Yolo to Kern. Tests were conducted in a similar fashion to compare local results with tests by UC farm advisors in other locations. This year, all trials were conducted in fields with buried drip irrigation systems.

Entries:

Varieties were selected in consultation with processors and seed companies.

Sixteen replicated and 15 observational varieties were included in the field trial (table 1A). The comparative standard varieties were AB 2, H 9780, H 2601 and Sun 6366. All mid entries except AB 2 and HT 1056 have nematode resistance; and most varieties have bacterial speck resistance, while several varieties have resistance to tomato spotted wilt (Table 1B). One variety has resistance to tomato yellow leaf curl virus (which is currently not an identified local problem).

Included in the test was a continued evaluation of double plants per plug vs. the conventional single plant per plug. The varieties included AB 2 and Sun 6366. All other varieties in this test were planted as single plants per plug.

Locations:

Our local trial was north of Davis with J.H. Meek and Sons.

Other UC tests were conducted by farm advisors representing San Joaquin, Stanislaus, Merced, Fresno and Kern counties.

Methods:

The trial was established from commercially grown greenhouse transplants. Plants were pulled from trays, counted, bundled and bagged ahead of the field planting. The grower's equipment and crew mechanically set the transplants. Skips were filled within a day of the planting. The few transplants that did not survive were replaced over a 2-week period.

The transplants were grown on twin lines, a foot apart from each other, centered on a 5' bed. All plots were 100' long. A short alley separated each replicate block.

All cultural practices in the ~1 acre experimental site was those of the cooperating grower and matched management of the remaining larger area of the commercial tomato field.

A field meeting was held at the site as fruit ripened to provide an opportunity to examine the performance of the varieties in side-by-side comparative viewing.

To measure yield, fruit from the entire plot were harvested into special weigh trailers using the grower's harvesting equipment and crew. A 5-gallon volumetric sample of non-sorted fruit was collected from the mechanical harvester to evaluate fruit defects. Fruit was sampled along the length of the plot. These fruit were graded into categories of marketable red, pink, green, sun-damage, mold and blossom end rot and measured by weight.

From the marketable reds, an ~7 pound sample from each plot was bagged and delivered to a local inspection station of the Processing Tomato Advisory Board. Color, °Brix (soluble solids) and pH were determined by PTAB with a procedure consistent with commercial grading. Additionally, similar samples were hand picked by the Diane Barrett Lab from the UC Davis Food Science and Technology Department to evaluate processing quality.

Statistical analysis of variance methods were used to help interpret the replicated data. Conclusions derived from non-replicated data should be viewed with much less confidence.

MID-MATURITY EVALUATION (TRANSPLANTED & DRIP IRRIGATED)

Our local mid-maturity variety trial evaluation was transplanted with J.H. Meek and Sons north of Davis on a class 2, Capay silty clay soil. Seedling plugs were mechanically transplanted on April 24th in double lines per bed (Table 2). Seedbed condition was very good. The field was irrigated with a new, buried drip system. Vine growth was robust and required vine training. Verticillium wilt was prevalent while powdery mildew incidence was low. Harvest on August 28 appeared optimal for fruit conditions.

REPLICATED ENTRIES

Table 4A mid replicated— yield, fruit quality and culls: Four of the varieties were in the top yield category led by HyPeel 849 with 79.2 tons per acre, but included AB 2, PX 002 and CXD 255 (all above 75 tons).

Brix level was moderate, averaging 5.1. The highest Brix group was led by HM 6898 with 5.9, but included H 2601, the pear-shape variety, and H 9780 each with 5.4 and PX 650 at 5.3 Brix.

H 4007 had the best color with 21.8, but included 8 others in the statistically significant same group.

Fruit pH was lowest with H 8504 at 4.27, but included H 9780 at 4.32 and HM 6898 at 4.33 in the statistically same group. Fruit pH was elevated with HMX 7885 at 4.57.

The level of pink, green and sunburn fruit were low to moderate with a maximum of 4% in any one category. Blossom end rot (BER) levels were surprisingly high. Many varieties had BER levels above 5% with HMX 7885 at 18%. The blossom end rot was noticeable during the season, but we didn't anticipate levels to be as high as measured at harvest. This BER result would not be expected given the mild summer season as well as the high tonnage and relatively moderate Brix levels (66.5 tons/acre with 5.1 Brix average).

We also compared double plants per plug to the standard target of a single plant in a transplant plug. AB 2 yielded more as a single plant in the plug (77.8 vs. 73.1 tons/acre, respectively). Sun 6366 was higher yielding as a double, but not statistically significantly better. Single plants had slightly better pH (4.40 vs. 4.44). Double plants were earlier (1% vs. 3% pink fruit), and overall with slightly smaller fruit (0.5 lbs less in a batch of 50 fruit).

Table 4B mid replicated— vine size, canopy cover and estimated maturity: The larger-vine varieties in this test were AB 2, Nun 6390, Sun 6366 and included many others. HMX 6903 was one of the smallest-vine varieties at 83% row-width cover as a double line planting. Overall vine size was moderately large in the trial.

Fruit canopy cover was evaluated shortly before harvest. In this visual assessment, a fruit canopy cover of 80% or more is desirable, while levels below 50% are usually problematic for fruit protection from sun damage. Canopy was poorest with HM 6898 at 68%, but also in that low group were HMX 6903, HMX 783 and HMX 7885. Canopy cover was best with HyPeel 849, PX 002, PX 650, AB 2 and CXD 255, all with 88% or higher.

An assessment of Verticillium wilt affected plants (%) was visually assessed during the fruit-sizing period. The varieties with the least percentage of symptomatic plants were AB 2, Sun 6366, CXD 255, HyPeel 849, PX 002, AB 3, Nun 6390 and included H 4007 and H 8504. A number of varieties had levels above 40%.

A visual estimate of days to harvest was assessed and compared to the standard AB 2. HMX 6903 and HM 6898 appeared to be several days earlier maturing than AB 2. The later maturing varieties in our test appeared to be H 9780 and CXD 255, about 5 to 6 days later maturing than AB 2.

NON-REPLICATED ENTRIES

Table 5A: mid observational: The highest yielding non-replicated variety was DRI 0309 with 73.4 tons per acre. Yields were generally high in the non-replicated entries. The exception was HT 1059 which produced fair tonnage (although lowest in the non-replicated trial at 53 tons per acre), but with very poor vine health.

Several varieties had high Brix at 5.7° which included Nun 6394, BOS 8800 and BQ 163. Color ranged from 22 to 25 amongst the varieties. The best color was associated with varieties UG 19406, CXD 282 and BQ 163. Acid levels as measured by pH was generally high, but lowest with UG 19406 at 4.23.

Table 5B mid observational— vine size, canopy, and estimated maturity: Vine size tended to be large, covering 90% or more of the row width, across all varieties. Fruit canopy cover was good overall except for HT 1059. The varieties that were exceptionally healthy with low vine necrosis were BQ 163, CXD 282 and UG 19406. Maturity ranged from 3 days earlier to 7 days later than AB 2.

UC STATEWIDE VARIETY REPORT: Statewide compiled variety report with other UC advisor tests is posted at UC Vegetable Research and Information Center at:

http://vric.ucdavis.edu/

Table 1A. Mid-Maturity Varieties, 2009 UC Processing Tomato Variety Trial, JH Meek and Sons.

	Company	16 replicated		15 observational	
1	Campbell Soup	CXD 255	VFFNP	CXD 269	VFFNP
				CXD 282	VFFF3NP
2	DeRuiter	**AB 2**	VFFP	DRI 0309	VFFNP SW
		AB 3 (DRI 0303)	VFFNP		
3	Harris Moran	HMX 6898	VFFNP		
		HM 6903	VFFNP		
		HM 7883	VF NP		
		HMX 7885	VFFNP		
4	HyTec Seeds			HT 1059	VF TYLCV
5	Heinz	**H 2601**	VFFNP	H 5508	VFFN SW
		H 4007	VFFNP	H 5608	VFFNP SW
		H 8504	VFFNP		
		H 9780	VFFNP		
7	Nunhems	Nun 6390	VFFNP	Nun 6385	VFFNP SW
		Nun 6366	VFFNP	Nun 6393	VFFN
				Nun 6394	VFFNP SW
8	Orsetti			BOS 8800	VFFN
9	Seminis	PX 002	VFFN SW		
		PX 650	VFFNP		
		HyPeel 849	VFFNP		
10	United Genetics			UG 4305	VFFN
				UG 19406	VFFNP
11	WoodBridge			BQ 163	VFFNP
				BQ 172	VFFNP
				BQ 205	VFFNP

Bold = trial standards

*** Check with seed company to confirm disease resistance.**

Table 1B. Disease Code Legend.

Code: Disease Resistance*	
V	= VERTICILLIUM WILT RESISTANT
F	= RACE 1 FUSARIUM WILT RESISTANT
FF	= RACE 1 AND 2 FUSARIUM WILT RESISTANT
FFF_3	= RACE 1, 2 AND 3 FUSARIUM WILT RESISTANT
N	= ROOT KNOT NEMATODE RESISTANT (SOME SPECIES)
P	= BACTERIAL SPECK RESISTANT (RACE 0)
TYLC	= TOMATO YELLOW LEAF CURL VIRUS
SW	= SPOTTED WILT VIRUS

*** Check with seed company to confirm disease resistance.**

Table 2. Plot Specifications, Transplant, Mid-Maturity, Davis, 2009

Cooperator:	Steve Meek and John Pon, J.H. Meek and Sons, Woodland
Location:	~1 mile south of CR 29, adjacent to east side of CR 99. SW ¼ of SW ¼, section 32, T 9N, R 2E, MDM SCS map #60.
Field Variety:	HyPeel 849, double lines on 5'-centered beds.
Plot Design:	Randomized complete block with 4 reps. Non-replicated plots adjacent to 1st rep. All individual plots 500 square feet (100' x 5')
Greenhouse:	Westside Transplants, Winters in #338 trays for replicated and #392 trays for observational entries
Planting Date:	24 April as transplants
Population:	~8700 plugs per acre.
Fertilizers:	5-25-26 @ 100 lbs/A 10-34-0 plus zinc 3-13-18 at planting with transplants 28-0-0 plus 5 S @ 155 lbs N/acre KTS (potassium thiosulfate) CAN 17
Field Meeting:	21 August
Fruit Quality Sample:	24 August, Food Science; 28 August, PTAB
Harvest	28 August (126 days after transplanting)
Soil type:	Capay silty clay, class 2, Storie Index 50 21% sand, 40% silt, 39% clay in top foot.
Soil Sample	June O-1 foot depth

pH	7.5
NO_3-N (ppm)	12
P (ppm)	14.7
K exchangeable (ppm)	261
Na exchangeable (meq/100 g)	0.89
Ca exchangeable (meq/100 g)	10.9
Mg exchangeable (meq/100 g)	15.0

Previous Crop:	corn
Irrigation method:	buried, drip irrigation
General Notes:	Transplants established and grew well. Verticillium wilt was prevalent. Low incidence of powdery mildew. Very high tonnage. Timely harvest for the trial. First tomato crop in rotation over several decades.

Table 3. Fruit Quality Factor Definitions

SOLUBLE SOLIDS OR °BRIX	A measure of mostly fruit sugars. Soluble solids are directly related to finished processed product yield of pastes and sauces. Soluble solids are estimated with a refractometer, and measured as °Brix.
pH	A measure of acidity. A level below 4.35 is desirable to prevent bacterial spoilage of finished product. pH rises as fruit matures.
COLOR	Measured with a Processing Tomato Advisory Board LED instrument simulating Agtron. Lower numbers correspond to better red fruit color.

FIELD SAMPLING PROCEDURE

Fruit quality determinations were obtained by collecting ~7 pound sample of ripe, non-defect fruit from each plot. A local grade station of the Processing Tomato Advisory Board evaluated our fruit samples for soluble solids (Brix), color and pH.

To determine finished product thickness, additional samples were collected by Sam Matoba and crew and evaluated in the Diane Barrett lab at the UC Davis Food Science and Technology Department as part of a California League of Food Processors-funded project. Two blocks of replicated varieties and all non-replicated plots were evaluated. °Brix, pH, titratable acidity (reported as percent citric acid), and juice Bostwick were the factors measured. The results of the Food Science project are in a separate report.

Fruit defects in the field were estimated by collecting ~5 gallons of unsorted fruit from the mechanical harvester. Fruit were separated into marketable red, pink, green, sun-damaged, mold and blossom end rot categories. Measurements were on a weight basis and reported as percent.

Table 4A. Davis, Replicated, Mid-Maturity: Yield, fruit quality and defects from processing tomato variety trial (transplant), JH Meek and Sons, 2009

	Replicated Variety	Yield tons/A		Brix	PTAB color	pH	% pink	% green	% sun burn	% mold	% BER	lbs. per 50 fruit	% stems
1	HyPeel 849	79.2	a	5.0	24.3	4.43	2	2	2	2	5	7.7	0.0
2	AB 2	77.8	a	4.9	24.3	4.34	3	3	2	3	3	8.0	0.0
3	PX 002	77.2	ab	4.8	23.5	4.45	1	0	2	4	5	8.1	0.5
4	CXD 255	76.5	abc	5.1	24.5	4.38	2	1	4	1	10	7.1	0.5
5	Sun 6366 doubles	73.2	bcd	4.7	23.5	4.47	1	1	4	3	7	6.3	0.0
6	AB 2 doubles	73.1	bcd	5.4	24.3	4.41	0	2	3	1	3	7.0	0.0
7	AB 3	72.5	cde	4.9	24.3	4.41	1	1	4	3	3	6.9	1.0
8	PX 650	70.4	de	5.3	24.8	4.43	2	1	4	1	2	7.7	0.0
9	Sun 6366	69.7	de	5.1	23.0	4.45	4	1	3	4	5	6.7	0.0
10	Nun 6390	68.2	ef	5.0	25.3	4.42	1	1	3	1	2	7.3	0.5
11	H 4007	65.4	fg	4.8	21.8	4.47	1	0	2	1	1	6.3	1.5
12	HMX 7883	63.7	gh	5.3	22.8	4.50	1	0	1	1	3	5.5	0.0
13	H 8504	63.3	gh	5.2	24.3	4.27	2	3	3	1	9	5.9	0.0
14	H 9780	60.1	hi	5.4	23.3	4.32	2	1	1	0	4	6.5	1.5
15	HMX 7885	57.5	ij	5.2	22.4	4.57	0	2	3	1	18	5.9	0.7
16	HM 6898	53.5	jk	5.9	22.5	4.33	0	1	3	2	4	6.5	7.0
17	H 2601	52.1	k	5.4	24.0	4.43	1	2	3	2	8	5.7	0.0
18	HMX 6903	42.7	l	4.9	23.5	4.44	1	2	6	4	12	7.4	0.0
	LSD 5%	4.4		0.58	1.9	0.06	NS	NS	NS	2.2	5.4	1.2	NS
	% CV	5		8	6	1	155	76	79	83	65	12	358
	average	66.5		5.1	23.7	4.02	1.3	1.3	2.9	1.9	5.8	6.8	0.7
Class Comparisons													
	Single plant vs.	73.8		5.0	23.6	4.40	3.1	1.8	2.5	3.0	4.2	7.3	0.0
	vs. Double plants	73.2		5.1	23.9	4.44	0.7	1.5	3.6	2.2	5.0	6.7	0.0
	probability	NS		NS	NS	0.04	0.01	NS	NS	NS	NS	0.11	-
	F value	0.2		0.1	0.1	4.6	6.4	0.5	1.0	1.1	0.2	2.7	-

Major Points:

- ✓ Very high yields, overall
- ✓ Brix levels maintained fairly well
- ✓ Low levels of pink/green, sunburn, and mold
- ✓ Blossom end rot high with several varieties
- ✓ High stem retention on HM 6898.
- ✓ Two plants per plug did not improve yield over single plants (AB 2 & Sun 6366).

Table 4B. Davis, Replicated, Mid-Maturity: stand, vine size, canopy cover and fruit maturity notes (transplant), JH Meek and Sons, 2009.

	Replicated Variety	Stand (plugs per 100')	canopy necrosis (%)	vine size (% cover)	% fruit canopy cover	visual symptoms Vert wilt (%)	estimated maturity (days to AB 2)
1	AB 2	99	18	100	88	7	0.0
2	AB 3	101	19	95	80	9	0.5
3	CXD 255	100	7	95	88	7	6.3
4	HyPeel 849	100	7	93	90	7	1.5
5	H 2601	99	18	90	80	40	0.0
6	H 4007	100	16	93	78	17	1.5
7	H 8504	102	18	95	83	17	1.5
8	H 9780	102	28	95	80	40	5.0
9	HM 6898	100	35	90	68	65	-2.3
10	HMX 6903	99	35	83	70	55	-3.3
11	HMX 7883	102	43	95	70	40	0.8
12	HMX 7885	99	35	97	71	42	1.2
13	Nun 6390	101	32	100	83	7	2.0
14	PX 002	100	5	98	90	9	2.3
15	PX 650	101	10	93	88	26	2.8
16	Sun 6366	102	35	100	83	11	-0.8
17	AB 2 doubles	102	18	98	90	7	1.5
18	Sun 6366 doubles	100	25	100	85	7	0.8
	LSD 5%	NS	12.5	6.7	7.2	11.9	2.1
	% CV	2	39	5	6	36	6
	average	100	22	95	81	23	1.2
Group comparisons:							
	singles vs.	100	14	96	87	10	1.0
	dbl plants/plug	101	26	99	86	8	0.5
	probability	NS	NS	NS	NS	NS	0.05
	F value	0.1	1.4	0.3	1.0	0.2	4.2

Table 5A. Davis, Non-Replicated, Mid-Maturity: Yield, fruit quality and defects, JH Meek and Sons, 2009.

	Observational variety	Yield tons/A	°Brix	PTAB color	pH	% pink	% green	% sun burn	% mold	% BER	lbs./ 50 fruit	% stems
1	DRI 0309 TSW	73.4	5.1	24	4.36	0	0	0	2	3	7.35	0
2	Nun 6394 TSW	71.6	5.7	23	4.46	0	1	4	2	1	6.55	0
3	Nun 6385 TSW	71.5	5.1	23	4.43	6	3	3	1	9	5.70	0
4	H 5608 TSW	70.4	4.8	25	4.37	1	2	2	1	3	6.85	2
5	UG 19406	69.6	5.4	22	4.23	3	0	0	0	0	6.85	0
6	BQ 205	69.4	4.5	24	4.35	1	1	2	3	4	6.25	0
7	CXD 282	68.9	4.7	22	4.44	4	1	1	0	6	6.55	0
8	H 5508 TSW	65.1	4.6	23	4.32	0	2	3	0	5	4.85	0
9	Nun 6393	65.0	5.1	23	4.46	1	1	6	1	5	5.90	2
10	UG 4305	63.6	5.4	24	4.47	0	1	1	5	1	6.00	0
11	CXD 269	63.6	5.4	23	4.40	2	2	2	1	2	8.30	0
12	BOS 8800	63.0	5.7	23	4.55	1	2	2	7	2	8.40	0
13	BQ 163	62.6	5.7	22	4.36	0	1	3	0	0	6.85	0
14	BQ 172	60.3	5.5	23	4.56	1	3	3	2	4	7.40	2
15	HT 1059	52.7	4.7	23	4.51	0	0	20	10	0	4.60	6
	average	66.0	5.2	23.1	4.42	1.4	1.4	3.5	2.5	2.9	6.6	0.8

*Data is **non-replicated** and should be viewed with much less confidence than replicated tests.*

Table 5B Davis, Non-Replicated, Mid-Maturity: Stand, vine size, canopy cover, and fruit maturity notes, transplants, JH Meek and Sons, 2009.

	Observational Variety	Stand (plugs per 100')	canopy necrosis (%)	vine size (% cover)	% fruit canopy cover	visual symptoms Vert wilt (% severity)	estimated maturity (days to AB 2)
1	BOS 8800	105	10	100	90	7	7
2	BQ 163	102	3	90	90	7	2
3	BQ 172	100	10	100	80	15	2
4	BQ 205	100	10	100	90	7	5
5	CXD 269	100	21	100	90	30	5
6	CXD 282	102	3	90	80	15	5
7	DRI 0309 TSW	101	10	90	80	15	-1
8	H 5508 TSW	99	35	90	70	30	4
9	H 5608 TSW	103	35	90	80	30	3
10	HT 1059	99	97	90	30	7	-3
11	Nun 6385 TSW	101	10	100	90	50	0
12	Nun 6393	102	35	100	70	15	-2
13	Nun 6394 TSW	99	35	100	80	30	1
14	UG 19406	98	3	100	90	7	0
15	UG 4305	100	21	90	80	30	1
	average	101	23	95	79	20	2

*Data is **non-replicated** and should be viewed with much less confidence than replicated tests.*