University of California Cooperative Extension, Yolo County
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TOMATO INFO

Vine Decline
Meeting: Jan 9, Thursday
Variety Trials
Fusarium wilt

'Vine Decline' disorder was a focus of nine recent, local field studies. Symptoms of leaf necrosis and vine collapse become evident at the early fruit ripening growth stage of tomatoes. Longer crop rotations between tomato plantings may be helpful. As acres of almonds and walnuts increase, the land remaining available for tomatoes may further limit the options.

In an effort with UCD Plant Pathologists Mike Davis and new faculty member, Johan Leveau, field tests with cooperating growers were established in which various materials were injected into their buried drip irrigation systems. Over the last three years, biological materials and conventional fungicides were tested. Other treatments included preplant chemigation with metham alone or followed with a biological. We also spread tons of well-composted poultry manure concentrated on the bed top ahead of springtime shallow tillage.

Disease levels (Verticillium wilt, Fusarium wilt, Fusarium crown and root rot, and corky root) were monitored and were not very affected by the treatments.

We have observed increased yield with composted manure including last year (Table A). Not all fields have responded. We are exploring various methods of timing and placement of the manure in our 2014 tests. Additionally, we have some evidence the response may be associated with potassium. Several of the responding fields had soil K levels below 170 ppm by an ammonium acetate lab-extraction method <u>and</u> K composed 2% or less of the cation exchange capacity (CEC). Our recent tests included manufactured NPK treatments. We hope to refine the expected response to manure and clarify if the response is strongly linked to K.

Table A. Effects of chemigation and surface-applied manure on yield, culls and fruit quality of processing tomatoes, J.H. Meek and Sons, Woodland, 2013.

	treatment	15-Aug yield tons		Brix	7-Aug necrosis
1	Manure 10 tons	71.2	a	5.1	28
2	nutrients (compost mimic)	68.0	a	5.0	18
3	manure 5 tons	64.3	b	5.0	25
4	nutrients luxury	61.9	bc	5.4	13
5	vermicompost	60.4	cd	4.8	32
6	Regalia @ 1 gpa	58.2	d	4.9	39
7	JH BioTech Promot	57.8	d	5.1	39
8	LH Organics Soil Sytem 1	57.4	d	4.9	39
9	Non treated	57.0	d	4.8	39
	LSD@5% (*probability*)	3.5		0.3	12.9
	% CV	4		4	29

Our grower cooperators over the years have included Steve and Sam Meek along with John Pon, Dustin Timothy & Timothy-Vigue Farming, Blake Harlan, Payne Farms, Don Beeman and Salvador Duenas, and Joe Yeung Farms. Tremont Group provided potassium supplies. UCD Russell Ranch and Greenbelt Carriers supplied composted manure. Financial support has been continuously provided by the California Tomato Research Institute.

South Sacramento Valley Processing Tomato Production Meeting

University of California Cooperative Extension Farm Advisors
Colusa/Sutter/Yuba and Yolo/Solano/Sacramento Counties

Woodland Community Center

2001 East Street, Woodland 95776
From Highway113, exit on CR 25A, head west to East St. Right turn on East St. for ~1 mile)

8 am to noon, Thursday, January 9, 2014

7:30-	Doors will open — Coffee and refreshments will be ready
8:00 am	1) *Evaluation of tomato plant health with composted manure & chemigations* 2) *Fusarium wilt evaluations* Gene Miyao, UC Farm Advisor, Yolo/Solano/Sacramento counties
8:20	*Managing pocket gopher and vole populations* Roger Baldwin, Wildlife Specialist, UC Davis
8:40	*Variety Update:* Scott Sullivan & Lance Stevens, Ag-Seeds Unlimited
9:00	*Variety Update*: Scott Picanso & Luke Slevkoff, T, S & L.
9:20	*Local Pesticide Regulation Update*: Yolo County Ag Commission's office
9:40	——————— Short Break———————————
10:00	*Field Bindweed Control Review*: Lynn Sosnoskie, Project Scientist, UCD
10:20	*Pest management research in Fresno County* Tom Turini, UC Farm Advisor, Fresno County
10:40	*Nematicidal control update:* Joe Nunez, UC Farm Advisor, Kern County
11:00	*Nitrogen management update under drip irrigation*: Martin Burger, research manager, Russell Ranch, UC Davis
11:20	*Awareness of Brown Marmorated Stink Bug,* Dick Hoenisch, National Plant Diagnostic Network, UCD
11:40	*Tomato spotted wilt virus & Curly top management update:* Bob Gilbertson, Plant Pathology Dept., UC Davis
12:10 noon	**end**

Hall Rental and Refreshments Courtesy of:

Dow AgroSciences (Jill LeVake)
Syngenta (Derrick Hammonds)
Bayer (Bob Austin)
Valent USA (JR Gallagher)
BASF (Dawn Brunmeier)
DuPont (Tim Gallagher)
FMC (LeAnne Becker)
Gowan (James Brazzle)
Farm Credit West (Anna Fricke)

Meeting is open to any interested party. Meeting facility is handicap accessible.

PCA Credit hrs: 0.5 laws & 3.0 other
Meeting Code M-0111-14
CCA hrs: 0.5 nutrient, 0.5 crop & 2.5 IPM

VARIETY TRIAL REPORT

The UC statewide tomato variety trial program began in 1973 with a goal of standardizing fruit quality analysis from UC field trials. Former UC farm advisors Mel Zobel, Ray King and Don May from Yolo, San Joaquin and Fresno counties, respectively, together with UCD breeder-geneticist Allen Stevens established the uniform processing tomato variety evaluation program and the UCD fruit quality lab. Initial funding support was provided by growers through the predecessor of the California Tomato Research Institute. The program operated for 41 years.

In recent years, our UC tomato team conducted 6 to 8 variety trials annually. While seed suppliers and processors efforts are considerable, the seed retailers Ag Seeds Unlimited and Timothy, Stewart & Lekos developed dedicated, ambitious and detailed variety evaluation programs each surpassing 100 trials annually across the Central Valley. Early in my UC career I sought advice from UC-retired, pioneering breeder Jack Hanna. He told me 'it takes years of trialing before one begins to understand a particular variety's strengths and vulnerabilities.' The industry often doesn't have the luxury of a long timespan to make informed variety decisions. Exposing the prospective varieties to a high number of field settings in small scale tests to cover a range of environmental conditions is key to more accurately assess the 'strengths and weaknesses' of the genetic material. Our UC group is not positioned to expand to the high number of tests needed to develop a stronger variety evaluation program.

The time has come to step aside to the skillful program of variety evaluations that the private sector is providing for the industry and for growers. There is plenty of work for UC advisors. We're simply redirecting our research effort.

For growers, because variety yield performance is sensitive to environmental influence, the final test is on your own ranch. The variety evaluation by others is simply a guide. Tables 1-3 are a summary of results of the 2013 UC variety evaluations. The complete report is located at: http://ceyolo.ucanr.edu/Vegetable_Crops/Processing_Tomato_Variety_Trials/

Table 1. Combined analysis from 5 replicated, processing tomato trials, UC Farm Advisors, 2013.

Variety	plots (#)	Yield (tons/acre)		rank	Soluble solids (°Brix)		rank	Color		rank	pH		rank
HM 1892	19	62.5	a	(1)	5.4	de	(5)	22.8	de	(10)	4.41	de	(7)
H 1175	19	60.2	ab	(2)	4.9	g	(9)	21.4	ab	(2)	4.48	g	(12)
H 5608	19	59.5	abc	(3)	5.1	fg	(7)	21.3	a	(1)	4.43	ef	(9)
N 6407	14	58.3	abcd	(4)	5.7	abc	(3)	24.2	f	(12)	4.34	bc	(4)
H 1161	19	57.0	bcde	(5)	5.9	a	(1)	23.1	e	(11)	4.33	ab	(3)
H 8504	19	56.5	bcde	(6)	5.0	g	(8)	22.3	bcde	(6)	4.29	a	(1)
N 6404	19	55.8	cde	(7)	5.6	bc	(4)	22.4	cde	(7)	4.42	de	(8)
N 6402	19	55.3	de	(8)	5.7	abc	(3)	22.0	abcd	(5)	4.44	efg	(10)
AB 0311	19	54.7	def	(9)	5.8	ab	(2)	21.9	abcd	(4)	4.35	bc	(5)
H 1170	19	54.3	def	(10)	5.6	cd	(4)	21.6	abc	(3)	4.38	cd	(6)
AB 2	19	53.6	efg	(11)	5.4	de	(5)	22.5	cde	(8)	4.35	bc	(5)
HM 1893	19	50.9	fg	(12)	5.3	ef	(6)	22.7	de	(9)	4.32	ab	(2)
SUN 6366	19	49.9	g	(13)	5.7	abc	(3)	21.3	a	(1)	4.47	fg	(11)
	Mean	56.0			5.5			22.2			4.39		
	CV=	11.4			6.5			6.8			1.5		
	LSD @ 0.05=	4.07			0.23			0.96			0.041		
	LSD @ 0.05=	4.74			0.26			1.12			0.048		
	to compare N 6407 with other varieties												

Table 2. Yield of replicated variety trials by location, UC Farm Advisors, 2013.

Variety	plots (#)	Yield 5 locations (tons/acre)		Colusa	San Joaquin	Stanislaus	Merced	Fresno
HM 1892	19	62.5	a	64.6	52.7	71.6	63.7	62.1
H 1175	19	60.2	ab	66.2	51.7	54.8	63.1	63.8
H 5608	19	59.5	abc	62.0	54.3	57.1	66.7	56.6
N 6407	14	58.3	abcd	60.4	51.7	66.9	55.6	---
H 1161	19	57.0	bcde	61.7	55.1	58.5	49.5	60.4
H 8504	19	56.5	bcde	60.7	45.1	62.6	53.7	62.0
N 6404	19	55.8	cde	53.4	50.9	56.3	65.2	53.5
N 6402	19	55.3	de	55.7	50.9	56.5	59.7	54.1
AB 0311	19	54.7	def	53.4	47.8	62.2	58.2	53.5
H 1170	19	54.3	def	54.7	39.4	58.1	59.5	60.8
AB 2	19	53.6	efg	45.8	48.2	58.0	68.0	49.2
HM 1893	19	50.9	fg	52.5	43.8	57.3	52.9	49.4
SUN 6366	19	49.9	g	45.4	43.5	53.2	51.6	56.5
	Mean	56.0		56.6	48.9	59.5	59.1	56.8
	CV=	11.4		9.3	8.4	10.7	14.9	9.1
	LSD @ 0.05=	4.07		7.51	5.87	10.72	12.58	7.44
	LSD @ 0.05= to compare N 6407 with other varieties	4.74						

Table 3. Combined average, non-replicated variety trials, UC Farm Advisors, 2013.

Variety	plots (#)	Yield (tons/acre)		rank	Soluble solids (°Brix)		rank	Color		rank	pH		rank
HMX 2897	5	57.7	a	(1)	5.3	fgh	(8)	21.2	ab	(3)	4.46	cd	(9)
H 1293	5	57.4	a	(2)	5.5	bcdefg	(6)	20.8	ab	(2)	4.50	def	(12)
N 6410	5	56.7	a	(3)	5.4	cdefgh	(7)	23.4	f	(12)	4.35	ab	(2)
UG 16609	5	53.4	ab	(4)	5.7	abcde	(4)	21.6	bcd	(5)	4.34	a	(1)
BQ 296	5	52.4	abc	(5)	5.8	abc	(3)	22.8	cdef	(9)	4.35	ab	(2)
N 6412	5	52.2	abc	(6)	5.6	abcdefg	(5)	21.2	ab	(3)	4.43	bcd	(7)
H 1285	5	51.6	abc	(7)	5.8	abcd	(3)	21.8	bcde	(6)	4.38	abc	(3)
H 1292	5	51.5	abc	(8)	5.5	bcdefg	(6)	20.0	a	(1)	4.56	f	(14)
C 322	5	51.5	abc	(8)	5.1	gh	(10)	21.4	abc	(4)	4.41	abc	(6)
HMX 2898	5	49.4	abc	(9)	6.0	a	(1)	23.2	ef	(11)	4.35	ab	(2)
BQ 313	5	49.2	abc	(10)	5.6	abcdef	(5)	21.6	bcd	(5)	4.49	def	(11)
HMX 3908	5	47.2	bc	(11)	5.0	h	(11)	21.6	bcd	(5)	4.40	abc	(5)
C 324	5	46.8	bc	(12)	5.3	efgh	(8)	21.8	bcde	(6)	4.45	cd	(8)
HMX 3907	5	44.9	bcd	(13)	5.2	fgh	(9)	21.2	ab	(3)	4.40	abc	(5)
BQ 295	5	44.8	cd	(14)	5.4	defgh	(7)	22.2	bcdef	(8)	4.47	cde	(10)
ISI 31060	5	44.7	cd	(15)	5.0	h	(11)	23.0	def	(10)	4.55	ef	(13)
IVF 5268	5	44.0	cd	(16)	5.6	abcdefg	(5)	21.6	bcd	(5)	4.39	abc	(4)
BQ 311	5	36.9	d	(17)	5.9	ab	(2)	22.0	bcdef	(7)	4.40	abc	(5)
	Mean	49.6			5.5			21.8			4.43		
	CV=	13.5			6.9			5.3			1.5		
	LSD @ 0.05=	8.45			0.48			1.47			0.086		

<u>Fusarium wilt variety trial evaluation:</u> In 2013, instead of participating in the standard variety trial with my UC colleagues, my focus was directed at assessing varieties when exposed to the soilborne pathogen Fusarium. My intent was to compare varieties in a field with a recent history of Fusarium crown and root rot. Instead, in one field, with a common set of 15 varieties, the primary pathogen was overwhelmingly Fusarium wilt, race 3. Infestation level was high when last measured 6 weeks prior to harvest after which vine necrosis escalated.

The race 3 resistant varieties (SV 0335TM and CXD 282) were in the highest yielding group as were several susceptible varieties (N 6407 and AB 311). Other varieties with reasonably low Fusarium infection level (H 2401, DRI 310 and AB 2) also yielded well. Several varieties (HM 7883, N 6404, BQ 268, N 6366 and others) performed poorly. *Tomato spotted wilt virus* was not a factor in this test.

<u>Bottom line</u>: In a highly infested field, Fusarium wilt resistant varieties are highly desirable. Clearly, there are differences in performance among the susceptible varieties in a Fusarium wilt race 3 infested field.

Table 4. Yield, fruit quality, and cull-out from August 30 harvest of tomato variety evaluation in Fusarium wilt, race 3 infested site, Don Beeman Farms, Woodland, 2013.

	Variety		Yield tons/A		°Brix	PTAB color	pH	% pink	% green	% sun burn	% rots	% canopy necrosis	# Fusarium wilt
1	N 6407	VFFNPtsw	55.1	a	4.43	26.0	4.52	2	2	8	4	69	16
2	SV 0335TM	VFFF3NPtsw	54.8	ab	5.00	22.5	4.43	2	3	2	9	10	2
3	CXD 282	VFFF3NP	54.6	ab	4.18	22.8	4.49	4	2	2	6	10	0
4	AB 311	VFFNPtsw	51.5	abc	4.75	22.0	4.41	2	3	2	6	46	13
5	H 2401	VFFNP	48.3	bcd	4.15	24.3	4.37	1	2	5	4	57	7
6	DRI 319	VFFNPtsw	48.0	cd	4.90	23.8	4.46	1	3	5	10	60	13
7	AB 2	VFFP	46.5	cd	4.58	23.8	4.42	0	3	4	5	39	8
8	H 1175	VFFN	46.0	cd	4.10	23.3	4.62	1	2	12	2	64	27
9	H 5608	VFFNPtsw	45.5	cd	4.23	22.3	4.53	1	2	8	4	60	22
10	H 8504	VFFNP	45.0	cd	4.20	25.8	4.39	2	3	12	3	68	18
11	HM 1892	VFFNP	42.2	de	4.68	23.8	4.54	1	2	11	6	76	23
12	N 6366	VFFNP	38.0	e	4.33	24.0	4.61	0	1	17	8	89	30
13	BQ 268	VFFNP	30.6	f	4.95	23.8	4.49	3	2	17	6	89	23
14	N 6404	VFFNPtsw	25.1	f	4.75	22.0	4.62	1	1	29	6	91	35
15	HM 7883	VFFNP	16.5	g	4.68	23.8	4.72	0	0	40	6	98	37
	LSD 0.05		6.5		1.42	1.42	0.07	2.2	NS	9.1	NS	21	11
	CV		11		4	4	1	106	61	55	54	24	41

The same 15 varieties were planted in the Woodland area two weeks later. The site was chosen after seeing the previous season's mixture of pest issues including Fusarium crown and root rot, some Fusarium and Verticillium wilt, Spotted wilt and powdery mildew. High temperature at transplanting was a challenge during stand establishment. Vine growth was limited. The high yielding group was led by HM 1892, which only included Harris Moran and Heinz varieties). None of the varieties averaged more than 30 tons per acre (Table 5). Note: yields were lowest around the selected trial area in the grower field.

Table 5. Yield, fruit quality, and cull-out of tomato variety trial, Woodland, 2013.

	variety	disease resistance	Marketable Yield tons/A		Brix	color	pH	% pink	% green	% sun burn	% mold	% canopy necrosis
1	HM 1892	VFFNP	29.5	a	5.6	22.5	4.46	3	5	12	7	43
2	HM 7883	VFFNP	29.5	a	5.4	22.8	4.52	1	2	12	7	65
3	H 5608	VFFNPtsw	29.2	ab	5.3	21.0	4.44	2	2	8	13	65
4	H 1175	VFFN	28.8	ab	5.3	21.8	4.48	2	3	6	10	50
5	H 2401	VFFNP	25.4	abc	5.3	23.8	4.33	4	6	3	8	39
6	H 8504	VFFNP	25.2	abc	5.4	23.0	4.32	5	10	5	12	36
7	AB 311	VFFNPtsw	24.3	bcd	6.0	22.5	4.39	2	4	8	12	40
8	AB 2	VFFP	23.0	cd	5.8	23.8	4.34	3	6	6	13	39
9	N 6366	VFFNP	22.8	cd	6.0	21.0	4.49	1	2	14	17	76
10	N 6407	VFFNPtsw	22.2	cd	5.9	24.0	4.41	3	2	12	9	59
11	N 6404	VFFNPtsw	22.1	cd	6.4	22.0	4.46	3	4	7	18	43
12	DRI 319	VFFNPtsw	21.9	cd	6.4	23.5	4.40	2	4	9	12	54
13	CXD 282	VFFF3NP	21.1	cd	5.3	22.0	4.45	2	4	11	11	61
14	BQ 268	VFFNP	20.8	cd	6.2	22.8	4.36	4	6	7	12	50
15	SV 0335TM	VFFF3NPtsw	19.8	d	6.5	23.3	4.39	2	2	14	11	61
	LSD 5%		4.9		0.46	1.1	0.06	2	3	4	6	22
	% CV		14		6	3	1	58	58	33	35	30

Potential of mechanical spread of Fusarium wilt, race 3: To evaluate the potential of *Fusarium oxysporum* to be spread from infested to non-infested fields from infected tomato plant debris, UCD Plant Pathologist Mike Davis and I collaborated on a UCD campus-based field test. The study began with the collection of Fusarium wilt, race 3 infected plants from 2 commercial fields northwest of Knights Landing. Collected plants were slowly dried and later cut into about 1" long stem pieces to bury under the center of pre-made beds in the fall of 2010. In the subsequent 3 years, from 2011-2013, tomatoes were cropped each year to evaluate the establishment and spread of this long-lived soilborne pathogen. In the first season, seedbed management was no-till season-long including the time between the fall 2010 introduction of the infected stems and the 2011 crop planting. In all subsequent years, tillage was restricted to flail mowing and roto-tilling in-line with the beds.

Table 6. Evaluation of spread of Fusarium wilt from Nov 2010 field introduction, UC Davis.

	Fusarium wilt infected plants*	
year	(#)	(%)
2010	-	-
2011	12	1%
2012	34	2%
2013	287	19%

* with lab confirmation

Our field study indicated that Fusarium wilt could establish quickly in a new soil environment to infect the following crop season (Table 6). In each subsequent season, the percent infection level continued to increase. By the third tomato crop year, the level approached 20%. While our test plot dimensions were small (16, 5-ft wide beds x 90'), the results were clear: Fusarium could establish quickly and once introduced, would progressively increase.

Bottom Line: Equipment, especially tomato harvesters and vine diverters, should be cleaned and inspected before moving into new fields. Vigilance in equipment cleaning may reduce the introduction of Fusarium wilt from infested fields.

While our study only involved handling of diseased plant tissue, infested soil may also be tied to the movement of Fusarium wilt.

Best wishes for a productive 2014.

Submitted by,

Gene Miyao
Farm Advisor, Yolo, Solano & Sacramento counties