

# Plant Resistance-Breaking Tomato Spotted Wilt Virus; Varietal Response and Management

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# Symptoms of TSWV



# TSWV Resistance

- SW5: Single dominant gene
- In widespread use in the Central San Joaquin Valley for nearly 10 years
- Documentation of resistance-breaking strains in CA 2016



Sw-5  
Resistance-  
breaking  
strain



**First detection** mid-Apr 2016, Sw-5  
fresh market tomatoes in Cantua  
Creek (Fresno Co.), with other reports  
in Firebaugh and Huron

# Resistance-breaking TSWV distribution, 2019

- 2017: Additional reports in Fresno and Merced
- 2018: Continuing issues in Fresno and Merced with reports in Kern and Kings
- 2019: Lower overall but throughout Fresno Co.
- 2020: Higher incidence within previous reported areas



# Relative Susceptibility of Processing Tomato Varieties to TSWV (2018 - 2020)

- Quantify response of commercial varieties to TSWV
- Document strain present



# Varieties Compared (2018 - 2020)

Sw5	AB 0311
Sw5	BOS 0811
Sw5	BP 13
Sw5	BP 16
Sw5	BQ 273
Sw5	BQ 400
Sw5	BQ 401
Sw5	BQ 403
Sw5	BQ 413
Sw5	DRI 319
No Sw5	H 1015
Sw5	H 1293
Sw5	H 1428
Sw5	H 1662
Sw5	H 5608
Sw5	H1776

No Sw5	H2401
Sw5	H5508
Sw5	HM 3887
Sw5	HM 4521
Sw5	HM 4885
Sw5	HM 4909
Sw5	HM 58801
Sw5	HM 58841
	HM 58871
Sw5	HM 5900
No Sw5	HM 7885
Sw5	HM 8163
Sw5	HM5235
Sw5	HM5369
Sw5	HM5511

Sw5	HM5522
Sw5	HM58811
	N 2428
No Sw5	N 6366
Sw5	N 6415
Sw5	N 6416
Sw5	N 6420
Sw5	N 6426
Sw5	N 6428
Sw5	N 6441
Sw5	SV 2756TM
Sw5	SV 8011TM
Sw5	SVTM 1082
Sw5	SVTM 9000
Sw5	UG 16609

# Ag Seeds and TS&L commercial field trials (Fresno, Kings and Merced)

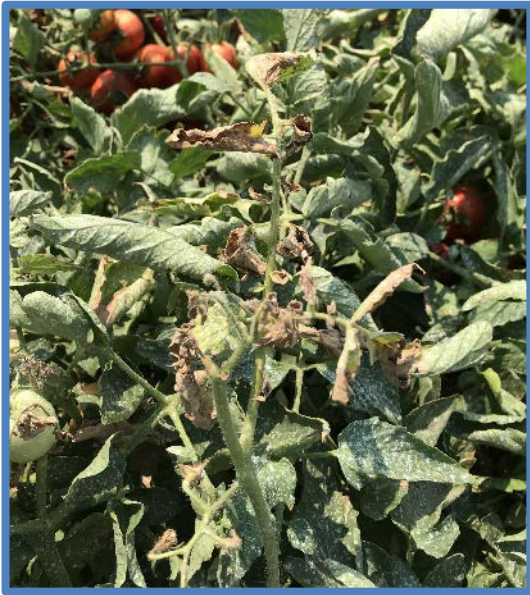
Company  
representatives  
provided maps  
of commercial  
trials

UC Advisors  
evaluate trials with  
substantial TSWV  
levels w/in 3 weeks  
of harvest (6-9  
trials/year)

Representative samples of at least  
six entries from at least three trials  
per year are tested for resistance  
breaking status (R. Gilbertson lab)



# Symptom Categories



1 shoot dieback



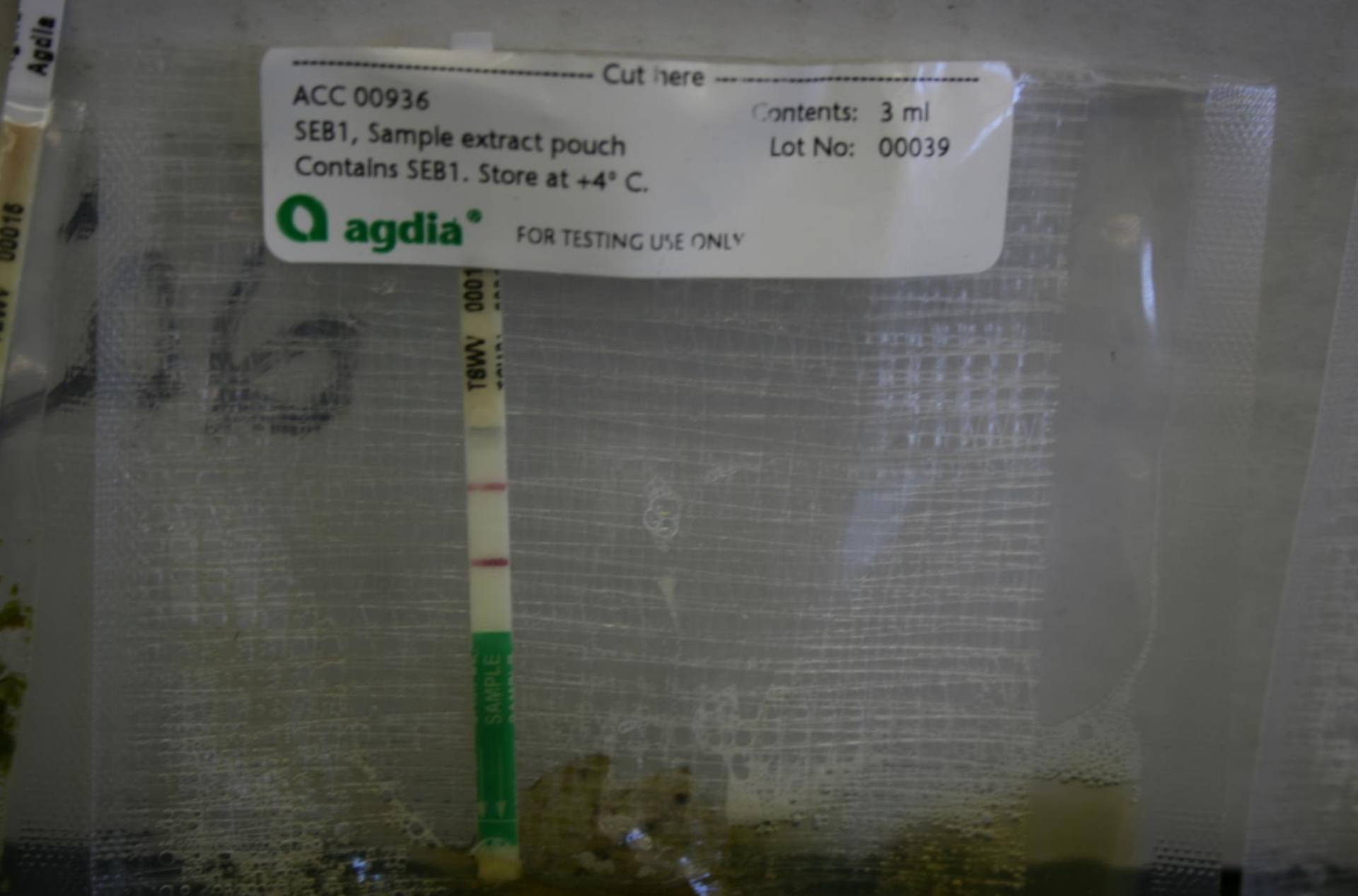
2 fruit symptoms with few foliar symptoms



3 systemic symptoms through leaves and fruit



4 collapse



ACC 00936

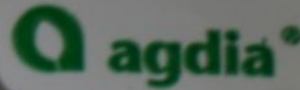
SEB1, Sample extract pouch

Contains SEB1. Store at +4° C.

Cut here

Contents: 3 ml

Lot No: 00039



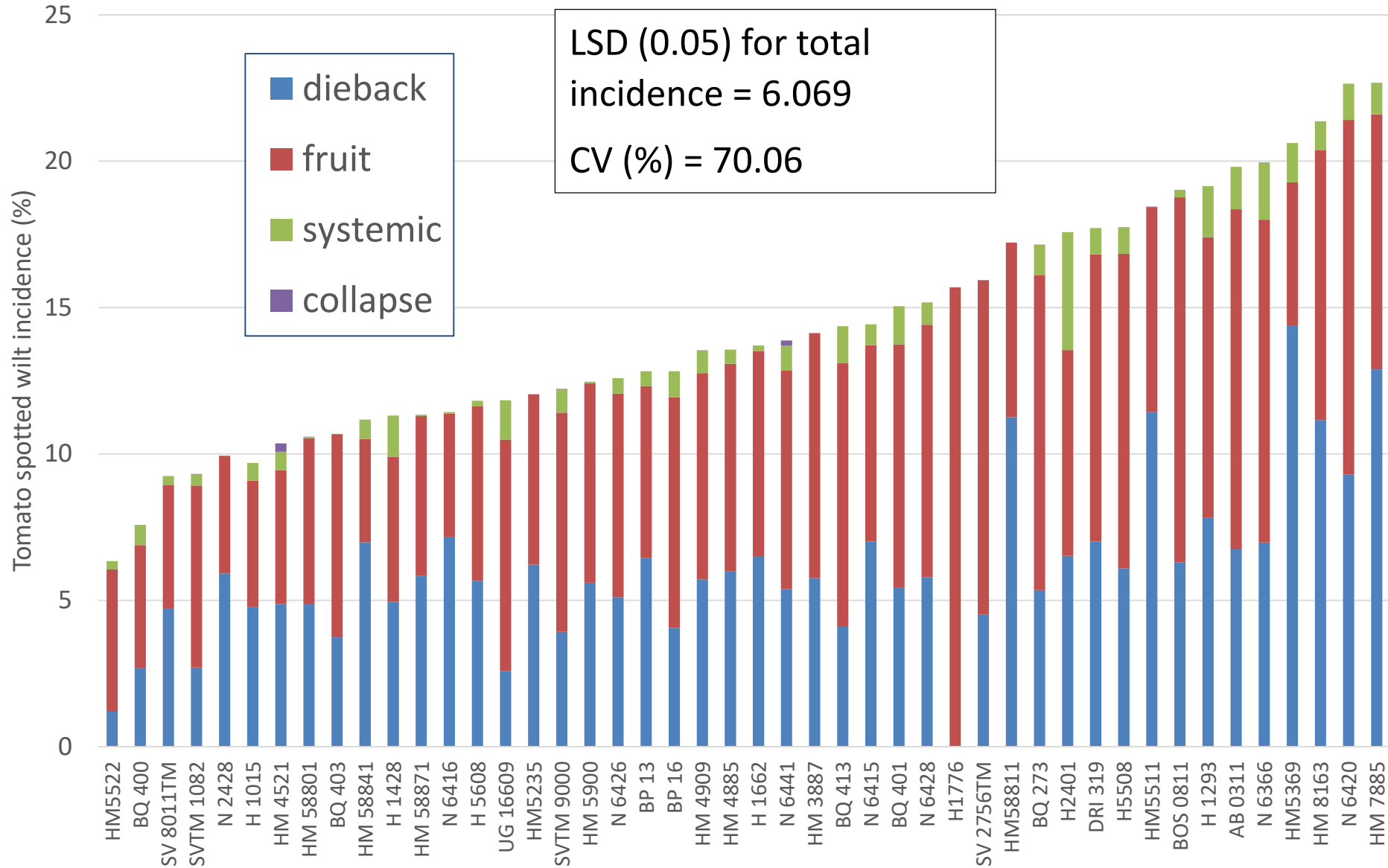
FOR TESTING USE ONLY

T8WV 0001

SAMPLE

Immunostrips available from AgDia ([www.agdia.com](http://www.agdia.com))

# Disease Incidence (46 entries x 21 sites), 2018-20



# Disease Incidence (46 entries x 21 sites), 2018-20

Variety	Use	Total incidence
HM5522	inter	6.339
BQ 400	early	7.579
SV 8011TM	inter	9.241
SVTM 1082	thin	9.317
N 2428		9.506
<i>H 1015</i>	<i>early</i>	9.693
HM 4521	inter	10.360
HM 58801	inter	10.579
BQ 403	early	10.675
HM 58841	inter	11.171
H 1428	thick	11.313
HM 58871	inter	11.336
N 6416	early	11.415
H 5608	thick	11.814
UG 16609	inter	11.834
HM5235	inter	12.041
SVTM9000	early	12.226

Variety	Use	Total incidence
HM5900	inter	12.463
N6426	thick	12.589
BP13	early	12.823
BP16	inter	12.824
HM4909	inter	13.539
HM4885	thick	13.567
H1662	thick	13.704
N6441	inter	13.876
HM3887	inter	14.130
BQ413	early	14.363
N6415	thick	14.428
BQ401	inter	15.047
N6428	inter	15.172
H1776	thick	15.278
SV2756TM	thick	15.783

Variety	Use	Total incidence
HM58811	thick	16.974
BQ273	inter	17.150
H2401	thick	17.572
DRI319	thin	17.718
H5508	thick	17.743
HM5511		18.262
BOS0811	thick	19.016
H1293	pear	19.150
AB0311	thin	19.808
N6366	thin	19.956
HM5369	pear	20.618
HM8163	pear	21.362
N6420	pear	22.641
HM7885	pear	22.679
LSD <sub>0.05</sub>		6.069
CV (%)		70.060

# Testing for Sw5 Resistance Breaking TSWV (R. Gilbertson lab)

- From three locations per year
- At least six entries
- Three shoots per entry

# Variety Trial: Strain Determination 2018

Variety	SW5	Strain detected (rb or wt)		
		Five Pts	Huron	Merced
S6366	-	Rb	Rb	Rb
UG19406	-	Rb	Rb	Rb
BQ413	+	Rb	Rb	Rb
UG16609	+	Rb	Rb	Rb
HM5900	+	Rb	Rb	Rb
H1293	+	Rb	Rb	Rb
N6420	+	Rb	Rb	Rb
BOS811	+	Rb	Rb	Rb
AB311	+	Rb	Rb	Rb

Strain identification  
Sw-5 resistance breaking (Rb)  
Wild type (wt)

# Variety Trial: Strain Determination 2019

Variety	SW5	Strain detected (rb or wt)		
		Five Pts	Dos Palos	San Joaquin
S6366	-	Rb	---	Rb
UG19406	-	Rb	---	Rb
BQ413	+	Rb	---	Rb
UG16609	+	Rb	---	Rb
HM5900	+	Rb	---	Rb
H1293	+	Rb	Rb	Rb
N6420	+	Rb	Rb	Rb
BOS811	+	Rb	Rb	Rb
AD811	+	Rb	Rb *	Rb **

Strain identification: Sw-5 resistance breaking (Rb) Wild type (wt)

\* TSWV was weakly positive

\*\* TSWV was detected in 1 of 3 samples

# Variety Trial: Strain Determination, 2020

Variety	SW5	Strain detected (rb or wt)		
		Mendota	Huron	Helm
AB0311	+	Rb	Rb	Rb
BQ413	+	Rb	Rb	Rb
N6472	+	Rb	Rb	Rb
H1293	+	Rb	Rb	Rb
H5608	+	Rb	Rb	Rb
SVTM9016	+	Rb	Rb	Rb
UG16609	+	Rb	Rb	Rb



# Alternative Genetics to Sw5

Evaluation of Commercial entries at UC West Side Research and Extension Center 2019-20



# 2019 Response of varieties and breeding lines to TSWV at UC WSREC

**Transplanted:** 24 May  
**Plot size:** single 60" bed by 75 ft  
**Plant spacing:** 12"  
**Notes:** Due to quantity of seed, as little as 5 ft per plot was used.

## Response of tomato varieties and lines to Tomato spotted wilt virus 2019

code	designation	
T1	131191-13	AL6/AL10/Sw5/AS
T2	131299-25	AL6/Sw5/AS
T3	1511284-1	FA7/AS
T4	181045-2	CV17NBL
T5	ISI 25033	
T6	Line 20-12	
T7	Terra 1	
T8	Terra 2	
T9	Terra 3	
T11	5608	Sw5 resistance
T12	6366	No TSWV resistance

Cooperation from Martha Mutschler Chu and private industry

2019  
Response  
of varieties  
and  
breeding  
lines to  
TSWV at  
UC WSREC

Entry <sup>z</sup>	TSWV Symptom Incidence (%) <sup>y</sup>							
	26-Jun	10-Jul	23-Jul	30-Jul	7-Aug	16-Aug	27-Aug	
H5608	0.000	0.000	2.161	3.512	4.368	4.368	5.299	
ISI 25033	0.000	0.000	0.413	5.951	4.596	4.596	5.920	
131191-13	0.000	0.000	0.000	0.000	1.337	4.461	6.456	
131299-25	0.000	0.000	0.210	0.210	0.989	0.989	6.512	
N6366	0.000	0.544	0.544	3.328	6.097	7.116	8.928	
Terra 3	0.000	0.000	0.244	3.569	3.589	7.326	12.259	
Terra 4	0.000	0.936	0.000	2.071	9.352	10.554	13.117	
Line 20-12	0.000	0.000	0.546	3.555	6.992	8.890	14.219	
Terra 2	0.000	0.000	1.769	1.769	3.741	12.243	16.432	
1511284-1	0.693	0.693	2.132	8.960	11.868	12.897	17.062	
181045-2	0.000	0.143	1.399	15.818	16.970	22.003	21.358	
Terra 1	0.000	0.646	2.859	34.158	51.124	65.577	70.393	
LSD (0.05) <sup>x</sup>	NS	NS	NS	2.467	2.494	2.957	3.623	

# 2020

## Response of varieties and breeding lines to TSWV at UC WSREC

**Transplanted:** 22 May

**Plot size:** single 60" bed by 75 ft

**Plant spacing:** 12"

### Response of tomato varieties and lines to Tomato spotted wilt virus 2019

code	designation	
<b>T1</b>	<b>Line 20 (12)</b>	
<b>T2</b>	<b>ISI -18205</b>	Pear Type
<b>T3</b>	<b>ISI-25003</b>	Round
<b>T4</b>	<b>131192-039</b>	Sw5/QtL6/A5
<b>T5</b>	<b>141278-012</b>	QTL6/AS
<b>T6</b>	<b>171002-2</b>	CU071026
<b>T7</b>	<b>181213-001</b>	CU17NBL
<b>T8</b>	<b>191065-010</b>	QTL6/CU17
<b>T9</b>	<b>191069-003</b>	Sw5/AS
<b>T10</b>	<b>191080-001</b>	QTL6/Sw5/CU17
<b>T11</b>	<b>191172-001</b>	FM Tomato 33EB
<b>T12</b>	<b>AB0311</b>	Sw5
<b>T13</b>	<b>N6366</b>	No Sw5

Cooperation from Martha Mutschler Chu and private industry

**2020  
Response  
of varieties  
and  
breeding  
lines to  
TSWV at  
UC WSREC**

Entry <sup>z</sup>	TSWV Symptom Incidence (%) <sup>y</sup>			
	25 Jun	17 Jul	24 Jul	18 Aug
191069-003	0.00	0.15	2.66	4.13
181213-001	0.00	0.59	0.87	4.15
ISI-25003	0.00	1.29	3.94	6.02
141278-012	0.30	0.30	1.28	6.79
131192-039	0.00	0.15	2.88	8.06
ISI -18205	0.00	1.04	0.40	8.31
171002-2	0.00	0.48	2.60	9.04
191180-001	0.00	1.08	5.70	11.36
Line 20 (12)	0.52	1.59	4.59	11.57
AB0311	0.00	2.02	8.42	13.62
N6366	0.13	0.29	8.13	13.76
191065-010	0.00	3.84	7.74	14.96
191072-001	0.00	4.24	13.83	15.38
LSD (0.05) <sup>x</sup>	0.64	3.00	3.62	0.91

Cooperation from Martha Mutschler Chu and private industry

# Summary

- Sw5 resistance breaking Tomato spotted wilt virus is common in portions of Central California
- Expression of TSWV varies among varieties.
- Management in high pressure regions will depend upon multiple management approaches

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