Update on some Diseases of Tomato and Pepper

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Phytophthora capsici

Broad Host Range

- Tomatoes
- Peppers
- Melons
- Squash
- Weeds?

Diseases caused:

- Post-emergence damping off
- Crown and Root Rot
- Blight (foliar)
- Fruit Rot

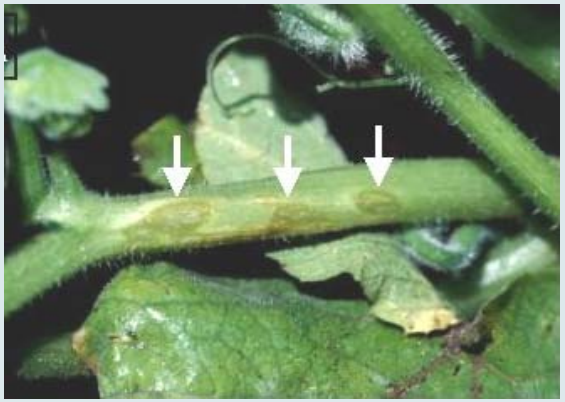
Crown and Root Rot

Clark

Holmes

Foliar infections (blight)

Vine blight - pumpkin



Pumpkin photos: Babadoost & Islam

Davis

- More of a problem in climates with higher humidity or summer rainfall

Fruit Rots

Babadoost & Islam

Everts

Ontario CropIPM

Lamour

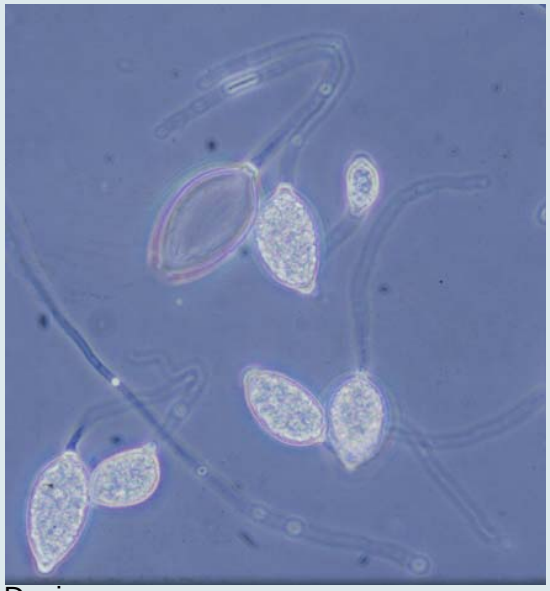
Clark

Davis

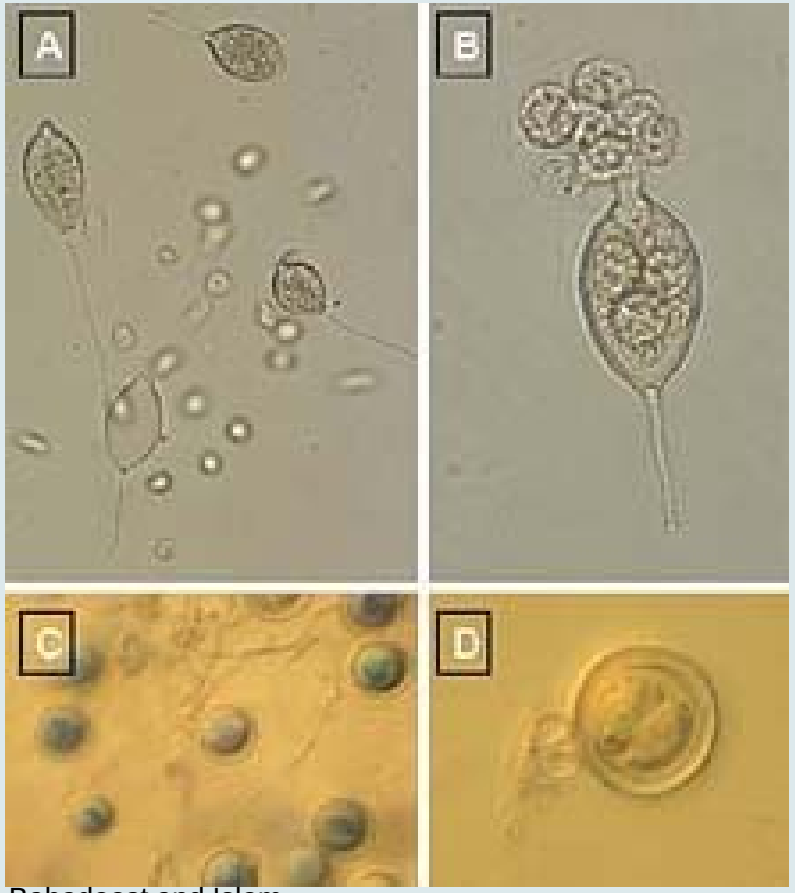
Disease spread and soil survival

Phytophthora capsici produces:

- sporangia and motile zoospores
- oospores which survive as long as 3 years in field soil



Davis



Babadoost and Islam

Aggravating conditions

- Saturated soil (as few as 5 to 6 hours!!)
- Heavy soils, compacted soils
- Warm, wet conditions
- Soil salinity or other plant stress

2009 Field Trial

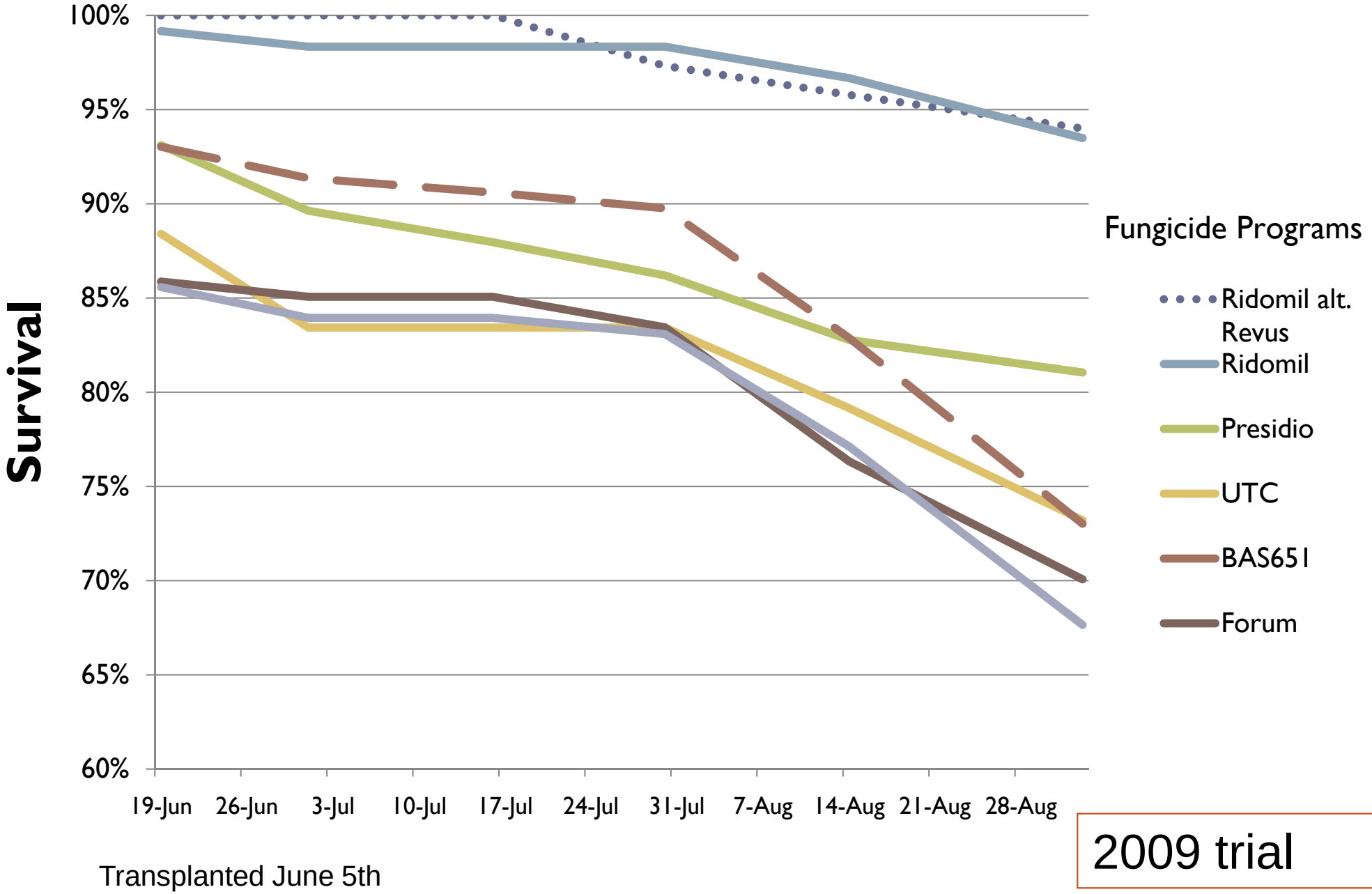
- Established at UC Davis Plant Pathology Farm
- Sweet Bell cv. 'Baron'
- Soil inoculated with *Phytophthora capsici* (colonized vermiculite in band near transplants)
- Six fungicide programs (plus non-treated control) evaluated in replicated design
- Chemicals (and irrigation) applied via surface drip system
- Chemicals applied monthly (3 applications total)
- In addition to chemical control programs, Phytophthora-tolerant pepper cultivars were also evaluated in an adjacent trial

Fungicide Programs Evaluated in 2009

Fungicide Program	Product(s)	Rate/acre	Active ingredient(s)	Timings
1	untreated control	–	–	–
2	Presidio	4 oz	fluopicolide	ABC
3	Ridomil Gold	1 pt	mefenoxam	ABC
4	Fosphite	3 qt	phosphorous acid	ABC
5	BAS651[y]	13.7 fl oz	?	ABC
6	Ridomil Gold	1 pt	mefenoxam	AC
	alt. Revus	8 oz	mandipropamid	B
7	Forum	6 oz	dimethomorph	ABC

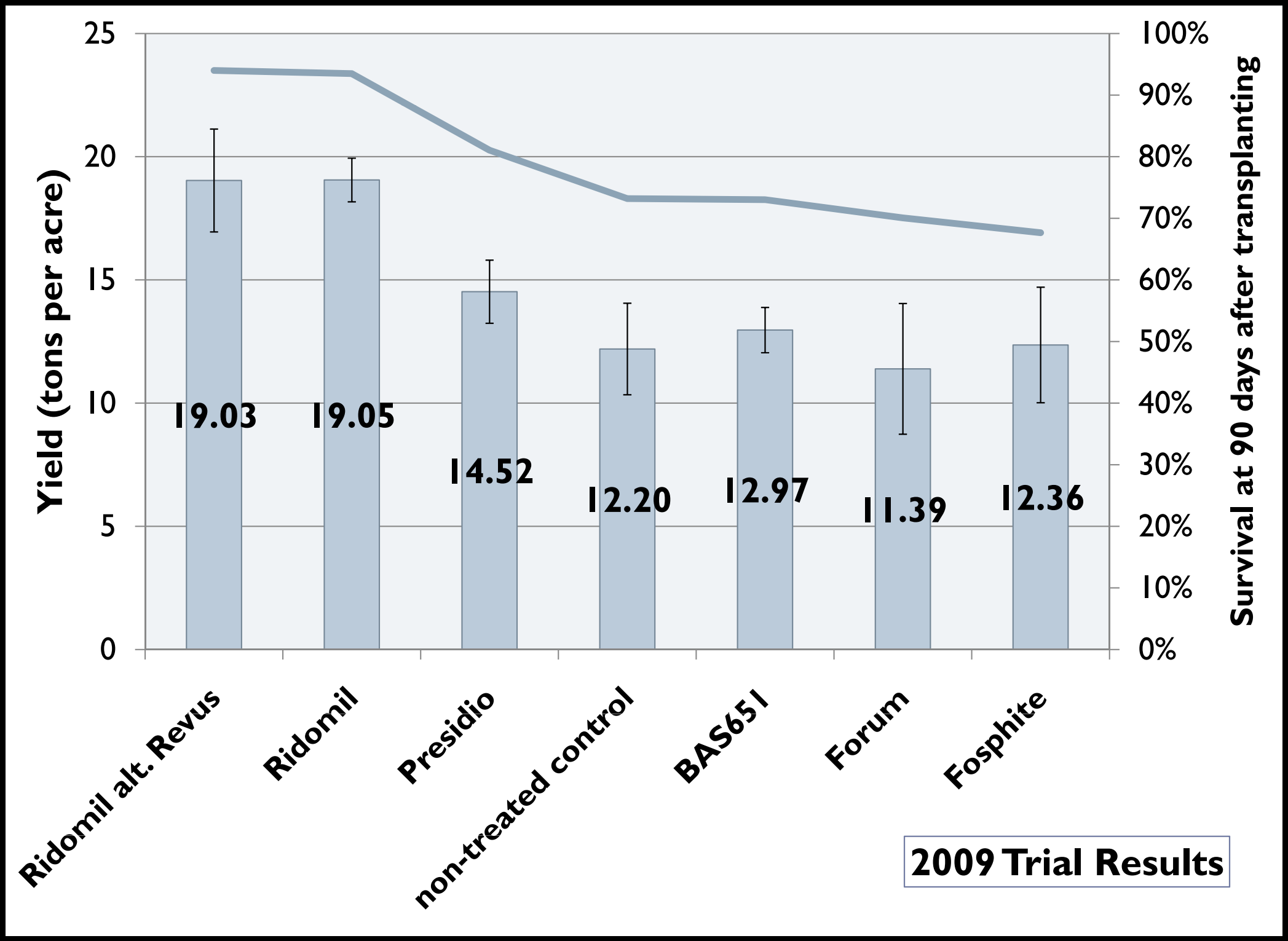
[y] Experimental

Pepper survival in inoculated soil



Transplanted June 5th

2009 trial


Yield (tons per acre)
Survival at 90 days after transplanting
25
20
15
10
5
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
19.03
19.05
14.52
12.20
12.97
11.39
12.36
Ridomil alt. Revus
Ridomil
Presidio
non-treated control
BAS651
Forum
Fosphite
2009 Trial Results

Survival of Phytophthora-tolerant varieties in inoculated soil

Variety/line	Pepper survival at 90 days		Yield (tons/acre)	
Baron	77.4%	+/- 5.9%	9.74	+/- 1.5
Prophet	95.0%	+/- 3.3%	15.87	+/- 1.7
Sakata 77824	97.4%	+/- 1.6%	15.15	+/- 1.3
Sakata 77827	100.0%		not harvested	
Sakata 77825	100.0%		12.94	+/- 0.6
Sakata 77826	98.5%	+/- 0.9%	19.16	+/- 0.7

Chemical	FRAC group	Products
metalaxyl, mefenoxam	4 – resistance known	Various products
phosphonates (phosphorous acid, fosetyl-Al)	33 – low risk	Various products
mandipropamid	40 – low/medium risk	Revus
fluopicolide	43 – resistance not known	Presidio
biological fungicides (e.g. *Bacillus subtilis*, *Gliocladium virens*, *Streptomyces lydicus*)	not classified	e.g. Rhapsody, SoilGard, Actinovate

- Note that Maneb, Tanos and Reason are also registered, but only for foliar use, not root & stem rot
- Always check labels before making recommendations or applications!

Chemical control of Phytophthora

- Resistance concerns
- Metalaxyl/mefenoxam may degrade rapidly in soils with a history of repeated use
- How to get the materials to where they need to be to prevent infection?

Cultural Control

- Rotation out of tomatoes, peppers and cucurbits for 3+ years
- Clean equipment of soil when leaving infested fields
- Don't reuse water draining from problem fields
- Plant susceptible crops on well-drained soils
- In heavy soils, use alternate furrow irrigation or well-managed drip irrigation
- Tolerant pepper varieties (e.g. cv. 'Revolution', cv. 'Prophet')

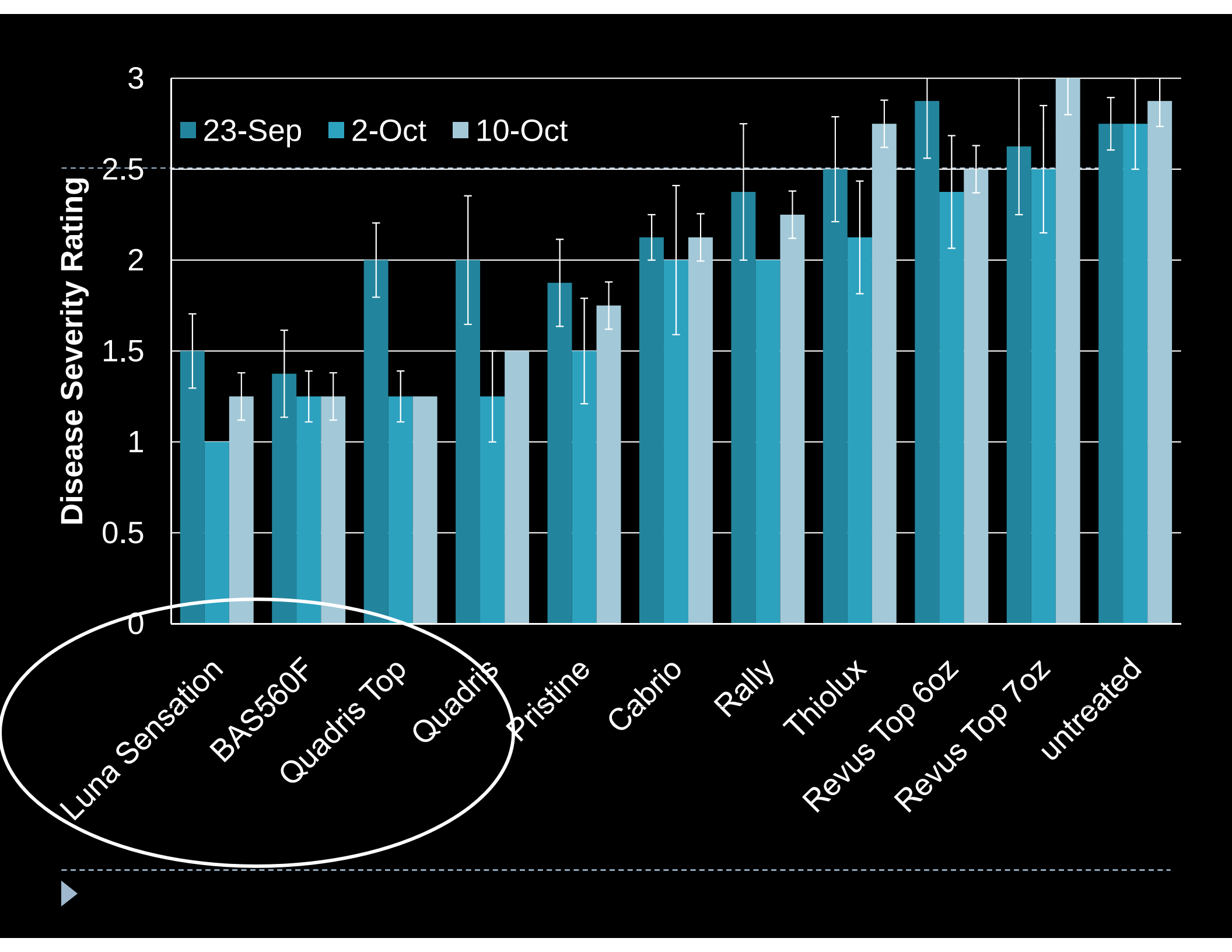
Powdery Mildew

Leveillula taurica (Oidiopsis sicula)

Group Code	Common names	Products	Resistance Risk
11	azoxystrobin trifloxystrobin pyraclostrobin	Quadris Flint Cabrio	high
3	myclobutanil difenoconazole	Rally Inspire	medium
13	Quinoxyfen (pepper)	Quintec	medium
M	sulfur	various	low
Not categorized	potassium bicarbonate oils biofungicides	various JMS stylet oil Trilogy Regalia Serenade Sonata Actinovate	low

Experimental materials

Group Code	Chemical group name	materials	Fungicide Resistance Risk
7	Succinate dehydrogenase inhibitors (SDHI)	boscalid (Endura) penthiopyrad (LEM-17) fluopyram (Luna)	medium
U8	Benzophenone	metrafenone (BAS560F)	resistance not known
11	Quinone outside inhibitors (QoI)	picoxystrobin (YT669)	high
Not categorized		potassium silicate (Sil-Matrix)	resistance not known


Disease Severity Rating
3
2.5
2
1.5
1
0.5
0
23-Sep
2-Oct
10-Oct
Luna Sensation
BAS560F
Quadris Top
Quadris
Pristine
Cabrio
Rally
Thiolux
Revus Top 6oz
Revus Top 7oz
untreated

PRODUCTS	RATES	ADJUVANTS	Powdery mildew (% foliage affected)		Marketable yield (tons)
Luna Sensation (USF2016)	7.6 oz	Dyne-amic 0.125%	7.2	f	15.6
Quadris	6 oz	Latron B1956 0.25%	8.1	ef	-
Luna Privilege (USF2015)	6.84 oz	Dyne-amic 0.125%	8.6	ef	13.0
Quadris Top	8 oz	Latron B1956 0.25%	9.5	ef	18.6
metrafenone (BASF560 F)	15 oz	Mor-Act 0.25%	10.4	def	15.3
metrafenone (BASF560 F)	15 oz	Silwet 0.06%	12.3	cdef	16.3
DPX-YT669 (picoxystrobin)	6 oz	Latron B1956 0.25%	12.8	cde	18.2
Cabrio	16 oz	Latron B1956 0.25%	13.2	bcde	
penthiopyrad (DPX-LEM17)	24 oz	none	13.2	bcde	16.6
penthiopyrad (DPX-LEM17)	10 oz	none	15.5	abcd	15.0
penthiopyrad (DPX-LEM17)	16 oz	none	16.9	abc	19.3
Rally	4 oz	Latron B1956 0.25%	18.3	ab	-
Rally	4 oz	Wet-Cit 0.25%	18.3	ab	15.7
Non-treated control	-	none	19.6	A	14.8
		LSD 5%	5.17		not

PRODUCTS	RATES	ADJUVANTS	Powdery mildew (% foliage affected)
Sil-Matrix	1%	Latron B1956 0.25%	11.8
Regalia plus Rally	0.5% + 2.5 oz	Nu-Film P 0.02%	11.8
Sonata	4 qt	none	11.8
Sulfur DF	20 lb	none	11.8
Actinovate fb Sulfur DF	9 oz fb 20 lb	Silwet 0.06% fb none	13.2
Regalia fb Rally	0.5% fb 4 oz	Nu-Film P 0.02% fb Latron B1956 0.25%	14.6
Serenade	3 lb	none	15.5
IAP 98% sulfur dust	40 lb	none	15.5
Actinovate plus Sonata	6 oz + 2 qt	none	15.5
Sulfur DF	20 lb	Oroboost 0.25%	15.5
Sil-Matrix	0.5%	Latron B1956 0.25%	15.9
Kaligreen	3 lb	none	16.9
Non-treated control	-	none	19.6
		LSD 5%	NS

Treatments	Foliage covered with powdery mildew (%)				Necrosis rating			
	22 Aug		1 Sep		25 Aug		2 Sep	
Luna Sensation 7.6 fl oz + D	5.3	c	13.3	b	1.5	ef	2.0	c
Quadris Top 8 fl oz + D	5.8	c	18.5	b	1.3	f	1.8	c
Quadris Top 8 1 oz + D (1,3) Bravo Weather Stik 2.75 pt (2,4)	15.0	c	21.8	b	2.8	cde	3.3	c
GWN-4617 3.4 oz + D	11.0	c	22.5	b	1.3	f	2.0	c
BAS560 15 fl oz + Widespread Max 0.03%	17.0	c	45.8	a	2.0	def	3.3	c
Cabrio 16 oz + D (1,3) Rally 4 oz/A + D (2,4)	34.3	b	49.8	a	3.3	bcd	5.0	b
Cabrio 16 oz + Franchise 0.25% (1,3) Rally at 4 oz + Widespread Max 0.03 % (2,4)	38.0	b	53.8	a	4.0	bc	6.5	ab
Flint 3.0 oz + D	39.8	b	60.5	a	3.8	bcd	5.5	b
Cabrio 16 oz + Franchise 0.13% (1,3) Rally at 4 oz/A + Widespread Max 0.03% (2, 4)	33.8	b	61.8	a	3.5	bcd	5.0	b
Regalia at 0.5% + Cabrio 8 oz + D	42.3	b	62.5	a	3.5	bcd	5.8	b
Regalia 0.5% + Rally 2.5 oz + D	37.3	b	63.0	a	3.7	bc	5.8	ab
Microthiol 10.0 lb	50.5	ab	65.0	a	2.8	bcde	6.3	ab
Regalia 1.0% + D	59.0	ab	67.5	a	4.8	ab	7.8	ab
Bravo Weather Stik 2.75 pt	59.0	ab	70.3	a	4.8	ab	7.3	ab
Untreated Control	70.3	ab	74.3	a	6.0	a	8.8	a

Powdery mildew chemical control

- Early treatment – fungicides are mostly preventative
- Good coverage, penetrate canopy
- Utilize good rotations and tank mixes – fungicide resistance is a real risk

Acknowledgements

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