



COLLEGE OF AGRICULTURE AND LIFE SCIENCES
**Yuma Center of Excellence
for Desert Agriculture**

"Solutions to Desert Agriculture's Pressing Problems"

**The Center Of Excellence
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WELCOME!



New Developments in Advancing Management of Fusarium Wilt of Lettuce



Lettuce Fusarium wilt management

Cultivar and crop protection products



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Yuma Agricultural Center

Fusarium wilt of lettuce

Caused by the soil-borne fungus

Fusarium oxysporum f. sp. *lactucae*



Fusarium wilt symptoms



Fusarium wilt symptoms



Lettuce cultivar evaluation trials

The goal: find lettuce tolerant or resistant to Fusarium wilt

Cultivar evaluation trials: 2015

Located in two Yuma growers' fields

Plot size: Four 100 ft lengths of bed per cultivar

Seeding dates: Sep 10, 16 Termination dates: Nov 16 to 20

Crisphead

Crusader

Dover

LT 4083

Midway

PIC

Prestige

Raider

Sunquest

Romaine

Green Thunder

King Henry

Rio Bravo

Vanguard

Valley Heart

Fusarium wilt symptoms



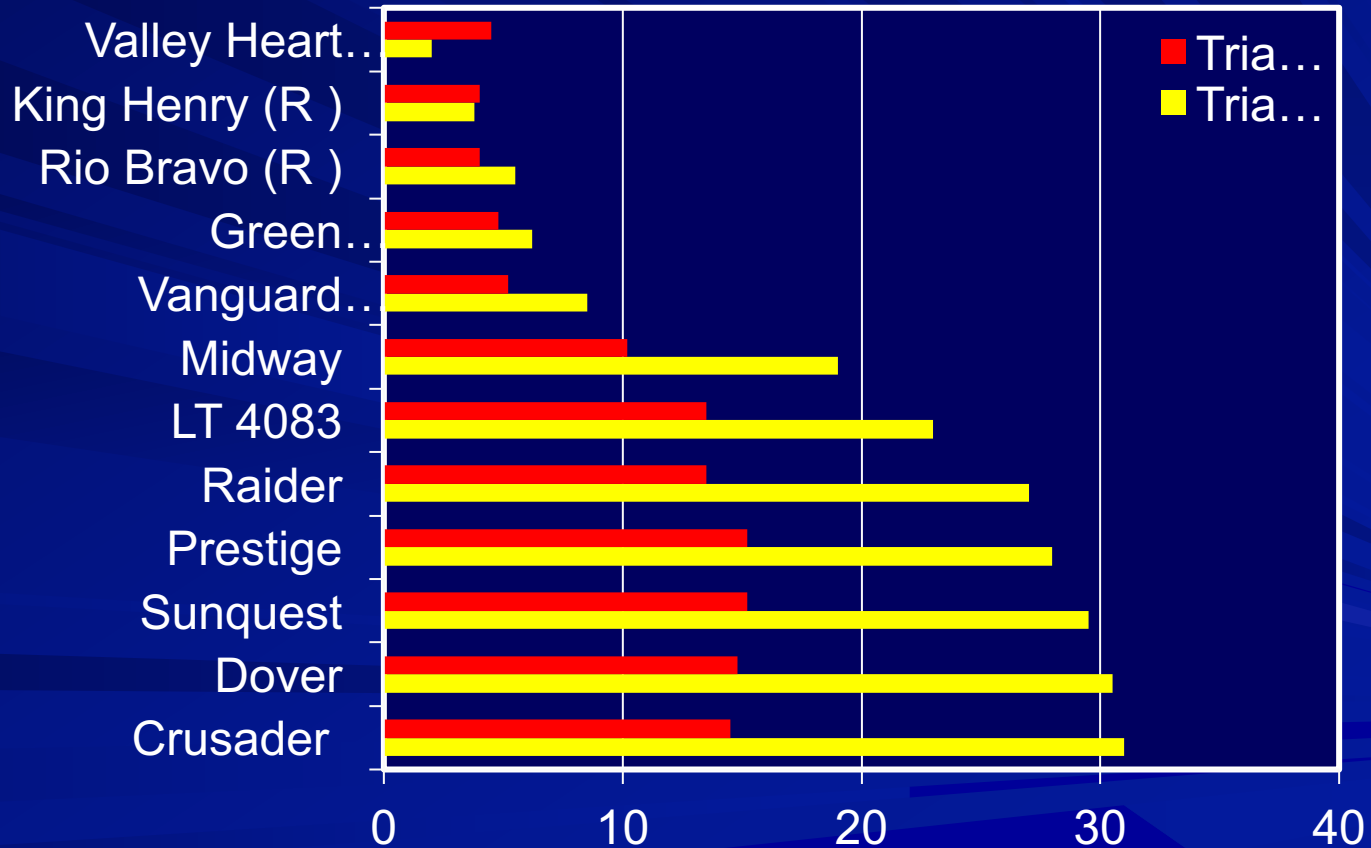
Lettuce cultivar evaluation trials - 2015

Percent dead or diseased plants

Lettuce cultivar	Trial site #1	Trial site #2
Valley Heart (R)	2.0 g	4.5 c
King Henry (R)	3.8 fg	4.0 c
Rio Bravo (R)	5.5 fg	4.0 c
Green Thunder (R)	6.2 fg	4.8 c
Vanguard PIC (R)	8.5 e-g	5.2 c
Midway (H)	19.0 c-e	10.2 b
LT 4083 (H)	23.0 a-d	13.5 a
Raider (H)	27.0 a-c	13.5 a
Prestige (H)	28.0 a-c	15.2 a
Sunquest (H)	29.5 a-c	15.2 a
Dover (H)	30.5 ab	14.8 a
Crusader (H)	31.0 a	14.5 a

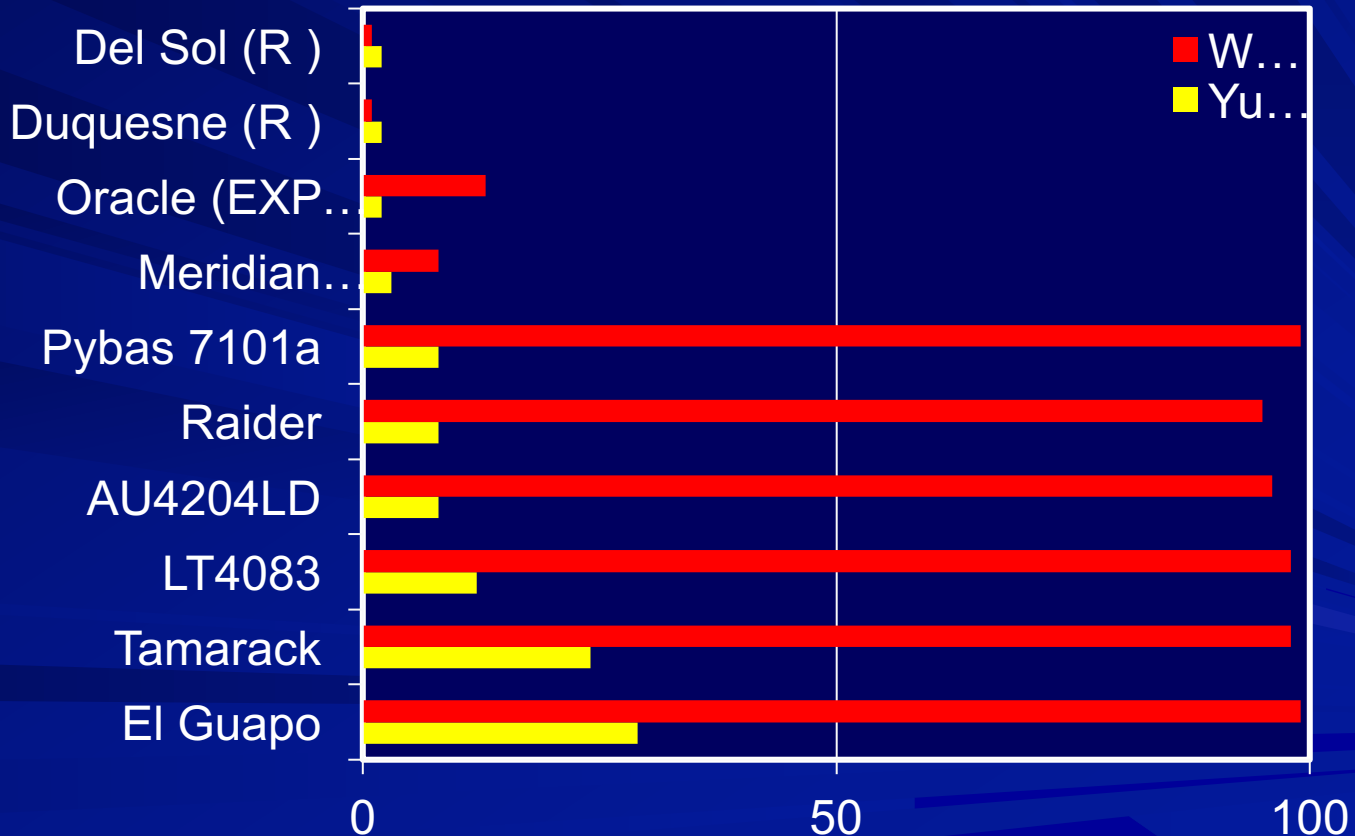
2015 Lettuce cultivar evaluation trials: Yuma

Percent dead or diseased plants



2016 Lettuce cultivar evaluation trials

Percent dead or diseased plants



2016 Lettuce cultivar evaluation trials

Yuma

Cultivar	% dead or diseased	Cultivar	% dead or diseased
Del Sol (R)	2 i	Midway	6 e-i
Duquesne (R)	2 i	Raider	8 d-f
Oracle (EXP 6362)	2 i	Pybas 7101a	8 d-f
16C652	2 i	16C657	8 d-f
16C653	2 i	AU4204LD	8 d-f
16C655	3 h-i	Desert Eagle	9 de
16C656	3 h-i	LT4083	12 d
Meridian (EXP 12M)	3 h-i	Tamarack	24 c
16C654	4 g-i	El Guapo	29 b
Raider (treated with Natural Guard)	4 g-i	Showtime	43 a

2016 Lettuce cultivar evaluation trials

Wellton

Cultivar	% dead or diseased	Cultivar	% dead or diseased
Del Sol (R)	1 f	AU4204LD	96 bc
King Henry (R)	1 f	LT4083	98 ab
Valley Heart (R)	1 f	Tamarack	98 ab
Duquesne (R)	1 f	1221	99 a
Meridian (EXP 12M)	8 e	El Guapo	99 a
Oracle (EXP 6362)	13 d	Pybas 7101a	99 a
Raider	95 c		



Wellton cultivar evaluation plots



Duquesne

Del Sol

Meridian

Crop protection product evaluation

The goal: find products that will reduce the severity of Fusarium wilt of lettuce

Crop protection product trials

- Lettuce variety Raider used in these trials
- First application for most products at seeding followed by germination sprinkler irrigation
 - Applied with a CO₂ backpack sprayer at a 50-gal per acre rate in a 4-inch band over each seed line
 - Most treatments applied again after seed germination

Crop protection products tested in 2015

Product name	Active ingredient
Actigard	Plant resistance activator
Actinovate	<i>Streptomyces lydicus</i> WYEC 108
Great White	Mixture of beneficial fungi & bacteria
Hydroguard	<i>Bacillus amyloliquifaciens</i>
Mycostop	<i>Streptomyces griseoviridis</i> K61
Rootpak	Mixture of several bacteria and fungi
Rootshield Plus	<i>Trichoderma harzianum</i> + <i>T. virins</i>
Serenade Soil	<i>Bacillus subtilis</i>

2015 Crop protection product trials

Treatment	# healthy plants	Treatment	# healthy plants
Rootshield Plus (L)	58 a	Mycostop (L)	52 b
Great White (H)	56 ab	Hydroguard (H)	52 b
Serenade (L)	55 ab	<u>Nontreated control</u>	<u>48 b</u>
Rootshield Plus (H)	55 ab	Mycostop (H)	47 b
Hydroguard (L)	54 ab	Serenade (H)	46 b
Rootpak (H)	53 b	Rootpak (L)	45 b
Actinovate (L)	53 b	Actinovate (H)	44 b
Great White (L)	53 b		
L = low rate; H = High rate			

Crop protection products tested in 2016

Product name	Active ingredient
A19649B	Conventional fungicide from Syngenta
Proline	Prothioconazole
Actigard	Plant resistance activator
Manzate	Mancozeb
Double Nickel	<i>Bacillus amyloliquifaciens</i> D747
LifeGard (CX-10250)	<i>Bacillus mycoides</i> (plant activator)
Serenade Soil	<i>Bacillus subtilis</i>
Taegro 2	<i>Bacillus amyloliquifaciens</i> FZB24
Bio-Tam	<i>Trichoderma asperellum</i> + <i>T. gamsii</i>
SP2700	Soil bacterium metabolites
Vesta	Mix of microbial organisms
(Continued on next slide)	

Crop protection products tested in 2016

Product name	Active ingredient
Promax	Thyme oil
88-710 strain	Biological organism
SS, SS, AGM	
Bio Tek	Mixture of 3 <i>Bacillus</i> sp.
DAD ID	
Actinovate	<i>Streptomyces lydicus</i> WYEC 108
Mycostop	<i>Streptomyces griseoviridis</i> K61
Rootshield Plus	<i>Trichoderma harzianum</i> + <i>T. virins</i>
Rootpak	Mixture of several bacteria and fungi
<i>F. o.</i> 1388 and 1397	Non pathogenic <i>Fusarium oxysporum</i>

Yuma: 2016 Crop protection products trial

Treatment	# dead plants	Treatment	# dead plants
Taegro 2 + Bio-Tam	8.5	Manzate (3.0 lb)	10.5
Double Nickel	8.75	Proline	10.5
A19649B + Actigard	9.25	Actinovate	10.75
Actigard (AT +3)	9.25	88-710 strain	10.75
<i>F. o.</i> 1388	9.25	Bio-Tam	11
Vesta	9.5	Actigard (AT + 1)	11.75
Rootshield Plus	9.5	Taegro 2	12
Serenade Soil	10.25	SS, SS, AGM	12
Actigard (AS +3)	10.25	DAD ID	12
Promax	10.5	<i>F. o.</i> 1379	13
Bio Tek	10.5	A19649B	13
LifeGard	10.5	<u>Nontreated control</u>	<u>13.5</u>

Wellton : 2016 Crop protection products trial

Treatment	# dead plants	Treatment	# dead plants
Taegro 2 + Bio-Tam	132.25	Double Nickel	142.75
Taegro 2	135	A196498B + Actigard	142.75
Manzate (2.0 lb)	135.5	SP2700 (33 + 22 oz)	142.75
Bio-Tam	136	Actigard (AS +3)	143
Actigard (AT +1)	136.5	Mycostop	144.5
Manzate (3.0 lb)	136.75	Rootshield Plus	144.5
Actigard (AT +3)	139.25	<u>Nontreated control</u>	<u>145</u>
<i>F. o. 1397</i>	139.25	SP2700 (33 + 11 oz)	145.25
Serenade Soil	139.25	Promax	145.5
Proline	140.75	Rootpak	146.25
<i>F. o. 1388</i>	141	Vesta	147.25
A196498B	141.5	Actinovate	147.5
LifeGard	142.25	Bio Tek	149

Wellton Fusarium trial

Crop protection products trial



Lettuce Fusarium wilt field research

The Road Ahead

- Cultivar evaluation (crisphead varieties)
 - Those in development and commercially available
- Crop protection product evaluation
 - Promising conventional and biological fungicides
- Cultural practices
 - Fallow, deep plowing, seed treatments, transplants
- Other thoughts or ideas? Contact me!
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