2016 Fusarium Wilt of Lettuce Trial Results

In 2016, Fusarium wilt of lettuce research trials were conducted at two Yuma County, Arizona locations, one near Wellton and the other near Yuma. Two studies were conducted at each location; 1) evaluation of lettuce varieties currently available or in development for their relative resistance to Fusarium wilt, and 2) assessment of crop protection products (conventional as well as biologically based materials) for their potential in reducing disease severity. The soil at each site was a silty clay loam. Lettuce was seeded in double rows 12 in. apart on beds with 42 in. centers, then sprinkler-irrigated to germinate seed on 8 Sep and 21 Sep for the Wellton and Yuma sites, respectively. Plants were thinned 3 Oct in Wellton and 4 Oct in Yuma to an approximate spacing of 11 inches. Symptoms of Fusarium wilt, including stunting and chlorotic leaves, were first observed at thinning at the Wellton location and about a month after thinning at the Yuma site. Maximum and minimum daily soil temperatures (EF) at the 4 inch depth recorded at a nearby University of Arizona AZMET (Arizona Meteorological Network) weather station were as follows -- for the Wellton site: 93-82 during Sep 9-30; 86-79 during Oct; and 76-67 for Nov 1-18, and for the Yuma site: 88-83 during Sep 21-30; 88-78 during Oct; 77-59 during Nov; and 61-59 during 1-6 Dec. Total rainfall during the trial period was 0.00 and 0.05 inches for the Wellton and Yuma locations, respectively. Disease severity was recorded at crop maturity (17-18 Nov in Wellton and 5-6 Dec in Yuma) by counting the number of lettuce plants in each test plot that were dead, chlorotic, or stunted due to infection by *Fusarium oxysporum* f. sp. *lactucae*. Disease severity data were subjected to analysis of variance (ANOVA), then compared for significance using Fisher's Protected LSD test. Research plots at both locations were managed using customary commercial fertilization, insect management, and irrigation practices.

Evaluation of lettuce varieties. At the Wellton location, 13 lettuce varieties (9 crisphead, 4 romaine) were planted in 75-ft-long plots, with four replicate plots per lettuce variety. At the Yuma location, 20 lettuce varieties (18 crisphead, 2 romaine) were planted in plots 75 ft in length, with six replicate plots per variety. Each plot contained about 160 plants in both locations. Plots were arranged in a randomized complete block design to facilitate statistical analysis of data collected. The percentage of lettuce plants of each variety that were dead or diseased at crop maturity is found in Table 1. Disease intensity at the Wellton location was high compared to that at the Yuma location, as shown by the percentage of dead or diseased plants for varieties planted at both locations. Romaine cultivars performed extremely well, suffering a very small 1 to 2% loss, even at the Wellton location. Two crisphead varieties, Meridian and Oracle, were the least diseased among crisphead varieties in the Wellton trial, compared to virtually complete loss for the other tested crisphead varieties. In the Yuma trial, Meridian and Oracle sustained losses of 3 and 2%, respectively, whereas all other tested crisphead varieties incurred losses ranging from 2 to 43%.

Assessment of crop protection product efficacy. The crop protection studies at each location were conducted in plots seeded with the crisphead variety Raider. At both locations, each treatment was applied to four 75-ft-long plots, arranged in a randomized complete block design. At the Wellton and Yuma locations, 24 and 21 different treatments were evaluated, respectively. Treatments were applied with a CO_2 backpack sprayer that delivered 50/gal per acre at 40 psi to flat-fan nozzles. Treatments were applied in a 4-inch band over each seed line. The first application of products for most treatments was made right after seeding and before the germination sprinkler irrigation. Specific timing and rates of application for each treatment are listed in Table 2. Each plot contained about 160 lettuce plants. Disease severity was assessed at crop maturity. Regrettably, none of the treatments at either location significantly reduced the percentage of lettuce plants affected by Fusarium wilt when compared with those in nontreated plots.

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Table 1. 2016 Lettuce Fusarium wilt cultivar evaluation field trials		
Cultivar [x]	Percentage of plants dead or diseased [y]	
	Wellton site	Yuma site
Del Sol (R)	1 f	2 i
Duquesne (R)	1 f	2 i
King Henry (R)	1 f	-----
Valley Heart (R)	1 f	-----
Meridian (EXP 12M)	8 e	3 hi
Oracle (EXP 6362)	13 d	2 i
16C652	-----	2 i
16C653	-----	2 i
16C655	-----	3 hi
16C656	-----	3 hi
16C654	-----	4 g-i
Raider (treated) [z]	-----	4 g-i
Midway	-----	6 e-i
16C657	-----	8 d-f
Desert Eagle	-----	9 de
Raider	95 c	8 d-f
AU4204LD	96 bc	8 d-f
LT4083	98 ab	12 d
Tamarack	98 ab	24 c
Pybas 7101a	99 a	8 d-f
1221	99 a	-----
El Guapo	99 a	29 b
Showtime	-----	43 a

[x] (R) denotes romaine cultivars. All other entries are crisphead cultivars.

[y] Disease severity was recorded at plant maturity at both locations, as described earlier. Values in each column followed by a different letter are significantly different from each other according to Fisher's Protected LSD test ($P = 0.05$).

[z] Seed treated with Natural Guard (Seteco, King City, CA 93930)

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Table 2. 2016 Lettuce Fusarium wilt crop protection products efficacy trials					
Product Name and rate applied	**Active ingredient**	**Wellton site**		**Yuma site**	
		Treatment dates	**Percent diseased plants[y]**	**Treatment dates**	**Percent diseased plants[y]**
Taegro 2 4.0 oz + Bio-Tam 3.0 lb	*B. amyloliquifacians* FZB24 + *T. asperellum* + *T. gamsii*	9/8 + 26	82	9/21, 10/4	5
Taegro 2 4.0 oz	*Bacillus amyloliquifacians* FZB24	9/8 + 26	84	9/21, 10/4	8
Manzate Pro-Stick 2.0 lb	Mancozeb	9/8	85	9/21	-------
Bio-Tam 3.0 lb	*Trichoderma asperellum* + *T. gamsii*	9/8 + 26	85	9/21, 10/4	7
Actigard 1.0 oz	Acibenzolar-*S*-methyl	10/4 + 19	85	10/4 + 20	7
Manzate Pro-Stick 3.0 lb	Mancozeb	9/8	86	9/21	6
F. oxysporum 1397	Antagonistic strain of *F. oxysporum*	9/8	86	9/21	6
Serenade Soil 4.0 qt	*Bacillus subtilis*	9/8 + 26	86	9/21, 10/4	6
Proline 5.7 fl oz	Prothioconazole	9/8 + 26	88	9/21, 10/4	6
F. oxysporum 1388	Antagonistic strain of *F. oxysporum*	9/8	88	9/21	6
A19649B 8.55 fl oz	-------[z]	9/8 + 26	89	9/21, 10/4	8
LifeGard 2.25 oz	*Bacillus mycoides*	9/8 + 26	89	9/21, 10/4	6
Double Nickel 2.5 pt	*Bacillus amyloliquifacians* D747	9/8 + 26	89	9/21, 10/4	6
A19649B 8.55 fl oz + Actigard 1.0 oz	-------z + Acibenzolar-*S*-methyl	9/8 + 26	89	9/21, 10/4	6
SP2700 33 oz, then 22 oz	Soil bacterium metabolites	9/8, 10/4	89	-------	-------
Actigard 1.0 oz	Acibenzolar-*S*-methyl	9/8 + 26	89	9/21, 10/4	6
Mycostop 0.68 lb	*Streptomyces griseoviridis* K61	9/8	90	-------	-------
Rootshield Plus 2.73 lb	*Trichoderma harzianum* + *T. virins*	9/8	90	9/21	6
SP2700 33 oz then 11 oz	Soil bacterium metabolites	9/8, 10/4	91	-------	-------
Promax 1.0 gal, then 0.5 gal	Thyme oil	9/8, 10/4	91	9/21, 10/12	6
Rootpak 2.28 lb	Bacteria + fungi mixture	9/8	91	-------	-------
Vesta 200 gal, then 150 gal	Soil microbial activator	10/4	92	9/21 + 27	6
Actinovate 0.68 lb	*Streptomyces lydicus* WYEC 108	9/8	92	9/21	7
Bio Tek 1.1 lb	Mixture of 3 *Bacillus* sp	9/8	92	9/21	6
SS (first two applications) AGM (third application)	-------[z]	-------	-------	9/21, 10/4 + 20	8
DAD ID	-------[z]	-------	-------	9/21, 10/4 + 20	8
Nontreated control	-------	-------	91	-------	9

y	Percentage of plants dead or diseased at maturity. Disease severity values were statistically analyzed and no significant difference among treatments at each site were detected.
z	Active ingredient(s) not known.

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