

## National Verticillium Wilt Trial

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This trial is carried out annually at the Hancock Agricultural Experiment Station on a field that has been inoculated with *Verticillium dahliae*. Breeders are asked to submit selections from their breeding programs. Typically, these are advanced lines that may be released as cultivars. Information about Verticillium wilt (VW) resistance is useful when considering the merits of a line as a potential cultivar.

We use multiple measures of VW resistance. First, we look at symptom expression throughout the growing season. Especially early in the season, we are able to see VW symptoms as wilting and yellowing. In the tables below, these data are listed by date (e.g. the score in the 722 column indicated the percent foliage with VW symptoms) and combined across dates under the AUDPC (area under the disease progress curve) column. This year, we used an unmanned aerial vehicle (UAV) to take pictures of the inoculated and fumigated fields. Plants were visibly smaller on the inoculated field. In the future, we hope to use the UAV to score for symptoms.

A second scoring criterion is the number of fungal spores (conidia) in the sap of green plants. We collect green stems and squeeze a known amount of sap onto petri dishes containing a medium conducive to growth of the fungal spores. Then, after a two week incubation period, we count the number of colonies that grew. A large number of colonies indicates that the fungus was able to reproduce, so the plant is susceptible. The “sap” column in the tables below indicates the number of colonies that grew from a 100 ul sample of green stem sap.

When the plant begins to die at the end of the growing season, the fungus forms resting spores (microsclerotia). So, a third measure of VW resistance is the ability of the fungus to produce these microsclerotia. It is important to identify potato varieties that do not add large numbers of microsclerotia to the soil because this serves as inoculum in subsequent years. We collect stems from dead plants at the end of the season, dry the stems, grind them in a mill and plate the powder on petri dishes containing the selective medium. Again, we count colonies after a two week incubation period. These data are listed in the “dry” column below. Colony counts from dry stems are typically lower than those from sap. The two values are sometimes, but not always, correlated with each other.

This year, we planted three trials on May 6, 2014. Each consisted of three replications of five-hill units of cultivars and advanced selections from the U.S. potato breeding programs. Trial A was planted on a fumigated field and was used to score for vine maturity of all clones and evaluate yield of eight cultivars standards. Trial B was planted on a field that was inoculated with *V. dahliae* in 2006 and has been maintained as a VW screening plot. This field was used to evaluate disease symptom expression, yield in the presence of *V. dahliae*, and colonization of dying stems. Trial C was also planted on the inoculated field and was destructively sampled during the summer to evaluate colonization of green stems.

On July 22 and August 12 and 25, plots in Trial B were scored for percent foliage expressing Verticillium wilt symptoms. On August 4, stems from all clones in Trial C were collected, surface disinfested, and squeezed in a vice to collect sap for plating. For each plot, 100 ul of sap was plated on selective medium and the plates were incubated in the dark for two weeks. After that, they were microscopically examined to determine the number of colony forming units per 100 ul of sap. After vine kill, stems were collected from clones in the Trial B

field on September 11 and allowed to air dry at room temperature. Stems were not collected from clones that had high levels of *V. dahliae* in stem sap. All main stems from a plot were ground in a Wiley mill and 50 mg per plot was plated on selective medium. Colonies were counted two weeks later.

Symptom and sap data from the trial clones are presented in Table 1. Clones are grouped based on maturity scores in the fumigated field. Susceptible clones generally showed good symptom expression in 2014. Stem colonization was high, as seen in the resistant cultivar standard Ranger Russet. Clones with potential resistance to Verticillium wilt include the early season clones AO3123-2, FL Vert06, and FL Vert09; the mid-season clones A02424-83LB, AF4463-8, and W8405-1R; and the late season clones MSQ086-3 and ORO8014-4. Some clones that have been in the trial for two years (indicated as 2<sup>nd</sup> yr in the table) or three years (3<sup>rd</sup> yr) did not perform well this year. This observation supports the need to evaluate clones in multiple years.

Table 1. Performance of early season clones in the Verticillium wilt trial.

Clone	Rep	722 VW	812 VW	825 VW	AUDPC	sap	dry
AC00206-2W	1	0	10	40	250	860	200
AC00206-2W	2	5	15	25	305	115	100
AC00206-2W	3	0	0	5	18	104	8
AF4320-17 (3rd yr)	1	5	10	20	233	150	300
AF4320-17 (3rd yr)	2	5	0	0	53	153	400
AF4320-17 (3rd yr)	3	15	10	10	303	24	250
AO03123-2	1	5	40	70	738	0	50
AO03123-2	2	5	5	5	125	1	24
AO03123-2	3	0	0	10	35	2	300
ATX91137-1Ru (2nd yr)	1	20	50	90	1075	24	600
ATX91137-1Ru (2nd yr)	2	10	30	60	645	5	600
ATX91137-1Ru (2nd yr)	3	15	40	80	878	900	80
CO04067-8R/Y	1	15	30	60	698	980	.
CO04067-8R/Y	2	5	10	30	268	600	.
CO04067-8R/Y	3	15	20	50	553	824	.
COTX09022-3Ru/Re/Y	1	0	0	0	0	800	.
COTX09022-3Ru/Re/Y	2	0	0	0	0	1000	.
COTX09022-3Ru/Re/Y	3	0	0	0	0	1000	.
Red Norland	1	0	20	40	360	2067	106
Red Norland	2	0	10	30	215	1566	0
Red Norland	3	0	5	20	125	833	1
Sierra Rose (2nd yr)	1	0	0	0	0	1000	.
Sierra Rose (2nd yr)	2	0	0	0	0	220	.
Sierra Rose (2nd yr)	3	10	10	30	320	1000	.
FL Vert06	1	20	45	60	915	21	80
FL Vert06	2	5	5	15	160	1	100
FL Vert06	3	35	75	90	1508	3	2
FL Vert09	1	10	40	75	808	124	120

FL Vert09	2	0	0	0	0	24	160
FL Vert09	3	0	15	40	305	30	1
W6002-1R	1	15	25	70	678	27	20
W6002-1R	2	10	15	30	375	29	80
W6002-1R	3	5	10	25	250	300	150
W6609-3 (2nd yr)	1	0	5	15	108	71	400
W6609-3 (2nd yr)	2	15	30	40	628	0	200
W6609-3 (2nd yr)	3	10	10	10	250	1000	320

Table 1b. Performance of mid- season clones in the Verticillium wilt trial.

<b>Clone</b>	<b>Rep</b>	<b>722 VW</b>	<b>812 VW</b>	<b>825 VW</b>	<b>AUDPC</b>	<b>sap</b>	<b>dry</b>
A02424-83LB (2nd yr)	1	5	5	20	268	0	800
A02424-83LB (2nd yr)	2	10	10	10	250	12	80
A02424-83LB (2nd yr)	3	0	10	20	180	5	80
A06914-3CR	1	15	25	80	713	520	.
A06914-3CR	2	5	10	30	268	600	.
A06914-3CR	3	5	5	15	160	200	.
AC03452-2W	1	5	20	50	448	0	200
AC03452-2W	2	0	0	0	0	27	24
AC03452-2W	3	0	0	5	18	0	200
AF 4609-1	1	10	20	50	500	640	.
AF 4609-1	2	0	0	0	0	3	.
AF 4609-1	3	0	0	5	18	600	.
AF4296-3 (3rd yr)	1	15	40	70	843	920	.
AF4296-3 (3rd yr)	2	0	0	5	18	59	.
AF4296-3 (3rd yr)	3	10	10	20	285	500	.
AF4463-8 (3rd yr)	1	10	30	60	645	83	40
AF4463-8 (3rd yr)	2	10	20	40	465	1	7
AF4463-8 (3rd yr)	3	10	25	50	555	148	3
CO04099-3W/Y	1	0	0	0	0	18	64
CO04099-3W/Y	2	5	10	20	233	0	400
CO04099-3W/Y	3	0	0	0	0	5	16
MSS176-1 (2nd yr)	1	0	0	0	0	3	80
MSS176-1 (2nd yr)	2	0	0	0	0	60	200
MSS176-1 (2nd yr)	3	0	0	0	0	9	400
MSS483-1	1	10	30	50	610	10	100
MSS483-1	2	5	5	10	143	23	600
MSS483-1	3	0	0	0	0	68	4
MSS576-5SPL (2nd yr)	1	5	25	90	643	190	600
MSS576-5SPL (2nd yr)	2	5	10	35	285	36	300
MSS576-5SPL (2nd yr)	3	5	10	25	250	2	68
NDTX071109C-1W	1	15	60	80	1098	1000	.
NDTX071109C-1W	2	5	10	25	250	1400	.

NDTX071109C-1W	3	0	5	40	195	760	.
Ranger Russet	1	20	60	95	1203	811	58
Ranger Russet	2	10	20	60	535	200	128
Ranger Russet	3	5	5	20	178	1060	265
Russet Norkotah	1	40	70	90	1505	116	71
Russet Norkotah	2	15	40	80	878	500	200
Russet Norkotah	3	5	5	15	160	566	60
FL Vert04	1	0	20	25	308	4	.
FL Vert04	2	0	0	0	0	1160	.
FL Vert04	3	10	15	50	445	800	.
FL Vert07	1	5	10	40	303	448	16
FL Vert07	2	5	10	20	233	148	8
FL Vert07	3	0	0	5	18	196	40
FL Vert08	1	5	15	50	393	640	32
FL Vert08	2	0	0	5	18	3	0
FL Vert08	3	0	0	10	35	0	100
W8405-1R	1	5	20	50	448	172	80
W8405-1R	2	5	15	30	323	0	8
W8405-1R	3	5	5	5	125	0	120
W9133-1rus	1	5	5	25	195	64	.
W9133-1rus	2	5	15	30	323	1000	.
W9133-1rus	3	0	0	5	18	1000	.
White Pearl	1	0	5	10	90	1316	251
White Pearl	2	10	20	20	395	1007	200
White Pearl	3	0	0	5	18	560	75
Yukon Gold	1	0	0	0	0	295	118
Yukon Gold	2	0	0	0	0	375	165
Yukon Gold	3	0	0	0	0	1254	201

Table 1c. Performance of late- season clones in the Verticillium wilt trial.

Clone	Rep	722 VW	812 VW	825 VW	AUDPC	sap	dry
A02507-2LB (3rd yr)	1	0	5	20	125	32	16
A02507-2LB (3rd yr)	2	0	0	5	18	360	20
A02507-2LB (3rd yr)	3	5	5	5	125	0	110
AF4342-3 (2nd yr)	1	5	15	25	305	0	200
AF4342-3 (2nd yr)	2	0	0	0	0	0	600
AF4342-3 (2nd yr)	3	15	20	35	500	1000	1000
AO06070-1KF	1	5	30	60	593	94	160
AO06070-1KF	2	5	15	35	340	0	480
AO06070-1KF	3	10	20	50	500	0	300
AO06191-1	1	10	20	40	465	1000	.
AO06191-1	2	5	5	20	178	720	.
AO06191-1	3	0	5	25	143	0	.

Atlantic	1	0	0	10	35	327	88
Atlantic	2	0	0	0	0	508	0
Atlantic	3	0	0	0	0	524	800
COTX09052-2Ru	1	10	20	50	500	400	.
COTX09052-2Ru	2	10	15	40	410	200	.
COTX09052-2Ru	3	15	20	35	500	1000	.
MSQ086-3 (2nd yr)	1	25	80	95	1475	13	20
MSQ086-3 (2nd yr)	2	0	0	0	0	0	0
MSQ086-3 (2nd yr)	3	0	0	0	0	0	2
MSS206-2 (2nd yr)	1	25	75	90	1403	13	0
MSS206-2 (2nd yr)	2	20	45	80	985	7	15
MSS206-2 (2nd yr)	3	0	0	0	0	35	80
MSS487-2 (2nd yr)	1	0	10	30	215	201	10
MSS487-2 (2nd yr)	2	5	15	40	358	4	120
MSS487-2 (2nd yr)	3	5	10	25	250	7	108
OR05039-4	1	5	40	90	808	1	120
OR05039-4	2	15	15	25	410	2	320
OR05039-4	3	0	5	15	108	12	68
OR08014-4	1	20	70	95	1313	0	80
OR08014-4	2	15	60	90	1133	5	60
OR08014-4	3	5	20	50	448	24	0
POR06012-3	1	20	90	100	1550	0	48
POR06012-3	2	0	10	70	355	18	120
POR06012-3	3	10	40	70	790	7	350
Russet Burbank	1	0	0	0	0	362	225
Russet Burbank	2	0	0	0	0	92	450
Russet Burbank	3	0	0	0	0	876	50
Superior	1	0	0	0	0	2050	220
Superior	2	0	0	0	0	300	205
Superior	3	0	0	0	0	2000	400
W5955-1	1	10	25	60	590	480	48
W5955-1	2	5	10	10	198	44	120
W5955-1	3	5	10	25	250	224	13
W9433-1rus	1	5	5	5	125	480	.
W9433-1rus	2	5	5	5	125	18	.
W9433-1rus	3	5	5	5	125	520	.