

TEXAS A&M  
AGRI LIFE  
EXTENSION



Wintergarden  
Spinach  
Producers  
Board



2022 Spinach Field Day  
February 16, 2022  
10:00 a.m. – 1:00 p.m.  
Tiro Tres Farms – Crystal City, TX



**SPINACH FIELD DAY PLANTING DATES:** *White Rust* on 11/17/21; & *stemphylium anthracnose commercial variety trials* on 12/15/21  
*Photos provided by Julia Paige Ritchie, Tiro Tres Farms*

*Coordinated by: Larry Stein, Paige Ritchie and Maribel Alonzo  
Texas A&M AgriLife Extension Service*

# Dedicated To

## Allen Mize

- *Involvement in the food industry for 34 years, approximately 24 of those being at Del Monte Foods*



## Leo Contreras

- *Part of Del Monte Foods for approximately 13 years, this included assisting with the Del Monte white rust nursery trials*





## Murray Phillips

- *Devoted his life to farming and spent approximately 30 years as a grower for Del Monte Foods. He also served on the Wintergarden Spinach Producers Board*

## Ray Dabney

- *Known as the finest field man, Ray was with Del Monte Foods for approximately 32 years*



*For their notable contributions to  
the spinach industry*

# AGENDA

10:00 a.m. - 1:00 p.m.

**Larry Stein**, Introductions  
Texas A&M AgriLife Extension Service

**Ed Ritchie**, Welcome  
President of Wintergarden Spinach Producers Board

**Larry Stein**, Tour overview of the research trials, cone planter,  
white rust control trial

**Mike Phillips**, overview of fungicide control trial stemphylium,  
Cargile Consulting

**Lindsey Du Toit and Kayla Spawton**, overview of stemphylium  
screening trials  
Washington State University

**Kimberly Cochran**, overview of anthracnose inoculum  
Texas A&M AgriLife Extension Service

Field Tour of research plots

**Lunch**

*You are welcome to stay after 1:00 pm*

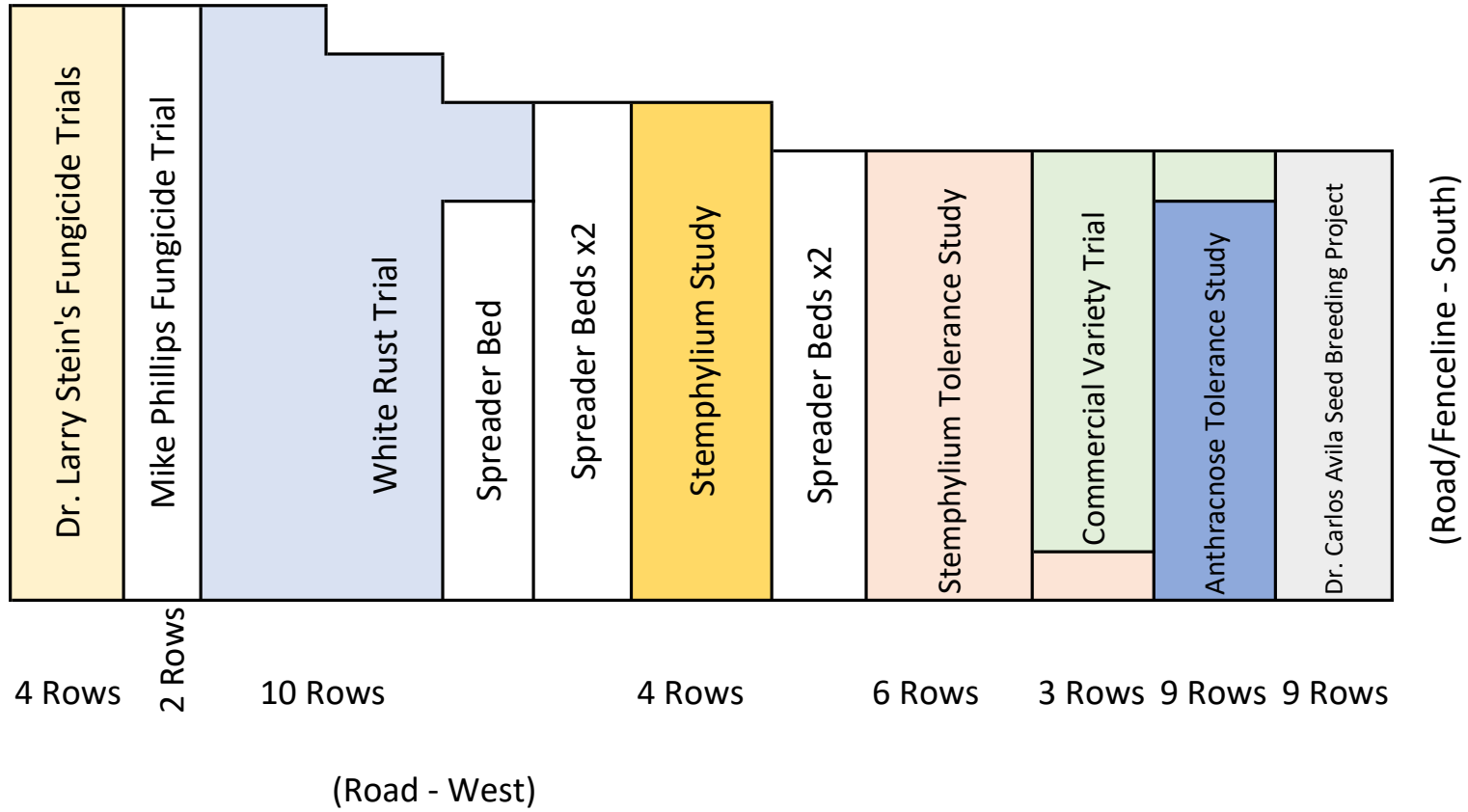


02/01/22

2022 White Rust Nursery

Photo provided by: Julia Paige Ritchie, Tiro Tres Farms

## Research Plot Layout 2021-22



# WHITE RUST TRIAL 2021-22

Plant Date: 11/17/2021



Row 2				Row 4				Row 6				Row 8				Row 10				Spreader Bed		Spreader Bed	
E113	E114	E116	E115	D113	D114	D116	D115	I17	I18	I120	I119	F95	F96	F98	F97	W35	W36	W38	W37				
E111	E112	E118	E117	D111	D112	D118	D117	I15	I16	I122	I121	F93	F94	F100	F99	W33	W34	W40	W39				
E109	E110	E120	E119	D109	D110	D120	D119	I13	I14	I124	I123	F91	F92	F102	F101	W31	W32	W42	W41				
E107	E108	E122	E121	D107	D108	D122	D121	I11	I12	I126	I125	F89	F90	F104	F103	W29	W30	W44	W43				
E105	E106	E124	E123	D105	D106	D124	D123	I9	I10	I128	I127	F87	F88	F106	F105	W27	W28	W46	W45				
E103	E104	E126	E125	D103	D104	D126	D125	I7	I8	I130	I129	F85	F86	F108	F107	W25	W26	0	W47				
E101	E102	E128	E127	D101	D102	D128	D127	I5	I6	I132	I131	F83	F84	F110	F109	W23	W24						
D175	0	F2	F1	C5	0	D130	D129	I3	I4	I134	I133	F81	F82	F112	F111	W21	W22						
D173	D174	F4	F3	C1	C2	D132	D131	I1	I2	I136	I135	E127	E128	F114	F113	W19	W20						
D171	D172	F6	F5	B5	0	D134	D133	H3	H4	I138	I137	E125	E126	F116	F115	W17	W18						
D169	D170	F8	F7	B3	B4	D136	D135	H1	H2	I140	I139	E123	E124	F118	F117	W15	W16						
D167	D168	F10	F9	B1	B2	D138	D137	G51	G52	I142	I141	E121	E122	F120	F119	W13	W14						
D165	D166	F12	F11	A5	0	D140	D139	G49	G50	I144	I143	E119	E120	G2	G1	W11	W12						
D163	D164	F14	F13	A3	A4	D142	D141	G47	G48	I146	I145	E117	E118	G4	G3	W9	W10						
D161	D162	F16	F15	A1	A2	D144	D143	G45	G46	I148	I147	E115	E116	G6	G5	W7	W8						
D159	D160	F18	F17	I75	0	D146	D145	G43	G44	I150	I149	E113	E114	G8	G7	W5	W6						
D157	D158	F20	F19	I73	I74	D148	D147	G41	G42	I152	I151	E111	E112	G10	G9	W3	W4						
D155	D156	F22	F21	I71	I72	D150	D149	G39	G40	I154	I153	E109	E110	G12	G11	W1	W2						
D153	D154	F24	F23	I69	I70	D152	D151	G37	G38	I156	I155	E107	E108	G14	G13	I75	0						
D151	D152	F26	F25	I67	I68	D154	D153	G35	G36	I158	I157	E105	E106	G16	G15	I73	I74						
D149	D150	F28	F27	I65	I66	D156	D155	G33	G34	I160	I159	E103	E104	G18	G17	I71	I72						
D147	D148	F30	F29	I63	I64	D162	D161	G31	G32	I162	I161	E101	E102	G20	G19	I69	I70						
D145	D146	F32	F31	I61	I62	D164	D163	G29	G30	I164	I163	D175	0	G22	G21	I67	I68						
D143	D144	F34	F33	I59	I60	D166	D165	G27	G28	I166	I165	D173	D174	G24	G23	I65	I66						
D141	D142	F36	F35	I57	I58	D168	D167	G25	G26	I168	I167	D171	D172	G26	G25	I63	I64						
D139	D140	F38	F37	I55	I56	D170	D169	G23	G24	I170	I169	D169	D170	G28	G27	I61	I62						
D137	D138	F40	F39	I53	I54	D172	D171	G21	G22	I172	I171	D167	D168	G30	G29	I59	I60						
D135	D136	G2	G1	I51	I52	D174	D173	G19	G20	I174	I173	D165	D166	G32	G31	I57	I58						
D133	D134	G4	G3	I49	I50	0	D175	G17	G18	0	I175	D163	D164	G34	G33	I55	I56						
D131	D132	G6	G5	I47	I48	E102	E101	G15	G16	A2	A1	D161	D162	G36	G35	I53	I54						
D129	D130	G8	G7	I45	I46	E104	E103	G13	G14	A4	A3	D159	D160	G38	G37	I51	I52						
D127	D128	G10	G9	I43	I44	E106	E105	G11	G12	0	A5	D157	D158	G40	G39	I49	I50						
D125	D126	G12	G11	I41	I42	E108	E107	G9	G10	B2	B1	D155	D156	G42	G41	I47	I48						
D123	D124	G14	G13	I39	I40	E110	E109	G7	G8	0	B3	D153	D154	G44	G43	I45	I46						
D121	D122	G16	G15	I37	I38	E112	E111	G5	G6	C2	C1	D151	D152	G46	G45	I43	I44						
D119	D120	G18	G17	I35	I36	E114	E113	G3	G4	0	B5	D149	D150	G48	G47	I41	I42						
D117	D118	G20	G19	I33	I34	E116	E115	G1	G2	C4	C3	D147	D148	G50	G49	I39	I40						
D115	D116	G22	G21	I31	I32	E118	E117	F79	F80	0	C5	D145	D146	G52	G51	I37	I38						
D113	D114	G24	G23	I29	I30	E120	E119	F77	F78	D102	D101	D143	D144	H2	H1	I35	I36						
D111	D112	G26	G25	I27	I28	E122	E121	F75	F76	D104	D103	D141	D142	H4	H3	I33	I34						
D109	D110	G28	G27	I25	I26	E124	E123	F73	F74	D106	D105	D139	D140	I2	I1	I31	I32						
D107	D108	G30	G29	I23	I24	E126	E125	F71	F72	D110	D109	D137	D138	I4	I3	I29	I30						
D105	D106	G32	G31	I21	I22	E128	E127	F69	F70	D112	D111	D135	D136	I6	I5	I27	I28						
D103	D104	G34	G33	I19	I20	F42	F41	F67	F68	D114	D113	D133	D134	I8	I7	I25	I26						
D101	D102	G36	G35	I17	I18	F44	F43	F65	F66	D116	D115	D131	D132	I10	I9	I23	I24						
C5	0	G38	G37	I15	I16	F46	F45	F63	F64	D118	D117	D129	D130	I12	I11	I21	I22						
C3	C4	G40	G39	I13	I14	F48	F47	F61	F62	D120	D119	D127	D128	I14	I13	I19	I20						
C1	C2	G42	G41	I11	I12	F50	F49	F59	F60	D122	D121	D125	D126	I16	I15	I17	I18						
B5	0	G44	G43	I9	I10	F52	F51	F57	F58														
B3	B4	G46	G45	I7	I8	F53	F54	F55	F56														
B1	B2	G48	G47	I5	I6																		
A5	0	G50	G49	I3	I4																		
A3	A4	G52	G51	I1	I2																		
A1	A2	H2	H1	H3	H4																		
Row 1				Row 3				Row 5				Row 7				Row 9							

\* Planter was plugged

# STEMPHYLUM PI TRIAL 2021-22

Plant Date: 11/17/2021



Spreader Bed	Spreader Bed	89	90	Row 2				Row 4		Spreader Bed	Spreader Bed
		87	88	92	91	263	264	266	265		
		85	86	94	93	261	262	268	267		
		83	84	96	95	259	260	270	269		
		81	82	98	97	257	258	272	271		
		79	80	100	99	255	256	274	273		
		77	78	102	101	253	254	276	275		
		75	76	104	103	251	252	278	277		
		73	74	106	105	249	250	280	279		
		71	72	108	107	247	248	282	281		
		69	70	110	109	245	246	284	283		
		67	68	112	111	243	244	286	285		
		65	66	114	113	241	242	288	287		
		63	64	116	115	239	240	290	289		
		61	62	118	117	237	238	292	291		
		59	60	120	119	235	236	294	293		
		57	58	122	121	233	234	296	295		
		55	56	124	123	231	232	298	297		
		53	54	126	125	229	230	300	299		
		51	52	128	127	227	228	302	301		
		49	50	130	129	225	226	304	303		
		47	48	132	131	223	224	306	305		
		45	46	134	133	221	222	308	307		
		43	44	136	135	219	220	310	309		
		41	42	138	137	217	218	312	311		
		39	40	140	139	215	216	314	313		
		37	38	142	141	213	214	316	315		
		35	36	144	143	211	212	318	317		
		33	34	146	145	209	210	320	319		
		31	32	148	147	207	208	322	321		
29	30	150	149	205	206	324	323				
27	28	152	151	203	204	326	325				
25	26	154	153	201	202	328	327				
23	24	156	155	199	200	330	329				
21	22	158	157	197	198	332	331				
19	20	160	159	195	196	0	333				
17	18	162	161	193	194	Spreader Bed					
15	16	164	163	191	192						
13	14	166	165	189	190						
11	12	168	167	187	188						
9	10	170	169	185	186						
7	8	172	171	183	184						
5	6	174	173	181	182						
3	4	176	175	179	180						
1	2	178	177								
Row 1				Row 3							

# STEMPHYLIUM/COMMERCIAL/ANTHRACNOSE TRIAL LAYOUT 2021-22

Plant Date: 12/15/2021

Spreader Bed

Spreader Bed

28	29	30
25	26	27
22	23	24
19	20	21
16	17	18
13	14	15
10	11	12
7	8	9
4	5	6
1	2	3
85	86	87
82	83	84
79	80	81
76	77	78
73	74	75
70	71	72
67	68	69
64	65	66
61	62	63
58	59	60
55	56	57
52	53	54
49	50	51
46	47	48
43	44	45
40	41	42
37	38	39
34	35	36
31	32	33
28	29	30
25	26	27
22	23	24
19	20	21
16	17	18
13	14	15
10	11	12
7	8	9
4	5	6
1	2	3

33	32	31
36	35	34
39	38	37
42	41	40
45	44	43
48	47	46
51	50	49
54	53	52
57	56	55
60	59	58
63	62	61
66	65	64
69	68	67
72	71	70
75	74	73
78	77	76
81	80	79
84	83	82
87	86	85
3	2	1
6	5	4
9	8	7
12	11	10
15	14	13
18	17	16
21	20	19
24	23	22
27	26	25
30	29	28
33	32	31
36	35	34
39	38	37
42	41	40
45	44	43
48	47	46
51	50	49
54	53	52
57	56	55
60	59	58



Stemphyllium



Commercial



Anthracnose

13	14	15
10	11	12
7	8	9
4	5	6
1	2	3
28	29	30
25	26	27
22	23	24
19	20	21
16	17	18
13	14	15
10	11	12
7	8	9
4	5	6
1	2	3
28	29	30
25	26	27
22	23	24
19	20	21
16	17	18
13	14	15
10	11	12
7	8	9
4	5	6
1	2	3
85	86	87
82	83	84
79	80	81
76	77	78
73	74	75
70	71	72
67	68	69
64	65	66
61	62	63
58	59	60
55	56	57
52	53	54
49	50	51
46	47	48
43	44	45
40	41	42
37	38	39
34	35	36
31	32	33
28	29	30
25	26	27
22	23	24
19	20	21
16	17	18
13	14	15
10	11	12
7	8	9
4	5	6
1	2	3
85	86	87
82	83	84
79	80	81
76	77	78
73	74	75
70	71	72
67	68	69
64	65	66
61	62	63

18	17	16
21	20	19
24	23	22
27	26	25
30	29	28
3	2	1
6	5	4
9	8	7
12	11	10
15	14	13
18	17	16
21	20	19
24	23	22
27	26	25
30	29	28
33	32	31
36	35	34
39	38	37
42	41	40
45	44	43
48	47	46
51	50	49
54	53	52
57	56	55
60	59	58
63	62	61
66	65	64
69	68	67
72	71	70
75	74	73
78	77	76
81	80	79
84	83	82
87	86	85

85	86	87
82	83	84
79	80	81
76	77	78
73	74	75
70	71	72
67	68	69
64	65	66
61	62	63
58	59	60
55	56	57
52	53	54
49	50	51
46	47	48
43	44	45
40	41	42
37	38	39
34	35	36
31	32	33
28	29	30
25	26	27
22	23	24
19	20	21
16	17	18
13	14	15
10	11	12
7	8	9
4	5	6
1	2	3

3	2	1
6	5	4
9	8	7
12	11	10
15	14	13
18	17	16
21	20	19
24	23	22
27	26	25
30	29	28
33	32	31
36	35	34
39	38	37
42	41	40
45	44	43
48	47	46
51	50	49
54	53	52
57	56	55
60	59	58
63	62	61
66	65	64
69	68	67
72	71	70
75	74	73
78	77	76
81	80	79
84	83	82
87	86	85





# Commercial Trial

Plant Date: 12/15/2021

Plant Population: 1.5 mil



	Seed Company	Variety	Germ	Seedcount	Treated
1	Enza Zaden	1076		60,000	No
2	Rijk Zwaan	51-370	90	55,027	No
3	Sakata	Countryside	87	52,911	No
4	Sakata	SSP9621	97	51,718	Yes
5	Nunhems BASF	Tabit		46,408	No
6	Pop Vriend	PV-1712	99	46,327	
7	Nunhems BASF	Corvus		46,239	No
8	Bejo	Patton	92	45,352	No
9	Bejo	Space	92	43,130	No
10	Enza Zaden	Traverse		42,696	No
11	Enza Zaden	Frontier		42,361	No
12	Bejo	Spiros	92	41,314	No
13	Pop Vriend	PV-1724	93	40,177	
14	Rijk Zwaan	Tarsier (51-728)	93	39,831	No
15	Pop Vriend	PV-1723	92	39,478	
16	Pop Vriend	PV-1713	97	38,803	
17	Pop Vriend	PV-1720	99	37,521	
18	Sakata	Seaside	98	36,943	No
19	Rijk Zwaan	51-727	86	35,809	No
20	Sakata	C2-606	97	35,118	Yes
21	Rijk Zwaan	51-733		33,677	No
22	Nunhems BASF	7553		32,000	No
23	Nunhems BASF	Octans		31,188	No
24	Rijk Zwaan	Bonnethead (51-722)	95	30,385	No
25	Bejo	3548	90	30,059	No
26	Enza Zaden	Crosstrek		29,550	No
27	Bejo	Responder	90	29,510	No
28	Nunhems BASF	Crater		28,958	No
29	Sakata	Riverside	89	28,544	No
30	Enza Zaden	Trailboss		28,306	No

# Stemphylium/Anthracnose Tolerance Trial

Plant Date: 12/15/2021

Plant Population: 1.5 mil



	Seed Company	Variety	Germ	Seedcount	Treated
1	Nunhems BASF	Tabit		20,624	No
2	Nunhems BASF	Serpens		20,915	No
3	Nunhems BASF	Sculptur		21,248	No
4	Nunhems BASF	Alcor		21,319	No
5	Rijk Zwaan	51-369	91	23,969	No
6	Pop Vriend	Mandolin	94	24,674	
7	Seminis/Bayer	SV6203VB	90	24,706	No
8	Nunhems BASF	Regor		24,756	No
9	Seminis/Bayer	5873-Motutapu	87	25,669	Yes
10	Rijk Zwaan	Silverwhale (51-300)	89	27,234	Yes
11	Pinnacle	San Juan	95	28,138	No
12	Pop Vriend	Austin	95	28,199	
13	Enza Zaden	Trailboss		28,306	No
14	Sakata	C2-606	93	28,410	No
15	Sakata	Riverside	89	28,544	No
16	Rijk Zwaan	Hammerhead (51-708)	90	28,781	No
17	Seminis/Bayer	Melville	93	29,120	No
18	Bejo	Responder	90	29,510	No
19	Enza Zaden	Crosstrek		29,550	No
20	Sakata	Oceanside	89	29,891	No
21	Bejo	3548	90	30,059	No
22	Rijk Zwaan	Cugoe (51-717)	94	30,119	No
23	Rijk Zwaan	Bonnethead (51-722)	95	30,385	No
24	Nunhems BASF	Formax		30,478	No
25	Nunhems BASF	Minkar		30,550	No
26	Nunhems BASF	Aries		30,773	No
27	Nunhems BASF	Octans		31,253	No
28	Nunhems BASF	NUN 4404 Palco		31,552	No
29	Rijk Zwaan	Eland (51-528)	90	31,829	No
30	Nunhems BASF	Lacerta		31,842	No
31	Nunhems BASF	Nun 05049		32,407	No
32	Nunhems BASF	Nun 07549		31,253	No
33	Rijk Zwaan	Vicuna (51-723)		35,426	No
34	Rijk Zwaan	Lizard (51-347)	95	35,865	No
35	Seminis/Bayer	Magnetic	95	36,000	No
36	Rijk Zwaan	51-372	95	36,586	No
37	Pop Vriend	Viroflay	95	36,911	
38	Sakata	Seaside	98	36,943	No
39	Seminis/Bayer	Kona		38,000	No
40	Rijk Zwaan	Sunangel (51-719)	92	38,024	No
41	Seminis/Bayer	Java	91	38,166	No
42	Seminis/Bayer	SV3580VC	94	38,852	No
43	Rijk Zwaan	Budgerigar (51-721)		38,901	No
44	Seminis/Bayer	SV2146VB	98	39,347	No

45	Rijk Zwaan	Tarsier (51-728)	93	39,831	No
46	Rijk Zwaan	Bonobo (51-353)	89	40,052	No
47	Seminis/Bayer	SV2157VB	95	40,148	No
48	Seminis/Bayer	Avenger	92	40,212	No
49	Rijk Zwaan	Parakeet (51-715)	93	40,982	No
50	Bejo	Spiros	92	41,314	No
51	Seminis/Bayer	Molokai	91	41,353	No
52	Rijk Zwaan	Salamander (51-363)	95	41,844	No
53	Enza Zaden	Frontier		42,361	No
54	Rijk Zwaan	Fantail (51-358)	92	42,487	Yes
55	Enza Zaden	Traverse		42,696	No
56	Rijk Zwaan	Blobfish (51-534)		43,056	No
57	Bejo	Space	92	43,130	No
58	Rijk Zwaan	Kodiak (51-359)	95	43,944	No
59	Rijk Zwaan	Platypus (51-707)	96	44,422	No
60	Pop Vriend	Laredo	93	44,510	
61	Pop Vriend	PV1664	87	44,950	
62	Bejo	Patton	92	45,352	No
63	Pop Vriend	Cocopah	94	45,400	
64	Pop Vriend	Colusa	95	45,957	Yes
65	Sakata	Lakeside	98	46,089	No
66	Nunhems BASF	Corvus		46,239	No
67	Pop Vriend	PV1569	97	46,327	
68	Mission	Breezer	93	46,387	No
69	Nunhems BASF	Crater		47,405	No
70	Rijk Zwaan	Spoonbill (51-716)		47,761	No
71	Rijk Zwaan	51-727	80	48,450	No
72	Nunhems BASF	NUN 04034 Hydrus		49,060	No
73	Nunhems BASF	NUN 01084 Scorpius		49,773	No
74	Enza Zaden	1076		50,000	No
75	Rijk Zwaan	Cabezon (51-718)	92	50,466	No
76	Nunhems BASF	Nimbus		50,569	No
77	Nunhems BASF	NUN 01240 Callisto		50,834	No
78	Nunhems BASF	NUN 05013 Canopus		51,725	No
79	Sakata	Countryside	87	52,911	No
80	Rijk Zwaan	51-370	90	55,027	No
81	Nunhems BASF	Dracus		57,843	No

	<b>Seed Company</b>	<b>Variety</b>	<b>Germ</b>	<b>Seedcount</b>	<b>Treated</b>
82	Pinnacle	308		19,976	No
83	Seminis/Bayer	Vancouver	94	25,540	Yes
84	Rijk Zwaan	Baboon (51-529)	86	28,184	Yes
85	Seminis/Bayer	Molokai	97	28,710	Yes
86	Seminis/Bayer	SV3580VC	90	39,789	Yes
87	Seminis/Bayer	Solomon	81	40,284	Yes

(82-87 Planted at 500,000 plant population for processing)

**Stemphylium Leaf Spot of Spinach:  
Susceptibility of Cultivars to *Stemphylium vesicarium*, Resistance of the Pathogens to Strobilurin  
(FRAC group 11) Fungicides, and the Potential for Onion to Serve as a Host Crop**

Kayla Spawton & Lindsey du Toit, February 2022  
Washington State University Northwestern Washington Research & Extension Center

- **Background:** Historically, Stemphylium leaf spot of spinach was thought to be caused by the fungus *Stemphylium botryosum*. However, isolations completed in du Toit's lab at Washington State University (WSU) and Correll's lab at the University of Arkansas (UA) over the last five years from spinach crops in Arizona, California, Florida, and Texas revealed there are at least two species of *Stemphylium* that can cause this disease: 1) *S. vesicarium*, and 2) *S. beticola*. The isolates previously identified as *S. botryosum* are now known to be *S. beticola*, a species first described in 2017 from sugar beet crops in the Netherlands.
- ***Stemphylium vesicarium* is the predominant species causing Stemphylium leaf spot of spinach in the Wintergarden area of Texas:** Over the past four years, *S. vesicarium* was the cause of Stemphylium leaf spot symptoms on almost all of the spinach samples received at Washington State University from the Wintergarden area of Texas (including 11 samples from the 2018-19 season, 11 from 2019-20, 2 from 2020-21, and 2 from 2021-22) Only one TX spinach sample was infected with *S. beticola*.
- **Resistance of *Stemphylium vesicarium* isolates to strobilurin (FRAC group 11) fungicides:** Isolates of *S. vesicarium* from spinach and onion, as well as isolates of *S. beticola* from spinach were tested in the lab for sensitivity to two FRAC group 11 fungicides commonly used in spinach crops: azoxystrobin (e.g., Quadris) and pyraclostrobin (e.g., Cabrio). Most *S. vesicarium* isolates were from spinach crops in Texas and Florida, and all were far less sensitive to both fungicides than the isolates of *S. beticola* (**Fig. 1**). The results were confirmed with greenhouse studies in which plants were sprayed with Quadris, Cabrio, or water and then inoculated with *S. vesicarium*. Neither of the fungicides was effective against the isolates of *S. vesicarium*. This explains why spinach growers in Texas have had difficulty controlling Stemphylium leaf spot with strobilurin fungicides.
- **Susceptibility of spinach cultivars to Stemphylium leaf spot and white rust:** In 2020-21, 79 spinach cultivars were planted in a field trial in La Pryor, TX (three replicate plots per cultivar) and inoculated with *S. vesicarium* to identify cultivars with resistance. White rust also developed in the trial from natural infection. Each plot was rated for severity of white rust eight weeks after planting, and severity of Stemphylium leaf spot a week later (on a 1 to 10 scale, with 1 = no symptoms and 10 = 100% of the leaves symptomatic). There was a wide range in severity of symptoms among cultivars ( $P < 0.001$ ) for both diseases (**Fig. 2**). Severity of Stemphylium leaf spot averaged 2.9 over the trial (ranged from 1.0 to 8.0 per plot). Of the 79 cultivars, 21 had no symptoms (mean severity of 1.0), 30 were partially resistant (1.1 to 3.0), 6 had moderate ratings (3.1 to 5.0), and 22 were susceptible (5.1 to 7.0) (**Fig. 1A**). White rust severity averaged 4.0 (range of 1.0 to 10.0 per plot). Five cultivars did not develop white rust (mean of 1.0), 24 were partially resistant (1.1 to 3.0), 29 had moderate ratings (3.1 to 5.0), 14 were partially susceptible (5.1 to 7.0), and 7 were highly susceptible (7.1 to 8.7) (**Fig. 1B**). No cultivar was completely resistant to both diseases. Salamander, PV 1569, Colusa, Sunangel, Spiros, Baboon, and Fantail had mean ratings  $\leq 2.0$  for both diseases.
- **Onion is a symptomatic host of *Stemphylium* isolates from spinach:** Isolates of *S. beticola* and *S. vesicarium* from spinach fields in California, Texas, and Washington, and an isolate of *S. vesicarium* from an onion crop in Washington, all caused leaf spots and leaf dieback on the onion cv. Hamilton in a greenhouse trial. The most severe symptoms were caused by the Washington onion isolate of *S.*

*vesicarium*. The results suggest onion may be a host for isolates of *S. vesicarium* in areas where spinach and onion are grown in proximity.

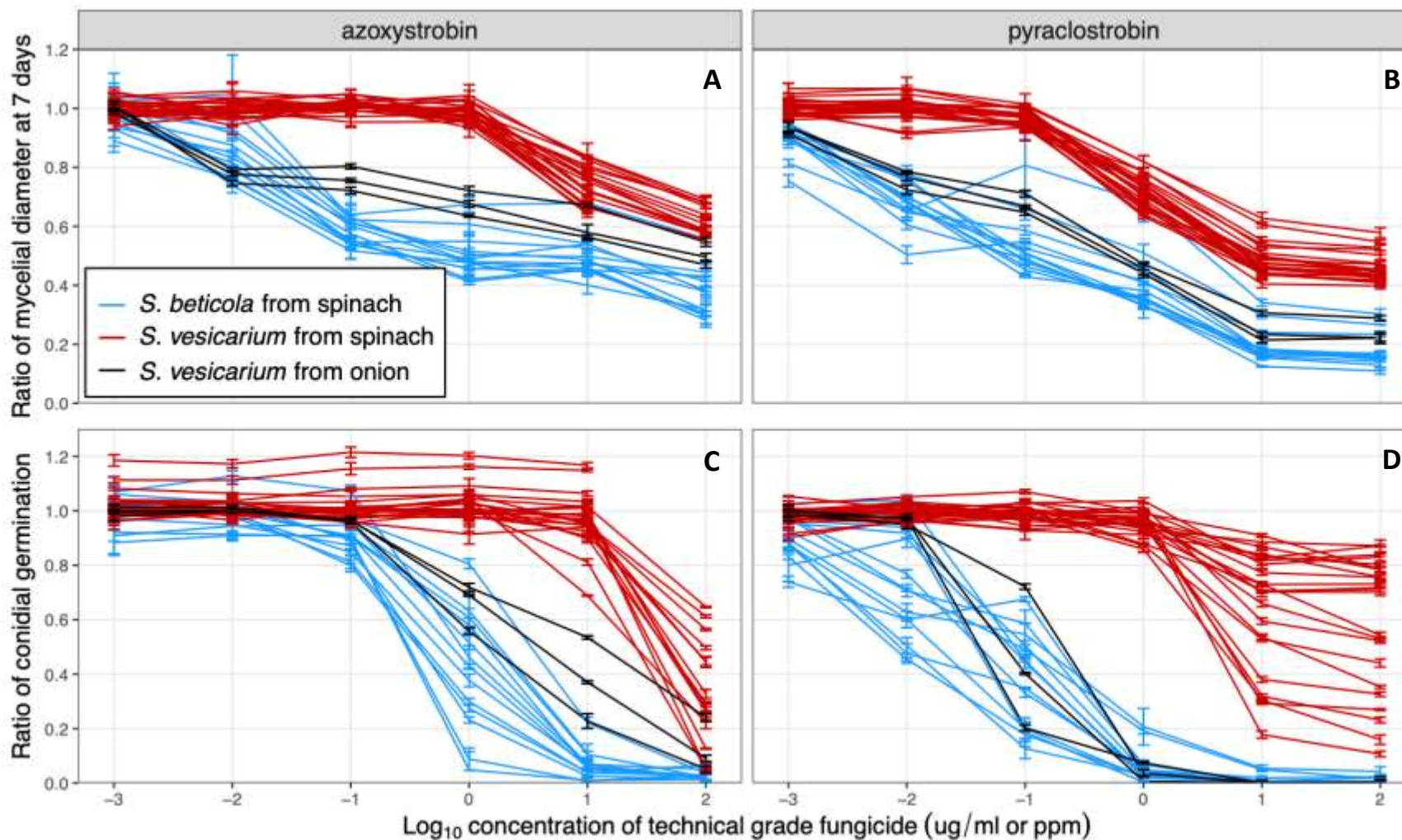
- **Ongoing research:** Two field trials were planted in the Texas Wintergarden area in late 2021 to evaluate the reactions of: 1) 333 Plant Introduction (PI) lines from the USDA spinach germplasm collection, and 2) 87 spinach cultivars for relative susceptibility to *S. vesicarium*. The cultivar trial is a repeat of the 2020-21 trial (**Fig. 2**) with additional cultivars. Furthermore, we are examining the diversity of *Stemphylium* species associated with spinach seed, and the genetic diversity of *S. vesicarium* isolates from spinach seed grown in all the main regions of the world where seed is produced. We also are comparing populations of *S. vesicarium* from symptomatic spinach crops in Texas to the seed lots used to plant those crops. This research will help us understand the potential distribution of isolates on seed and the potential relative significance of seedborne inoculum in outbreaks of the disease.

### **Acknowledgements**

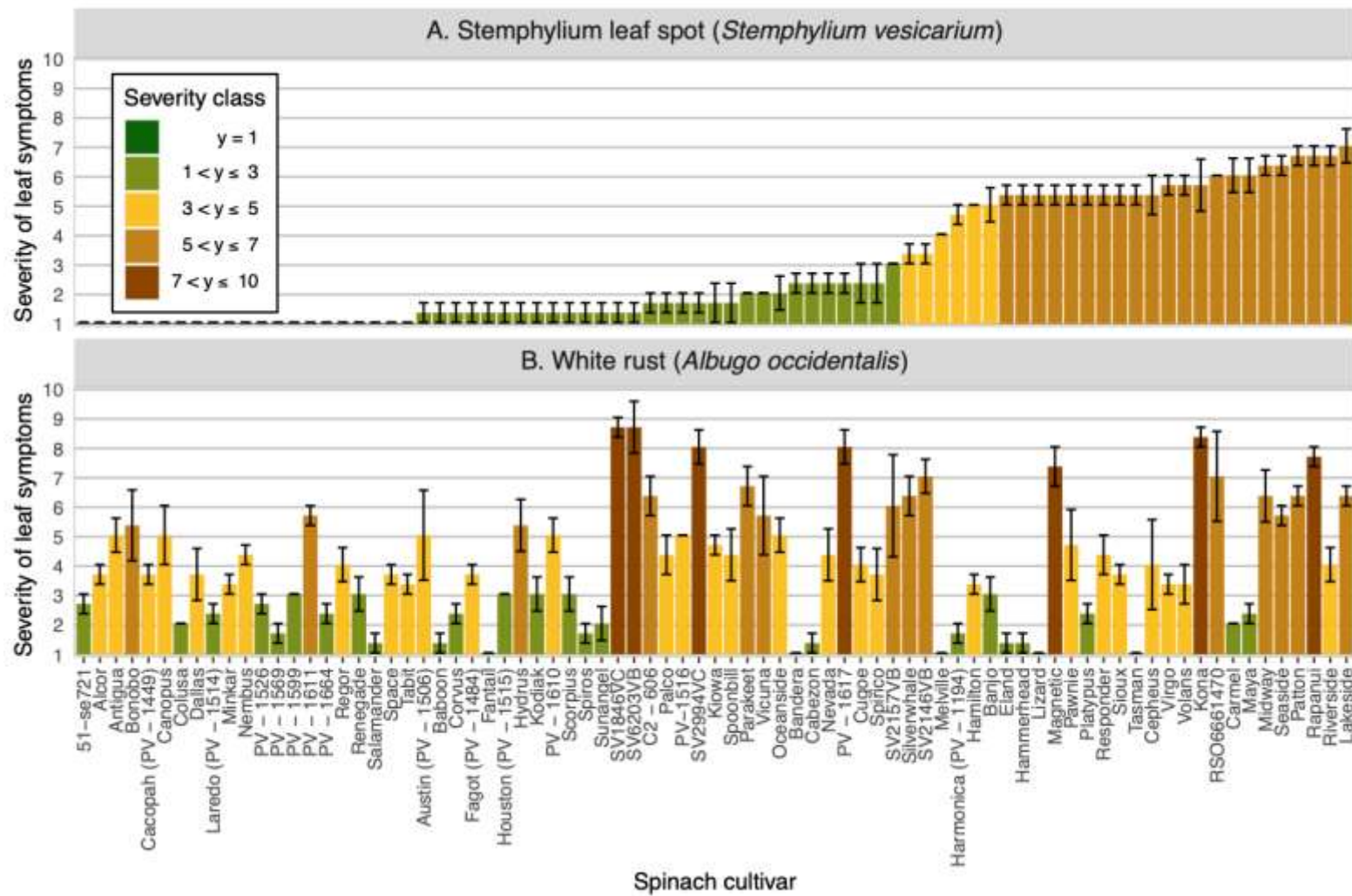
We thank the Texas Wintergarden Spinach Producers' Board, Puget Sound Seed Growers' Association, Washington State Commission on Pesticide Registration, and ARCS Foundation for funding this project; seed company personnel, seed growers, crop consultants, and other agricultural companies for in-kind support; and the Vegetable Seed Pathology team at Washington State University (Michael Derie, Sanjaya Gyawali, Paul Morgan, Eliza Mae Andrews, Alex Batson, Ryan Solemslie, Marilen Nampijja, Tomasita Villaroel, and Babette Gundersen) for technical support. We also acknowledge the hard work of our collaborators in Texas, including Dr. Larry Stein, Ed and Paige Ritchie, Jimmy Crawford, and their respective teams who made the field trials possible.

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**Fig. 1.** Mycelial growth (A and B) and spore germination (C and D) of 23 isolates of *Stemphylium vesicarium* from spinach (red lines), 13 isolates of *S. beticola* from spinach (blue lines), and 3 isolates of *S. vesicarium* from onion (black lines) growing on agar medium amended with technical grade azoxystrobin (A and C) or pyraclostrobin (B and D) at 0.001, 0.01, 0.1, 1, 10, and 100 ppm. The ratios for mycelial growth and conidial germination were calculated as the colony diameter or percentage spore germination of each isolate on agar medium at each fungicide concentration divided by the colony diameter or percentage spore germination, respectively, of that isolate on agar medium not amended with fungicide.



**Fig. 2.** Mean severity of *Stemphylium* leaf spot caused by *Stemphylium vesicarium* (A) and white rust caused by *Albugo occidentalis* (B) for each of 79 spinach cultivars in a field trial in La Pryor, TX in 2020-21. Disease ratings were completed 9 and 8 weeks after planting, respectively, on a scale of 1 to 10 (1 = no symptoms, and 10 = 90-100% of the canopy with symptoms). Each cultivar was planted in three replicate plots, with each plot 10 feet long x 1 bed wide. Plots were inoculated with a mix of three isolates of *S. vesicarium* from TX. White rust developed as a result of natural infection. Cultivars are arranged in the same order in A and B to highlight differences in susceptibility to the two diseases. Ratings are color-coded based on mean severity of symptoms for each disease.

**Cargile Consulting****Trial ID: SPINACH 2022 Location: Trial Year: 2021****Protocol ID: Investigator (Creator): Mike Phillips, Cargile Consulting**

<b>No.</b>	<b>Name Type</b>	<b>Rate Unit</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
1	UNTREATED CHECK		101	203	309	409
2.	LUNA SENSATION FL	7 FL OZ/A	102	210	307	409
3.	MERIVON FL	7 FL OZ/A	103	206	301	402
4.	REASON FL	7 FL OZ/A	104	201	308	407
5.	MIRAVIS PRIME FL	13.4 FL OZ/A	105	211	305	412
6.	MIRAVIS PRIME FL +ACTIGARD WG	13.4 FL OZ/A 0.38 OZ WT/A	106	204	311	403
7.	MIRAVIS PRIME FL +PROPHYTE FL	13.4 FL OZ/A 48 FL OZ/A	107	208	306	401
8.	MIRAVIS PRIME FL +LIFEGARD WG	13.4 FL OZ/A 1 FL OZ/A	108	202	303	406
9.	CABRIO WG	16 OZ WT/A	109	207	302	408
10.	INSPIRE EC	7 FL OZ/A	110	212	304	410
11.	INSPIRE SUPER FL	20 OZ/A	111	209	310	405
12.	VELTYMA BAS 751 FL	10 FL OZ/A	112	205	312	411



## 2021 - 2022 Spinach Fungicide Trial for White Rust Control

Larry A. Stein, Texas A&M AgriLife Extension Service

	TREATMENT
1.	Untreated check
2.	Life Gard 2 oz alt. Merivon 7 oz alt. Miravis Prime 13.4 alt. Merivon
3.	Life Gard 2 oz alt. Presidio 3 oz alt. Merivon 7 oz alt. Presidio
4.	Life Gard 2 oz alt. Merivon 7 oz alt. Reason 7 oz alt. Merivon
5.	BAS 751 (Veltzman) 10 oz/A
6.	Life Gard 2 oz alt. Prophyt 1.5 qts/A alt. Oso 8.5 oz alt. Prohyt
7.	Miravis Prime 13.4 oz/A (.25% NIS) alt. Switch 14 oz/A alt. Orondis Ultra 8 oz (.25% NIS) alt. Miravis Prime 13.4 oz/A (.25% NIS) alt. Switch 14 oz/A
8.	Miravis Prime 13.4 oz/A (NIS) + Actigard .38 oz/A alt. Switch 14 oz/A + Actigard .38 oz/A alt. Orondis Ultra 8 oz/A + Actigard .38 oz/A alt. Miravis Prime + Actigard (as before) alt. Switch + Actigard (as before)

## ***Colletotrichum spinaciae* Infested Oat Inoculum Protocol**

**Kimberly Cochran, Ph.D.**

**Plant Pathology Extension Specialist and Assistant Professor**

**Texas A&M University, AgriLife Extension**

Field trial inoculation is an important aspect of conducting product efficacy trials and variety trials so that even disease pressure can be achieved for comparison across treatments and varieties. In my early spinach pathology efforts, I found an older protocol<sup>1</sup> that used glass flasks to create *Colletotrichum* sp. inoculum, which made breaking up clumps of fungal growth and getting inoculum out of flasks very difficult. Additionally, limited lab space was an issue that made large scale inoculum production with flasks a challenge in my lab. Consequently, I utilized components of the older protocol with my knowledge of creating large amounts of inoculum in past research with the goal of creating inoculum that was more easily scaled up or down for different project needs with evenly colonized consistent quality inoculum, all while being affordable, user friendly, and easily reproducible.

### **Supplies:**

- Single spore isolate *Colletotrichum spinaciae* culture- several plates (1/3 plate/bag of inoculum)
- Scalpels
- Autoclave
- Autoclave indicator strips
- Impulse sealer
- Metal center twist ties
- Aluminum foil
- Permanent marker
- Distilled or reverse osmosis water (500 ml/ 1190 g (42 oz, one large container) of oats)
- Mushroom spawn bags, vented (Fig 1) Use 0.2 micron size vent only, available online.
- Old fashioned oats, sufficient for project plus 10% extra. Must be old fashioned oats\*, NOT instant oats.

\*Raw oats (ex: animal feed) or steel cut oats are also suitable. However, I find the old-fashioned oats crumble well for hand spreading inoculum. Animal feed grade oats may need sifting prior to use.

## Instructions:

1. Place 1190 g (a single large 42 oz container) of oats in a 8" x 5" x 19" large size 0.2 micron vented spawn bag, LOOSELY close and secure with a twist tie. Loosely cover openings with foil, place on an autoclave tray, and autoclave twice on a 60 min dry cycle, 24 hr apart. Place a fresh autoclave indicator strip in the autoclave for each cycle. Cool completely. Keep sterile until use.
  - a. It is important to use a vented bag and not seal it tightly before autoclaving. Failing to do so can result in the bag popping or compromising the vent filter or seams.
  - b. While these bags can hold more, I find they perform better if you leave ample space for mixing/shaking the bags later.
  - c. Be mindful to not overload your autoclave with spawn bags. Only place bags in a single layer, preferably with a bit of space between, the quantity varies by autoclave model obviously.
2. Autoclave distilled water (500ml per 1190g (42 oz) container of oats used), twice 24 hr apart and cool completely. Keep sterile until use.
3. In a laminar flow hood or other sterile work space, add sterile water so oats are moist but not saturated using sterile technique. Close the bag and shake vigorously for approx. 30 sec so that water coats the oats and doesn't settle in the bottom.
4. Using aseptic technique, cut 1/3 of a 100mm petri dish culture into small (3-4mm squares) pieces and place into the spawn bag with the oats and water.
  - a. More or less culture material can be used, which will affect the time it takes for oats to become fully colonized.
5. Promptly seal with the impulse sealer and shake vigorously to evenly distribute moisture and fungal culture pieces.
  - a. I prefer to double seal bags for more durability during later mixing steps.
6. Label each bag with date and fungal isolate information and lay flat on a clean surface.
7. Incubate infested oat inoculum at or slightly above room temperature. Shake inoculum bags and break up clumps of colonized oats every other day. Inoculum should be ready in about 14-20 days, depending on incubation temperature (optimal approx. 77-80°F; 24-26.5°C). Bags should look like Fig. 2 during this process.
8. Infested oat inoculum is ready for use when you see dark fungal growth evenly throughout the oats. If I am using more than one bag I bulk the inoculum in a large container to ensure uniformity for the experiment, breaking up any clumps larger than a pea as I go. Rubbing inoculum over a mesh screen in a frame may be helpful in this step.
9. Spread infested oat inoculum evenly through the desired plot(s) with a gloved hand.
  - a. I typically use approx. ½ cup per 10 x 2 ft. plot section, but this may vary by project goals. I use a scoop so that each plot gets the same quantity.
  - b. Prior to use I weigh the infested oat inoculum in the scoop, then dry this and weigh it again for my records.

**Tips to ensure success:**

- Empty and combine bags of inoculum no earlier than the night before inoculation for optimal quality.
- If facing cooler than ideal temperatures for the fungus, inoculate plants with adequate growth so that the canopy is fairly closed to protect the inoculum from the elements.
- Irrigate after inoculation with overhead sprinkler irrigation lightly every day (ideally afternoon) for 5 days for best results. This fungus thrives with moist conditions.



Fig 1: Mushroom spawn bag with 0.2 micron vent. I use 8" X 5" X 19" size.



Fig 2: Infested oat inoculum during the incubation process.

<sup>1</sup>Original Colletotrichum oat inoculum by John Damicone, Ph.D., modified by Kimberly Cochran, Ph.D.

# WHITE RUST RATINGS

Date: 1/13/2022

	Rep 1	Rep 2	Rep 3
A1	4	3	7
A2	x	7	8
A3	4	4	7
A4	x	5	7
A5	6	7	6

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
	5	4	4
	x	8	8
	3	4	6
	x	5	8
	5	5	7

Date: 1/13/2022

	Rep 1	Rep 2	Rep 3
B1	8	8	9
B2	x	7	8
B3	6	8	8
B4	x	8	7
B5	7	8	8

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
	8	8	8
	x	8	8
	7	4	7
	x	6	6
	8	8	8

Date: 1/13/2022

	Rep 1	Rep 2	Rep 3
C1	6	7	7
C2	x	8	7
C3	8	7	7
C4	x	9	8
C5	8	8	8

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
	5	5	6
	x	5	8
	5	4	7
	x	6	8
	7	8	8

Date: 1/13/2022

	Rep 1	Rep 2	Rep 3
D1	3	8	7
D2	x	7	6
D3	1	2	2
D4	x	3	8
D5	4	6	6
D6	x	7	8
D7	6	7	8
D8	x	8	8
D9	1	5	3
D10	x	5	6
D11	4	4	6

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
	7	8	8
	x	7	7
	2	3	3
	x	6	7
	4	5	4
	x	6	7
	5	6	7
	x	6	7
	3	4	5
	x	5	7
	4	5	6

# WHITE RUST RATINGS

Date: 1/13/2022

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
D12	x	3	3
D13	3	4	6
D14	x	7	7
D15	4	8	6
D16	x	7	7
D17	6	8	8
D18	x	8	7
D19	4	6	3
D20	x	4	6
D21	6	8	8
D22	x	7	8
D23	2	5	6
D24	x	6	7
D25	2	4	7
D26	x	8	8
D27	3	4	3
D28	x	8	7
D29	5	8	7
D30	x	8	8
D31	7	8	9
D32	x	8	8
D33	3	6	8
D34	x	6	7
D35	2	5	4
D36	x	6	2
D37	3	7	7
D38	x	7	7
D39	4	8	8
D40	x	6	7
D41	7	8	8
D42	x	8	8
D43	6	8	8
D44	x	9	9

	Rep 1	Rep 2	Rep 3
x	4	4	
5	4	5	
x	6	6	
7	8	8	
x	7	5	
8	7	8	
x	4	6	
5	5	5	
x	5	5	
5	4	6	
x	5	8	
3	5	4	
x	5	5	
4	3	4	
x	7	8	
3	3	4	
x	7	6	
6	8	7	
x	6	8	
6	5	7	
x	7	8	
5	6	7	
x	4	5	
2	6	5	
x	3	4	
4	4	6	
x	5	6	
6	7	8	
x	4	5	
6	6	7	
x	7	8	
7	8	8	
x	8	9	

# WHITE RUST RATINGS

Date: 1/13/2022

	Rep 1	Rep 2	Rep 3
D45	5	8	9
D46	x	6	8
D47	6	7	8
D48	x	8	7
D49	3	8	8
D50	4	8	8
D51	6	8	9
D52	5	8	8
D53	6	8	8
D54	6	8	8
D55	7	8	9
D56	2	2	4
D57	2	3	3
D58	3	8	6
D59	2	8	7
D60	4	8	6
D61	2	5	5
D62	3	7	5
D63	8	8	8
D64	4	6	4
D65	7	6	5
D66	8	9	8
D67	4	8	7
D68	4	8	7
D69	3	7	7
D70	3	4	4
D71	3	4	4
D72	4	7	5
D73	5	7	6
D74	4	7	6
D75	5	7	7

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
	6	8	8
	x	7	7
	5	5	6
	x	4	5
	8	7	8
	6	6	7
	6	7	8
	5	5	8
	7	7	7
	8	7	7
	7	7	8
	3	3	4
	5	4	6
	5	5	8
	4	7	6
	6	7	7
	3	5	3
	4	5	4
	4	6	5
	3	4	3
	3	6	5
	8	8	8
	5	8	5
	5	7	7
	3	6	5
	6	4	5
	7	4	6
	8	5	6
	6	7	7
	6	4	5
	6	5	6



# WHITE RUST RATINGS

Date: 1/13/2022

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
E101	3	6	7
E102	5	7	5
E103	5	7	7
E104	5	8	6
E105	6	7	7
E106	6	8	6
E107	4	8	8
E108	4	9	7
E109	4	7	6
E110	3	2	2
E111	2	3	2
E112	4	7	4
E113	2	5	3
E114	4	7	6
E115	3	6	4
E116	4	6	6
E117	5	6	7
E118	5	7	7
E119	4	9	7
E120	x	8	7
E121	6	8	6
E122	x	7	6
E123	5	7	4
E124	x	8	5
E125	5	6	6
E126	x	8	6
E127	7	7	6
E128	x	8	6

	Rep 1	Rep 2	Rep 3
	5	5	5
	6	5	5
	4	6	4
	5	6	5
	6	8	7
	4	7	6
	5	8	7
	6	7	6
	6	8	7
	4	3	4
	3	5	3
	4	4	5
	3	6	4
	5	6	6
	4	8	4
	4	6	5
	5	8	6
	5	8	6
	4	8	6
	x	8	5
	7	8	6
	x	7	6
	5	8	5
	x	7	5
	5	8	6
	x	7	6
	4	8	6
	x	7	6

# WHITE RUST RATINGS

Date: 1/13/2022

Date: 2/1/2022

			Rep 1	Rep 2	Rep 3
F1	F41	F81	5	9	6
F2	F42	F82	X	8	6
F3	F43	F83	7	8	8
F4	F44	F84	X	8	5
F5	F45	F85	4	8	4
F6	F46	F86	X	10	8
F7	F47	F87	8	10	8
F8	F48	F88	X	10	5
F9	F49	F89	8	9	8
F10	F50	F90	X	9	7
F11	F51	F91	8	10	7
F12	F52	F92	X	10	6
F13	F53	F93	9	9	7
F14	F54	F94	X	8	8
F15	F55	F95	8	9	7
F16	F56	F96	X	4	4
F17	F57	F97	9	8	5
F18	F58	F98	X	5	6
F19	F59	F99	4	7	6
F20	F60	F100	X	6	7
F21	F61	F101	6	8	6
F22	F62	F102	X	8	7
F23	F63	F103	4	7	3
F24	F64	F104	X	6	7
F25	F65	F105	5	7	4
F26	F66	F106	X	4	7
F27	F67	F107	3	4	5
F28	F68	F108	X	8	8
F29	F69	F109	5	8	7
F30	F70	F110	X	7	7
F31	F71	F111	8	8	8
F32	F72	F112	X	8	8
F33	F73	F113	7	7	7

	Rep 1	Rep 2	Rep 3
	7	8	7
	X	6	5
	6	8	7
	X	8	5
	6	8	6
	X	8	8
	7	8	8
	X	8	5
	6	9	7
	X	8	7
	8	9	7
	X	8	6
	8	8	7
	X	7	8
	8	8	8
	X	6	5
	6	8	5
	X	5	4
	5	8	4
	X	7	6
	6	8	7
	X	6	6
	4	8	4
	X	6	6
	5	8	6
	X	5	4
	3	7	6
	X	8	6
	6	8	7
	X	7	6
	7	8	8
	X	7	6
	6	8	7

# WHITE RUST RATINGS

Date: 1/13/2022

			Rep 1	Rep 2	Rep 3
F34	F74	F114	X	6	8
F35	F75	F115	6	7	7
F36	F76	F116	X	8	8
F37	F77	F117	7	7	6
F38	F78	F118	X	8	8
F39	F79	F119	7	8	8
F40	F80	F120	X	8	7

Date: 2/1/2022

			Rep 1	Rep 2	Rep 3
			X	8	6
			5	8	4
			X	7	5
			4	7	6
			X	8	8
			5	8	7
			X	8	

Date: 1/13/2022

	Rep 1	Rep 2	Rep 3
G1	7	8	6
G2	x	8	7
G3	8	8	8
G4	x	8	8
G5	7	8	8
G6	x	8	8
G7	8	8	7
G8	x	8	6
G9	8	8	8
G10	x	7	8
G11	7	8	8
G12	x	7	7
G13	8	8	8
G14	x	8	8
G15	7	7	8
G16	x	8	8
G17	8	8	8
G18	x	7	8
G19	6	6	7
G20	x	6	7
G21	7	7	7
G22	x	8	8
G23	8	8	8

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
	5	9	7
	x	6	7
	7	9	8
	x	9	8
	6	9	8
	x	8	7
	7	9	6
	x	6	4
	8	9	8
	x	6	8
	8	9	7
	x	9	8
	9	8	8
	x	6	6
	9	8	7
	x	9	8
	9	9	8
	x	6	5
	6	7	6
	x	6	5
	8	9	8
	x	8	7
	8	9	8

# WHITE RUST RATINGS

Date: 1/13/2022

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
G24	x	6	7
G25	8	8	9
G26	x	7	9
G27	8	7	8
G28	x	7	8
G29	7	8	7
G30	x	5	7
G31	7	7	7
G32	x	7	8
G33	8	8	8
G34	x	5	6
G35	8	7	8
G36	x	7	8
G37	7	7	7
G38	x	8	8
G39	6	6	7
G40	x	7	8
G41	8	8	8
G42	x	5	8
G43	8	7	5
G44	x	3	4
G45	6	7	6
G46	8	7	8
G47	8	8	8
G48	8	8	8
G49	8	8	8
G50	8	8	8
G51	7	8	8
G52	8	8	8

	Rep 1	Rep 2	Rep 3
x	7	8	
9	9	8	
x	8	8	
7	8	8	
x	6	8	
8	6	8	
x	8	7	
7	6	6	
x	7	7	
8	8	8	
x	6	4	
9	8	8	
x	7	8	
6	5	6	
x	7	7	
7	6	6	
x	7	8	
9	8	7	
x	6	7	
8	6	8	
x	4	5	
7	7	6	
8	8	8	
9	8	8	
9	7	7	
9	8	8	
8	8	8	
8	7	8	
7	6	7	

# WHITE RUST RATINGS

Date: 1/13/2022

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3		Rep 1	Rep 2	Rep 3
H1	8	8	8		8	7	8
H2	6	6	7		6	6	7
H3	8	8	8		7	8	9
H4	8	8	8		8	7	8

Date: 1/13/2022

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
I1	3	6	7
I2	4	5	6
I3	8	8	8
I4	8	8	8
I5	8	8	8
I6	8	7	8
I7	8	8	8
I8	7	7	8
I9	8	8	8
I10	7	7	7
I11	7	5	8
I12	6	4	6
I13	7	7	7
I14	8	7	8
I15	7	8	8
I16	9	8	8
I17	4	6	7
I18	5	7	6
I19	5	9	8
I20	7	8	8
I21	6	6	6
I22	5	6	6
I23	7	6	8
I24	6	7	8
I25	8	9	8
I26	5	8	7
I27	8	8	8

	Rep 1	Rep 2	Rep 3
	4	5	4
	5	5	3
	7	6	7
	7	5	6
	8	7	8
	8	7	8
	8	7	8
	8	6	7
	8	6	8
	4	5	6
	5	5	8
	4	3	6
	7	6	7
	8	6	8
	8	8	8
	8	8	8
	7	6	5
	7	5	5
	9	8	8
	8	6	8
	5	5	5
	6	5	7
	5	5	7
	7	6	8
	8	8	8
	7	6	7
	8	8	8

# WHITE RUST RATINGS

Date: 1/13/2022

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
128	7	8	9
129	7	8	9
130	8	7	8
131	8	8	8
132	8	9	9
133	7	8	9
134	8	8	9
135	5	8	8
136	6	8	8
137	8	8	8
138	8	8	8
139	5	7	7
140	6	5	7
141	5	6	5
142	7	7	8
143	5	7	7
144	7	8	8
145	8	8	8
146	8	8	8
147	7	6	6
148	7	8	6
149	7	8	7
150	6	7	6
151	4	7	7
152	7	8	6
153	7	8	8
154	5	7	6
155	6	8	8
156	7	7	7
157	7	8	7
158	7	8	6
159	7	8	7
160	7	8	7

	Rep 1	Rep 2	Rep 3
	8	8	8
	7	8	8
	7	6	8
	8	8	8
	8	8	9
	9	8	8
	9	7	9
	8	7	9
	8	8	8
	8	8	8
	8	6	7
	7	7	7
	6	5	5
	4	5	5
	5	8	7
	5	5	5
	8	7	8
	7	7	8
	8	5	8
	7	6	7
	8	7	7
	7	8	7
	6	7	7
	7	6	6
	8	7	8
	8	8	8
	8	9	7
	8	8	8
	5	6	7
	5	7	7
	5	6	7
	5	6	6
	5	6	7

# WHITE RUST RATINGS

Date: 1/13/2022

Date: 2/1/2022

	Rep 1	Rep 2	Rep 3
I61	7	6	7
I62	8	8	6
I63	6	8	7
I64	8	7	7
I65	6	7	7
I66	8	8	6
I67	7	7	7
I68	7	7	8
I69	7	7	7
I70	7	7	8
I71	7	6	6
I72	7	7	7
I73	7	7	8
I74	8	8	7
I75	7	7	8

	Rep 1	Rep 2	Rep 3
	4	6	7
	5	6	7
	5	7	6
	4	7	7
	5	6	7
	7	8	7
	7	6	7
	6	6	8
	7	7	7
	5	7	8
	7	7	5
	7	7	7
	7	7	8
	7	7	7
	4	7	7

Date: 1/13/2022

Date: 2/1/2022

	Rep 1
W1	5
W2	5
W3	5
W4	5
W5	5
W6	5
W7	4
W8	6
W9	5
W10	5
W11	5
W12	5
W13	5
W14	5
W15	6

	Rep 1
	5
	4
	5
	5
	4
	6
	5
	5
	5
	4
	6
	5
	5
	5
	4

# WHITE RUST RATINGS

Date: 1/13/2022

Rep 1

W16	6
W17	6
W18	7
W19	6
W20	6
W21	5
W22	5
W23	4
W24	6
W25	5
W26	5
W27	5
W28	6
W29	5
W30	4
W31	5
W32	5
W33	5
W34	5
W35	5
W36	5
W37	6
W38	6
W39	6
W40	6
W41	6
W42	6
W43	7
W44	7
W45	6
W46	7
W47	7

Date: 2/1/2022

Rep 1

6
5
5
5
4
4
5
3
4
4
4
3
6
4
6
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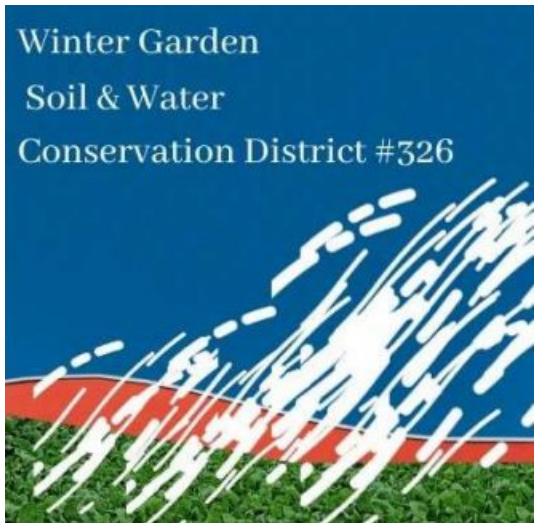


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*A **HUGE** thank you to all who helped us get ready for this field day, especially the sponsors listed in your program. No doubt, without their help, this would not be possible!!*



\*\*\*\*\*

***2021-2022 Spinach Trial  
Tiro Tres Farms  
Crystal City, TX***



02/01/22

*2022 Spinach Research Trial*

*Photo provided by: Julia Paige Ritchie, Tiro Tres Farms*