

Ohio Vegetable & Small Fruit Research & Development Program

Final Report

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Project Title: Screening bell and specialty pepper varieties for resistance to bacterial speck and bacterial canker

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Why was this project funded? Peppers produced in Ohio are affected by three major seedborne bacterial diseases: bacterial spot, bacterial speck (also known as syringae leaf spot), and bacterial canker. There are a number of pepper varieties with good resistance to bacterial spot. However, the resistance of pepper varieties commonly grown in Ohio to bacterial speck (*Pseudomonas syringae* pv. *syringae*; *Pss*) and bacterial canker (*Clavibacter michiganensis* subsp. *michiganensis*; *Cmm*) is unknown. Previous preliminary research in our lab approx. 10 years ago indicated that pepper varieties differed significantly in resistance to bacterial speck. The objective of the project was to determine the degree of resistance in bell and specialty pepper varieties to bacterial speck and bacterial canker.

Project outline. We screened 25 bell and specialty pepper varieties for resistance to bacterial speck and bacterial canker in separate, replicated trials at the OSU Wooster Campus research farm in Wooster (bacterial canker) and the OSU North Central Agricultural Experiment Station (NCARS) in Fremont (bacterial speck). Plants were inoculated with *Pss* or *Cmm* several times in the growing season and rated for disease severity and fruit symptoms throughout the season. Due to hot, dry weather during crucial times during the trials, symptom development was relatively low for both diseases.

What was discovered?

Bacterial canker disease severity was very low in this trial (Table 1), although disease incidence ranged from moderate (~25%) to high (90%). Although there were significant differences in bacterial canker severity among the pepper varieties tested, overall the

Table 1. Bacterial canker disease incidence and severity on pepper cultivars.

Variety	Pepper type	Source	Bacterial canker (foliar, 28 Aug)	
			Severity (%) ^z	Incidence (%) ^y
SV7468PB	Bell	Seminis	0.1 f ^x	25.4 hi
Green Machine with X10R	Bell	Seminis	0.2 f	26.3 hi
Midas	Bell/Lamuyo	Sakata	0.2 f	31.7 f-i
SV6988PB	Bell	Seminis	0.1 f	37.9 e-i
SV9504PB	Bell	Seminis	0.2 f	38.9 e-i
Archimedes with X3R	Bell	Seminis	0.3 ef	42.3 e-i
Paladin	Bell	Syngenta Seeds	1.2 b-e	58.1 b-f
Turnpike with X5R	Bell	Seminis	0.8 b-f	58.2 b-f
King Arthur	Bell	Rupp Seeds	0.8 c-f	60.1 b-e
Rampart	Bell	Syngenta Seeds	0.9 b-f	62.2 b-e
SV3964PB	Bell	Seminis	1.3 a-d	63.0 b-e
Bastille	Bell	Syngenta Seeds	1.5 abc	69.8 a-d
Aristotle with X3R	Bell	Seminis	1.6 abc	72.3 a-d
Red Knight X3R	Bell	Rupp Seeds	2.1 a	75.9 abc
Cutlass	Bell	Syngenta Seeds	1.7 ab	80.1 ab
Bayonet	Bell	Syngenta Seeds	1.5 abc	80.7 ab
Intruder	Bell	Syngenta Seeds	1.4 a-d	90.0 a
SV3782PP X3R	Banana	Seminis	0.2 f	26.0 hi
Lola	Banana	Sakata	0.2 f	38.0 e-i
Pageant	Banana	Syngenta Seeds	0.8 b-f	55.7 b-g
Cavalcade	Banana	Syngenta Seeds	0.8 b-f	59.5 b-e
PS 11435810	Jalapeño	Seminis	0.1 f	20.2 i
Tzotzil	Jalapeño	Seminis	0.3 ef	29.8 ghi
Compadre	Jalapeño	Syngenta Seeds	0.5 d-f	47.5 d-h
SV3198HJ with X3R	Jalapeño	Seminis	0.3 ef	50.0 c-h
P value			0.0001	0.0001

^zDisease ratings values were based on the percent foliar disease (severity).

^yDisease incidence values were based on the percentage of plants with bacterial canker per plot.

^xValues are the means of four replicate plots; means followed by the same letter within a column are not significantly different at P≤0.05. Means were separated using Fisher's least significant difference test.

severity was too low to make realistic distinctions between varieties. However, among the bell pepper varieties, bacterial canker incidence was lowest (25.4-42.3%) in 'SVPB 7468', 'Green Machine with X10R', 'Midas', 'SV6988PB', 'SV9504PB' and 'Archimedes with X3R', and highest (69.8-90%) in 'Bastille', 'Aristotle with X3R', 'Red Knight X3R', 'Cutlass', 'Bayonet' and 'Intruder'. Among banana peppers, disease incidence was significantly lower (26%) in 'SV3782PP X3R' than in 'Pageant' (55.7%) and 'Cavalcade'

(59.5%). Bacterial canker incidence in the jalapeño variety 'PS 11435810' (20.2%) was significantly lower than in the jalapeño varieties 'Compadre' (47.5%) and 'SV3198HJ with X3R' (50%). Due to the low disease severity, these varieties will need to be screened again under disease conducive conditions to fully assess susceptibility to bacterial canker.

Pseudomonas leaf spot disease pressure was very low in this trial (Table 2). This disease is favored by cool wet conditions, and although September temperatures were relatively cool, rainfall amounts were very low and the disease did not develop beyond low levels of severity (<10%). *Pseudomonas* leaf spot severity was very low ($\leq 2.3\%$) in the banana and jalapeño varieties and there were no significant differences in the final field rating or season-long disease progress (AUDPC) among varieties. Among the bell pepper varieties, 'Bastille' was significantly more susceptible to the disease than all other varieties. Disease severity on 'Red Knight X3R' was significantly lower than on 'Cutlass', the least susceptible variety tested.

Take-home messages.

- While disease severity was not informative in assessing resistance of pepper varieties to bacterial canker, varieties could be differentiated based on disease incidence. 'SVPB 7468', 'Green Machine with X10R', 'Midas', 'SV6988PB', 'SV9504PB' and 'Archimedes with X3R' were the most resistant varieties based on disease incidence, although none were immune.
- *Pseudomonas* leaf spot disease pressure was very low and therefore meaningful conclusions cannot be drawn regarding relative susceptibility or resistance of these cultivars to this disease. However, 'Bastille' bears watching as disease severity was higher on this variety than the others.
- Due to the low disease severity in both trials, these varieties will need to be screened again under disease conducive conditions to fully assess susceptibility to *Pseudomonas* leaf spot and bacterial canker.
- If bacterial disease is suspected on peppers, including varieties with bacterial spot resistance (e.g. X3R, X5R, X10R varieties), samples should be sent to the OSU Vegetable Disease Diagnostic Lab for confirmation. Bacterial spot and *Pseudomonas* leaf spot, in particular, look very similar on pepper leaves. Disease diagnostic services are free for Ohio vegetable and fruit growers. <http://u.osu.edu/vegetablepathologylab/diagnostic-submission/>
- Since pepper seeds are not routinely tested for bacterial canker or *Pseudomonas* leaf spot, growers should consider having seed lots sanitized (e.g. Clorox treatment) to prevent these diseases, which can cause significant damage under favorable environmental conditions.

Table 2. Pseudomonas leaf spot disease incidence and severity on pepper cultivars.

Variety	Pepper type	Source	Pseudomonas leaf spot disease severity	
			% ^z (16 Sep)	AUDPC ^{yz}
Cutlass	Bell	Syngenta Seeds	1.0 c ^x	34.5 c
SV7468PB	Bell	Seminis	1.5 bc	32.3 c
Turnpike with X5R	Bell	Seminis	1.5 bc	45.1 c
Green Machine with X10R	Bell	Seminis	1.5 bc	45.8 c
Midas	Bell/Lamuyo	Sakata	1.5 bc	44.3 c
Aristotle	Bell	Seminis	1.8 bc	45.3 c
SV6988PB	Bell	Seminis	2.3 bc	51.6 bc
SV9504PB	Bell	Seminis	2.5 bc	67.5 bc
SV3964PB	Bell	Seminis	2.5 bc	63.7 bc
Bayonet	Bell	Syngenta Seeds	2.5 bc	65.0 bc
Paladin	Bell	Syngenta Seeds	2.8 bc	59.8 bc
King Arthur	Bell	Rupp Seeds	3.0 bc	74.6 bc
Archimedes with X3R	Bell	Seminis	3.3 bc	79.4 bc
Rampart	Bell	Syngenta Seeds	3.3 bc	77.5 bc
Intruder	Bell	Syngenta Seeds	3.5 bc	84.8 bc
Red Knight X3R	Bell	Rupp Seeds	4.0 b	107.7 b
Bastille	Bell	Syngenta Seeds	8.8 a	177.6 a
Pageant	Banana	Syngenta Seeds	1.0 c	32.8 c
Lola	Banana	Sakata	1.3 bc	30.9 c
SV3782PP X3R	Banana	Seminis	2.3 bc	29.1 c
Cavalcade	Banana	Syngenta Seeds	2.8 bc	78.7 bc
SV3198HJ with X3R	Jalapeño	Seminis	1.3 bc	33.5 c
Tzotzil	Jalapeño	Seminis	1.5 bc	51.6 bc
Compadre	Jalapeño	Syngenta	1.8 bc	53.2 bc
PS 11435810	Jalapeño	Seminis	2.0 bc	63.8 bc
P value			0.0016	0.00096

^zDisease ratings and area under the disease progress curve (AUDPC) values were based on the percent foliar disease (severity).

^yAUDPC values were calculated according to the formula: $\sum ((x_i + x_{i-1})/2)(t_i - t_{i-1})$ where x_i the rating at each evaluation time and $(t_i - t_{i-1})$ is the number of days between evaluations.

^xValues are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.05$. Means were separated using Fisher's least significant difference test.