

Functional *avrA* gene in *Ralstonia solanacearum* can elicit a cross protection reaction in mechanically transmitted bacterial wilt

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## Bacterial wilt of tobacco in the Southeastern US.



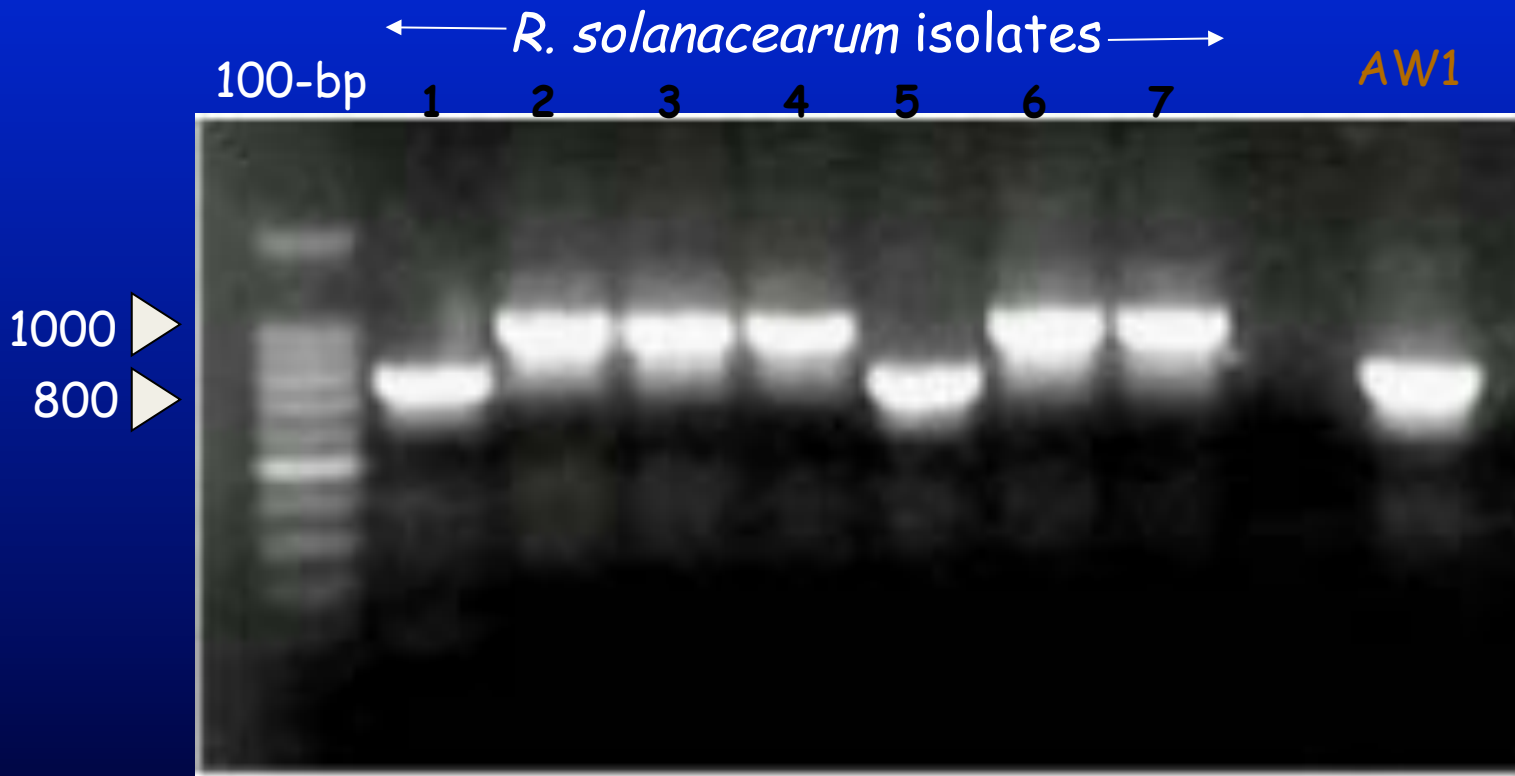
Carolinas  
Economically important

Georgia and Florida  
Rarely occurs on tobacco  
(common on tomato in tobacco-growing areas)

# Gene-for-gene concept and the role of a functional *avrA* gene in bacterial wilt

If the host carries a host resistance gene (*R*) which corresponds to a pathogen avirulence gene (*avr*) a resistance reaction occurs, i.e. there is no disease

Do all *R. solanacearum* isolates within the USA possess an *avrA* gene?

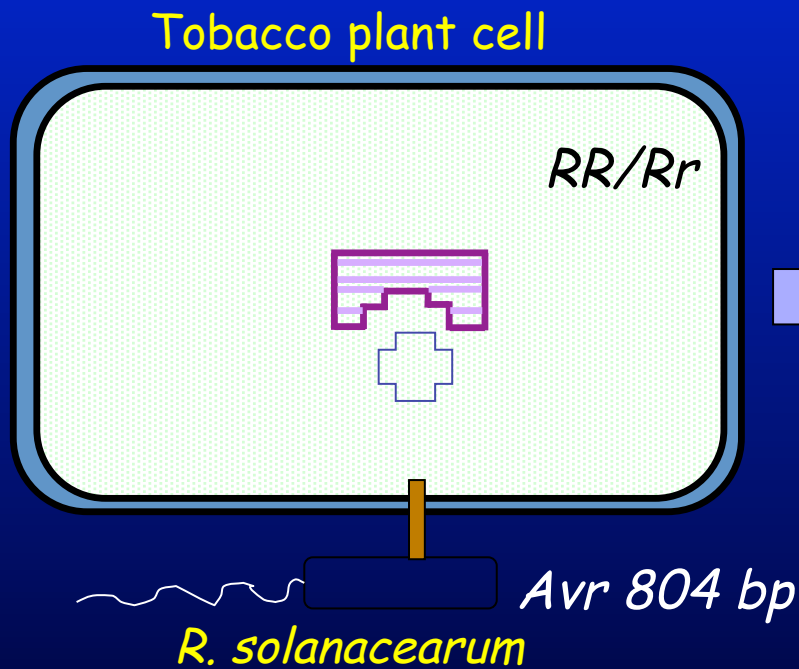


A. Roberson et al.

# Pathogenicity tests on tobacco and tomato

Size of <i>avrA</i>	Pathogenicity	
	Tobacco	Tomato
804-bp	-	+
984-bp	+	+

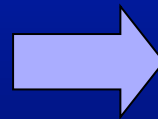
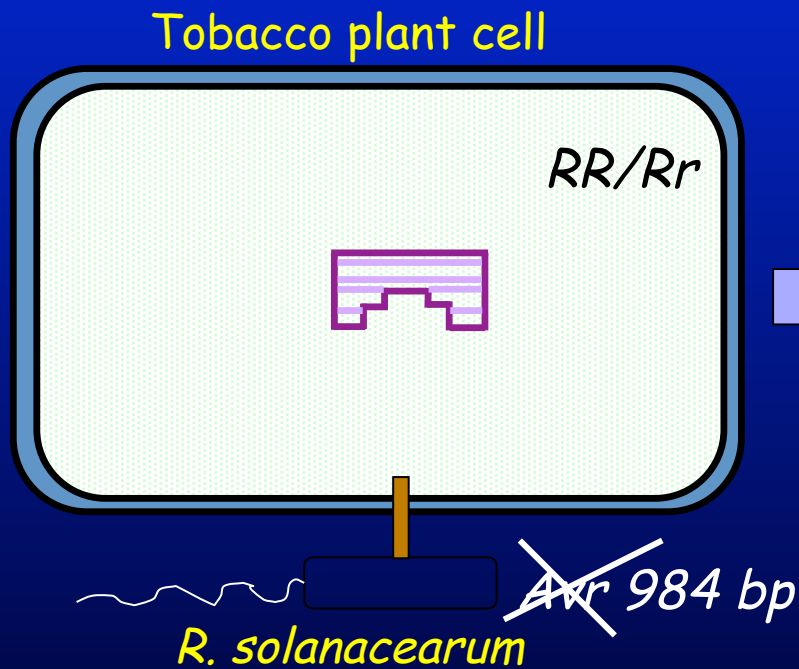
# Georgia:



Plant defenses activated,  
Therefore no disease  
symptoms

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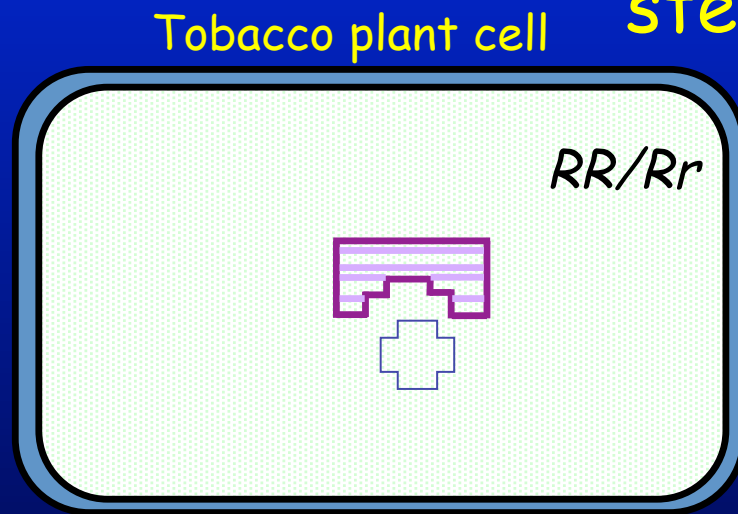
# North and South Carolina:



Plant defenses are not activated,  
Therefore disease occur

# Objective

Evaluate the ability of *R. solanacearum* 804 bp to elicit a cross protection Rx to *R. solanacearum* 984 bp in tobacco stem tissue



Plant defenses activated,  
Therefore no disease symptoms?

*R. solanacearum* Avr 804 bp  $1 \times 10^8$  Genetic variation?

*R. solanacearum* ~~Avr 984 bp~~  $2 \times 10^6$  Genetic variation?

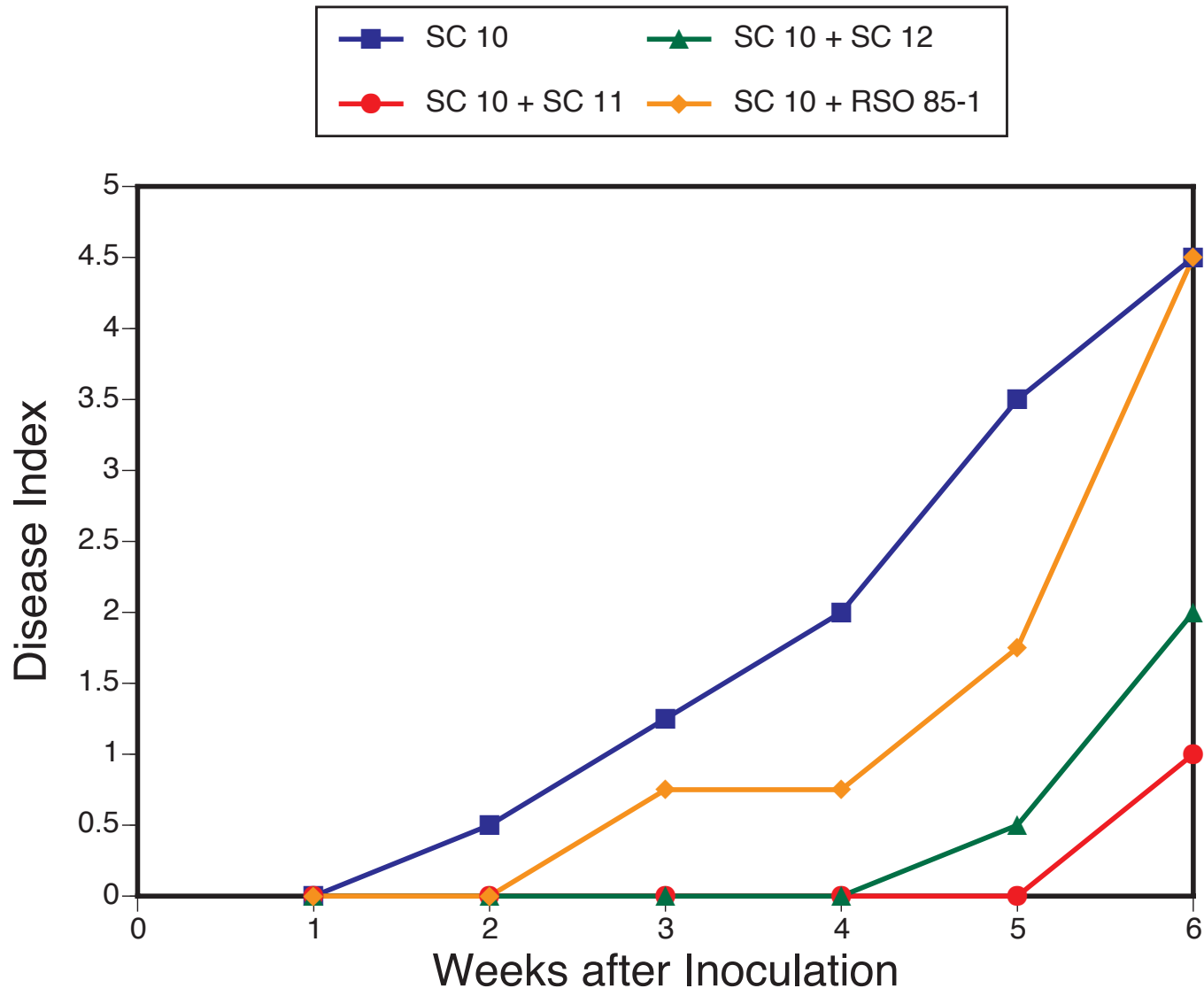


# Experimental design

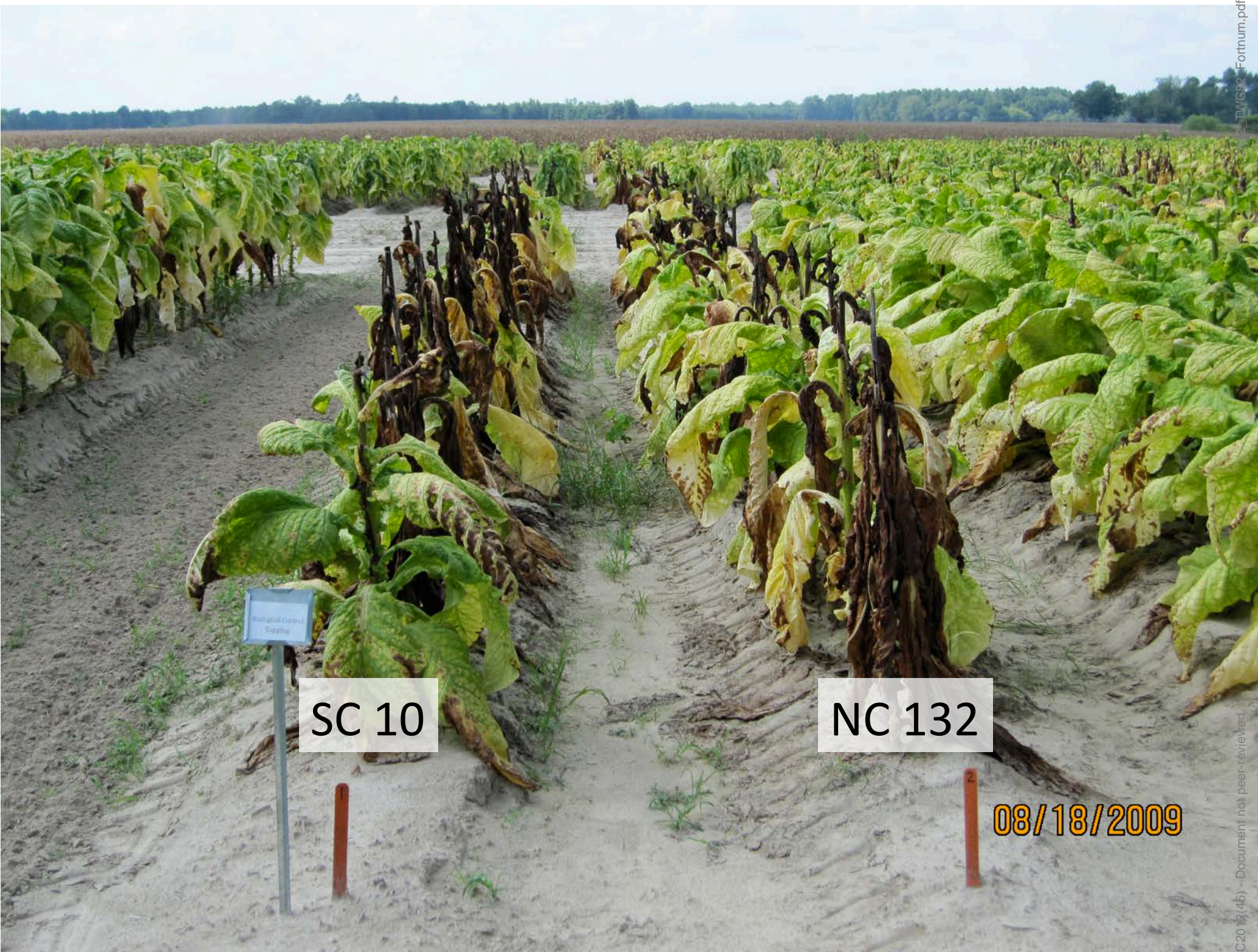
- RCB design - Treatments were replicated 4 times (2010 - 2011 resp.)
- Rotation – rotated three years to non-tobacco
- The *R. solanacearum* cultures were grown on nutrient agar (48 hr), re-suspended in deionized water at  $OD_{600}=0.2=10^8$  cells / ml and used as a stock culture. The  $10^8$  suspension was used to make inoculum for a  $10^6$  dilution.
- *R. solanacearum* with a functional *avrA* gene was applied at  $1 \times 10^8$
- *R. solanacearum* with a non-functional *avrA* gene was applied at  $2 \times 10^6$  (2010, 2011)

*R. solanacearum* SC 10 - 984 bp

*R. solanacearum* SC 11, SC 12, RSO 85-1 – 804 bp



CORESTA 2010



Biological Control  
Topping

SC 10

NC 132

08/18/2009



SC 10 + SC 11

SC 10 + SC 12

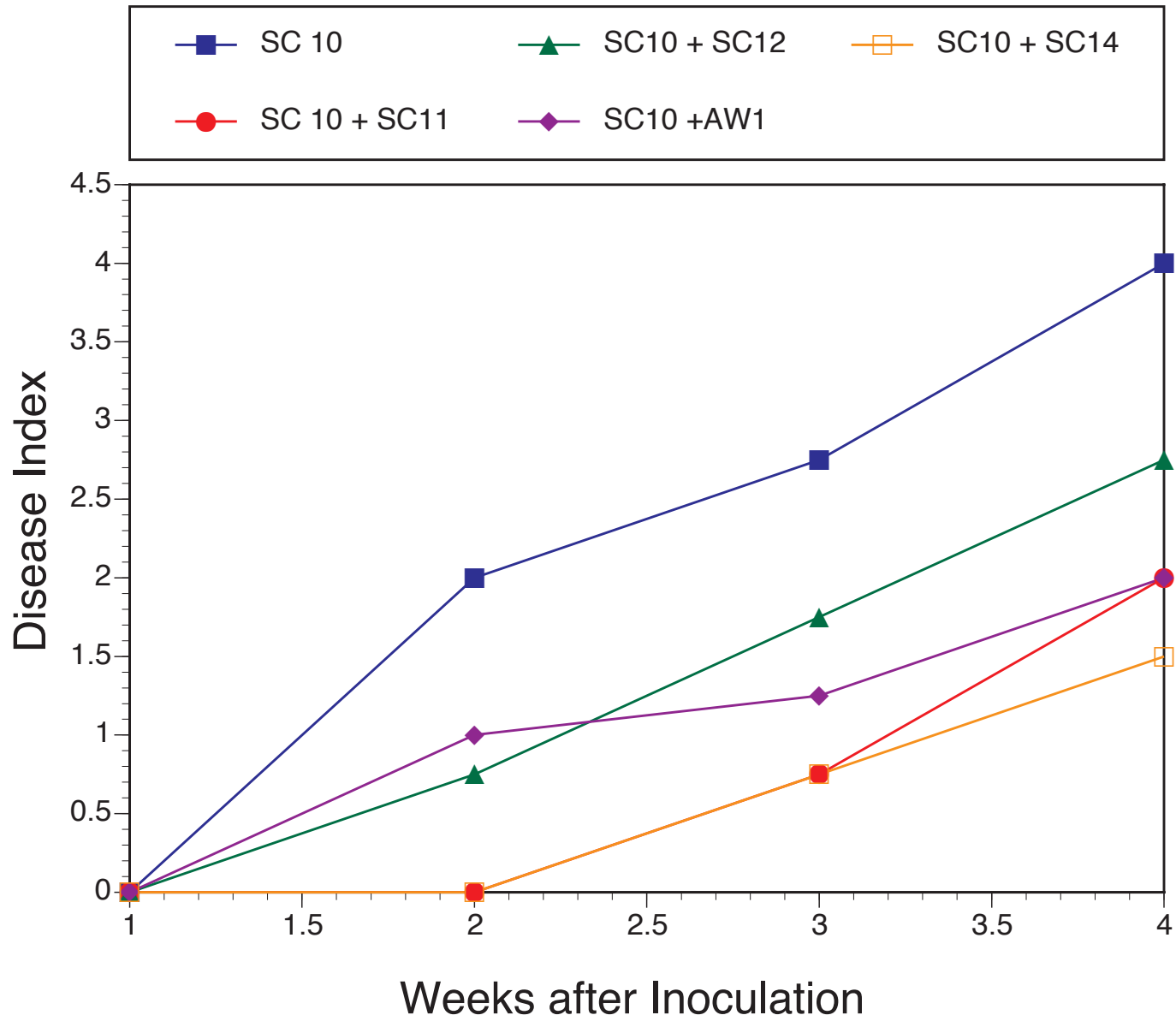
08/18/2009

# Treatments

1. SC10 – Tobacco isolate – 984 bp
2. SC 06 – Tobacco isolate – 984 bp
3. Y3 – Tobacco isolate – 984 bp
4. SC 11 – Tomato isolate - 804 bp
5. SC 12 - Tomato isolate - 804 bp
6. SC 14 - Tomato isolate - 804 bp
7. AW1 -- Tomato isolate - 804 bp

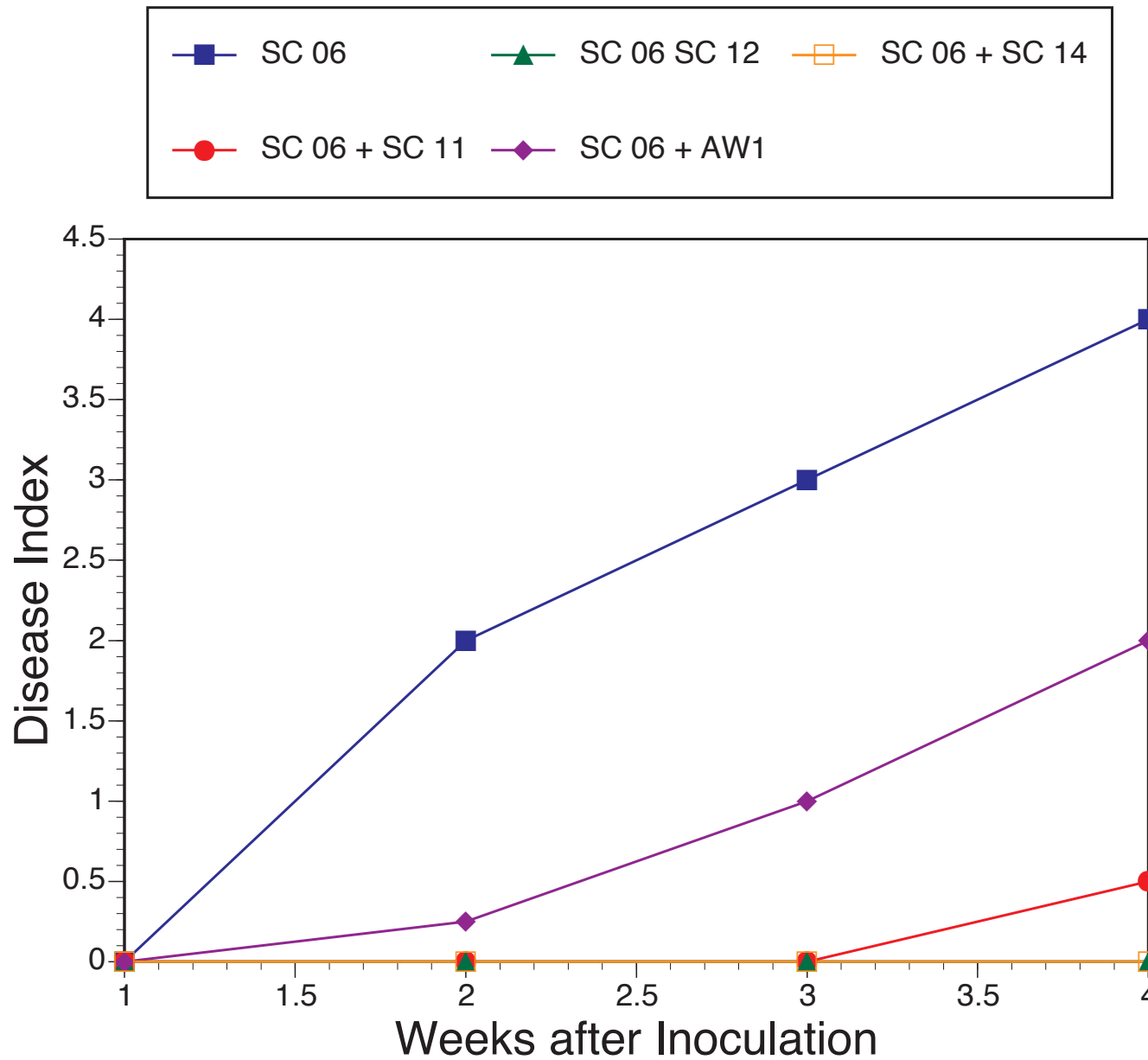
*R. solanacearum* SC 10 - 984 bp

*R. solanacearum* SC 11, SC 12, SC 14, AW1 – 804



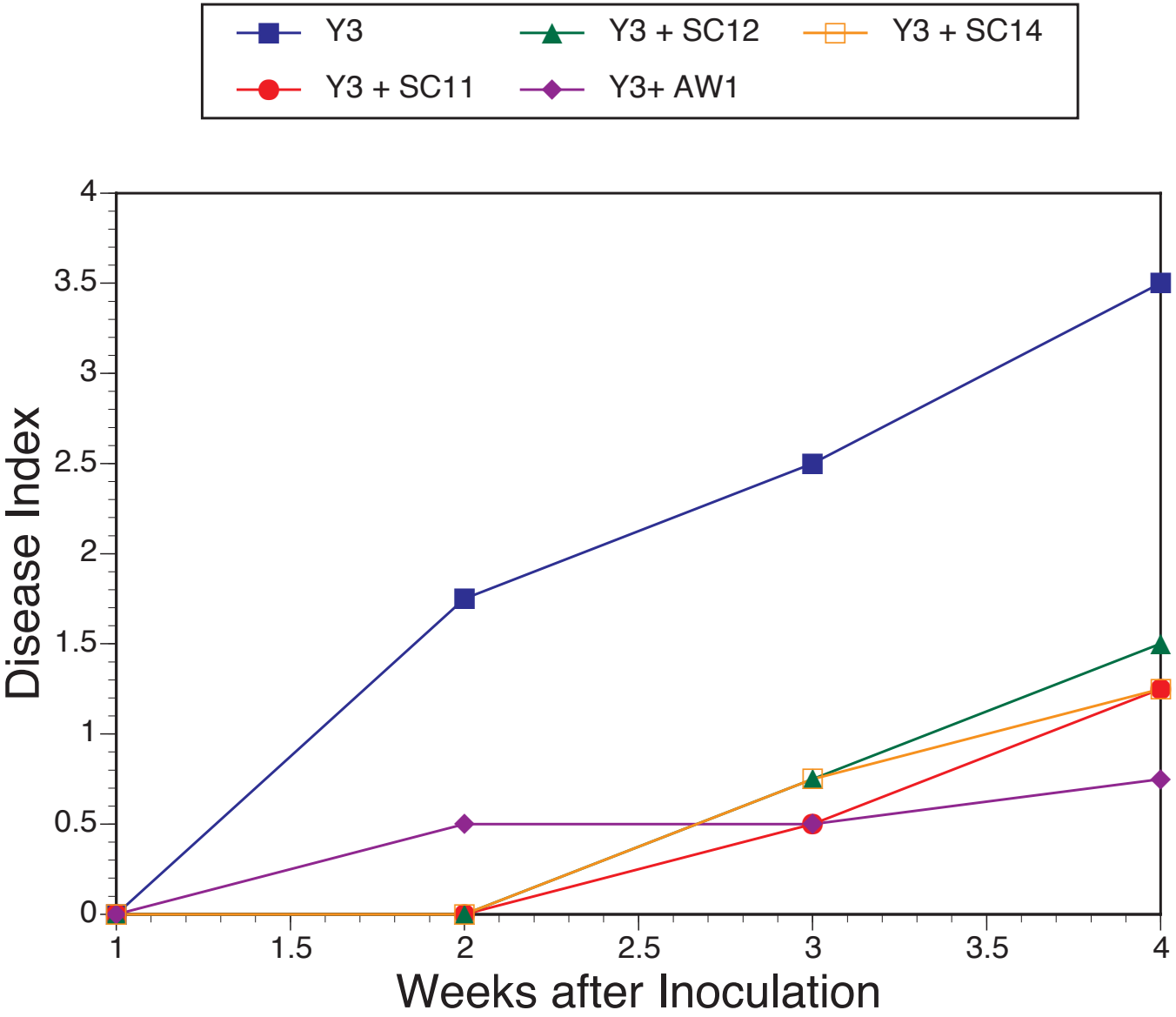
*R. solanacearum* SC 10 - 984 bp

*R. solanacearum* SC 11, SC 12, SC 14, AW1 – 804



*R. solanacearum* SC 10 - 984 bp

*R. solanacearum* SC 11, SC 12, SC 14, AW1 - 804





# AUDPC 2010

		Pathogenic strain 984 bp			
		Check	SC 10	SC 06	Y3
Check		0	51.4 a	53.5 a	45.7 a
Pathogenic strain 804 bp	+ SC 11	0	17.4 cde	2.8 fg	11 def
	+ SC 12	0	32.2 b	0 g	14.6 de
	+ AW1	0	24.6 bc	20 cd	9.8 ef
	+ SC 14	0	14.6 de	0 g	13.3 de

# AUDPC 2011

		Pathogenic strain 984 bp			
		Check	SC 10	SC 06	Y3
Check		0	86.6 a	82.7 a	46.8 b
Pathogenic strain 804 bp	+ SC 11	0	16.65 c	0 d	0 d
	+ SC 12	0	55.0 b	9.6 cd	12 cd
	+ AW1	0	11.6 cd	0 d	0 d
	+ SC 14	0	7.8 cd	0 d	0 d

# Summary

- *R. solanacearum* with a functional *avrA* gene applied with a pathogenic strain of *R. solanacearum* can block bacterial wilt (stem infection)
- *R. solanacearum* with a functional *avrA* gene produced localized necrosis but was arrested close to the point of inoculation
- *R. solanacearum* (*avr-804*) induced cross protection varied across pathogenic (*avr-984*) and avirulent strains (*avr-804*)



