Grafting Tomato For Soilborne Disease Management

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November 12th, 2008
Tomato Grafting Workshop

Pittsboro, NC

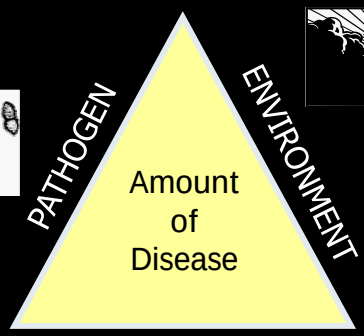
NC STATE UNIVERSITY

Rootstock Selection

- Soilborne Disease Management
  - Bacterial Wilt
  - Fusarium Wilt
  - Root-knot Nematodes
  - Southern Stem Blight
  - Verticillium Wilt
- Vigor / Crop Productivity

Plant Disease Diagnosis

Disease: any condition that is harmful to the host, is caused by the continuous irritation by a primary causal agent (pathogen), and results in the production of symptoms



Diagnosis

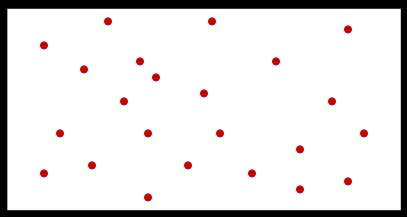
GOAL: To eliminate what the problem is NOT, to discount the highly improbable, and focus on the most likely. (FJL)

"the game is afoot…"

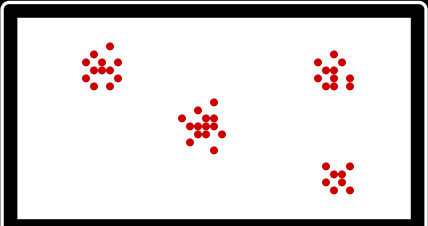
Encountering Problems

- Location – Where is the problem occurring?
  - Plant
  - Field
  - Region
- Spatial distribution – How is it distributed?
  - Plant
    - families, species, cultivars
    - Host tissue
  - Field
    - Low spots, high spots, field edges
  - Region
    - Climate, soil types, agricultural systems
- Temporal distribution – When did it occur?
  - Event vs Continuous
  - Crop cycle
  - Season
  - Year-to-year

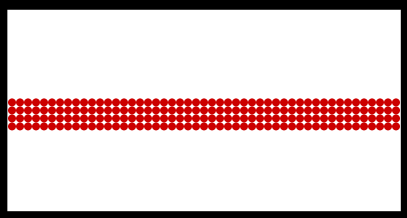
Spatial Distribution



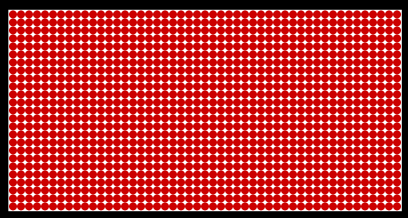
Random



Aggregated

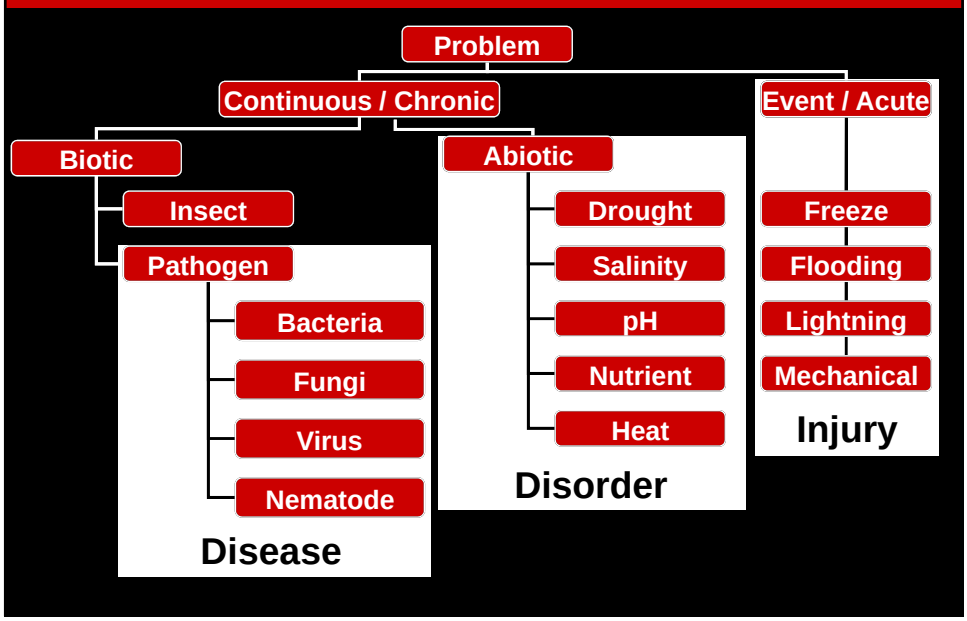


Linear



Disaster

Disease vs Disorder vs Injury



Nematode - Coffee

***Sclerotinia* Lettuce Drop - Lettuce**

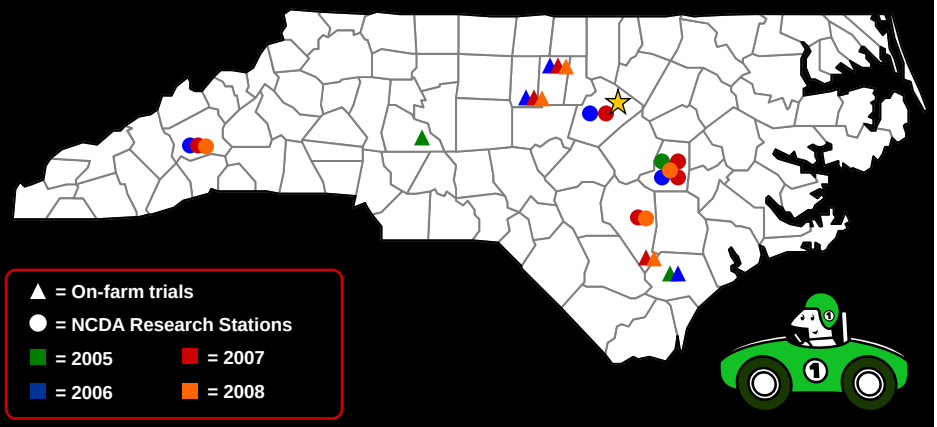
Bacterial Wilt - Tomato

Resources

- Resources:
  - NCSU Plant Disease and Insect Clinic
  - NCDA Agronomic Division
    - Nematode Assays
    - Soil Analysis
    - Tissue Analysis
  - NC Cooperative Extension
  - Compendium of Tomato Diseases
  - Web resources

Shawn Butler, Tom Creswell, David Stephan

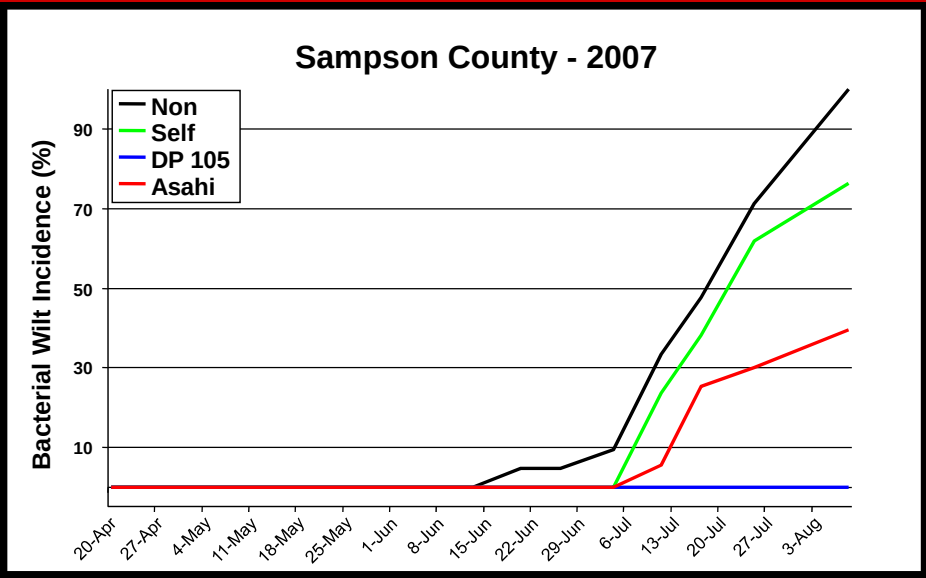
- **Major soilborne diseases in NC.**
  - **Verticillium Wilt**
  - **Fusarium Wilt**
  - **Root-knot Nematodes**
  - **Southern Stem Blight**
  - **Bacterial Wilt**



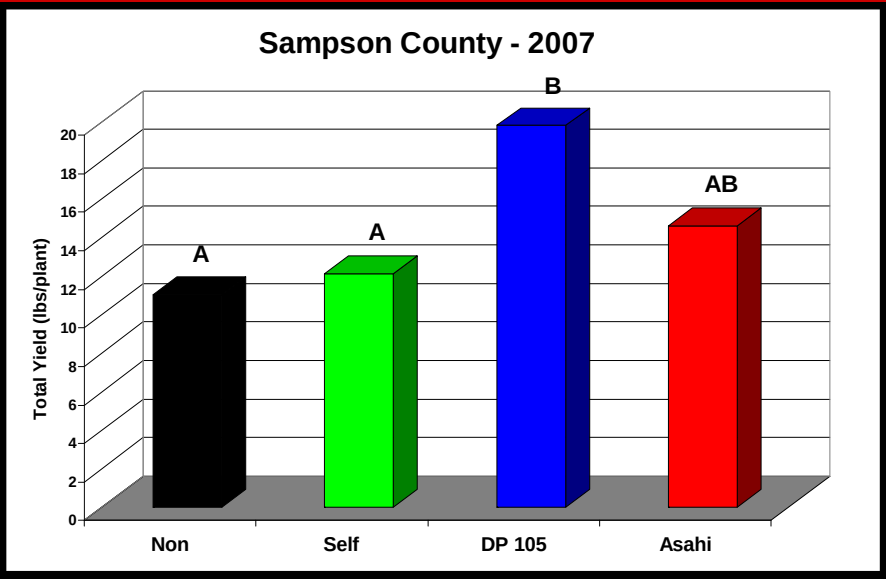
Bacterial Wilt

- Southern Bacterial Wilt is caused by *Ralstonia solanacearum*.
  - Vascular wilt
  - Warm, wet weather
  - Tomato, eggplant, pepper, tobacco

Bacterial Wilt



Bacterial Wilt

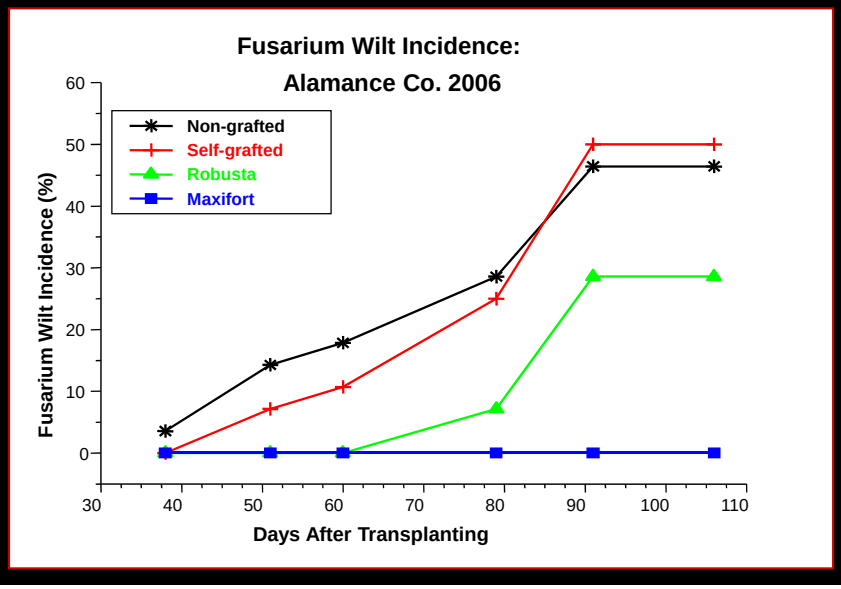


Based on LSD at P=0.05

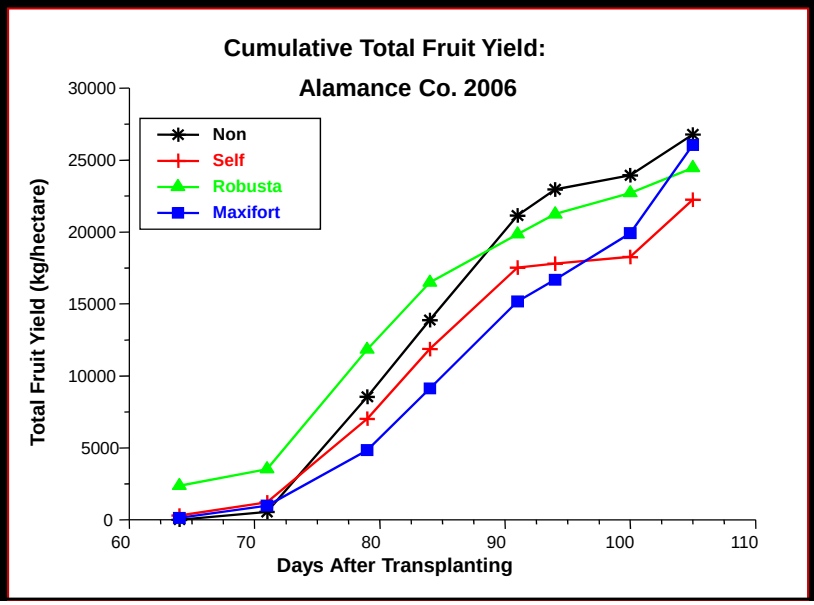
Fusarium Wilt

- Fusarium wilt is caused by *Fusarium oxysporum*.
  - Unilateral wilting
  - Yellowing of leaves
  - Browning of xylem

Fusarium Wilt



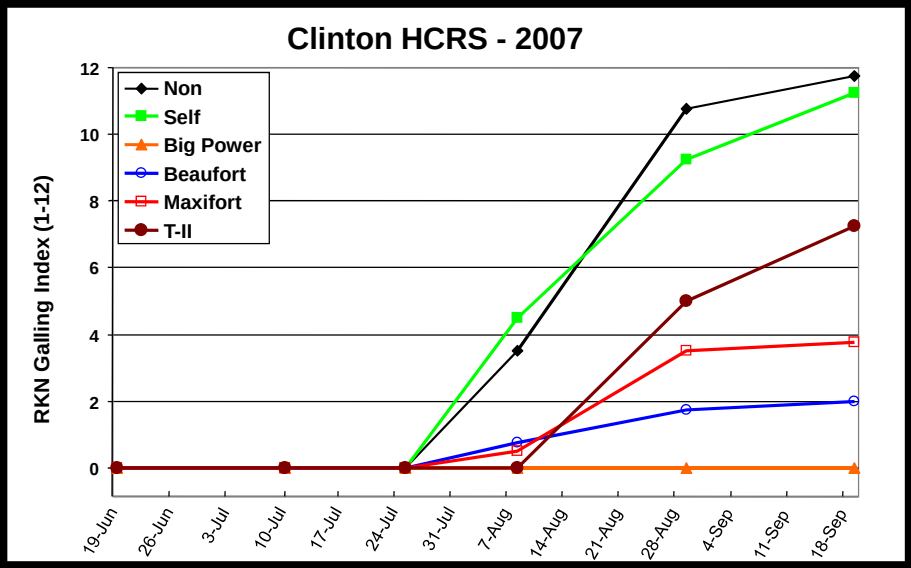
Fusarium Wilt



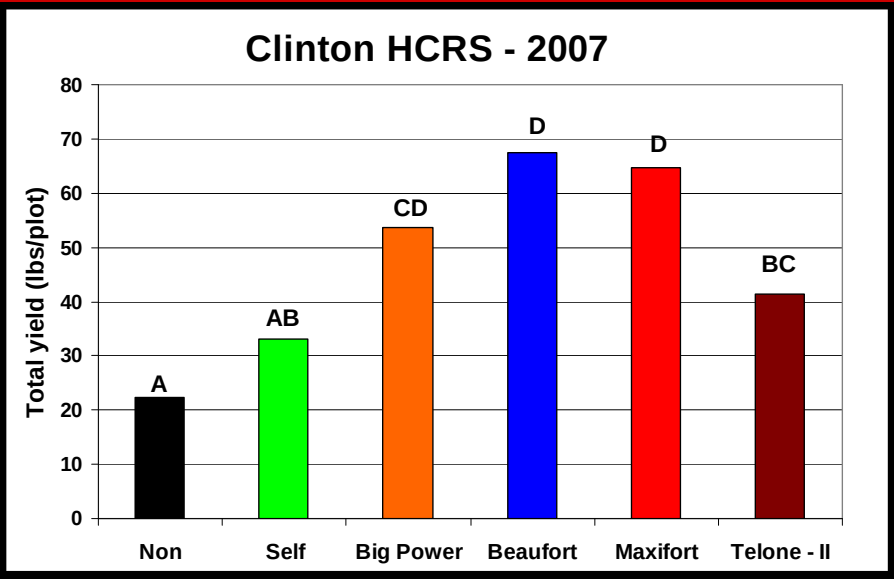
Root-knot Nematodes

- Root-knot Nematodes
  - *Meloidogyne spp.*
  - Root galls
  - Stunting and poor vigor
  - Prefer light soil

Root Knot Nematode



Root Knot Nematode



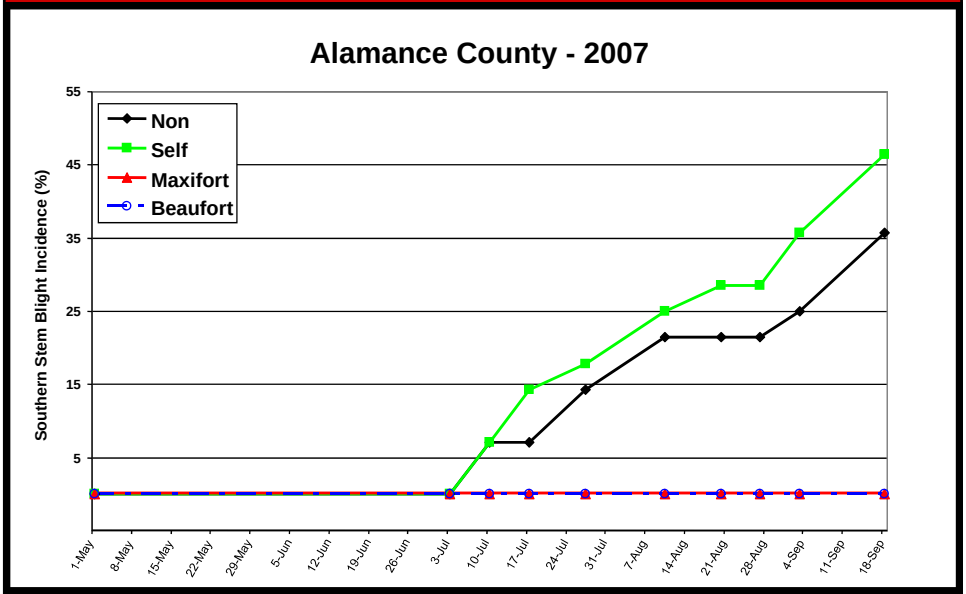
* - Trial also affected by SSB

Least Significant Difference at P=0.05

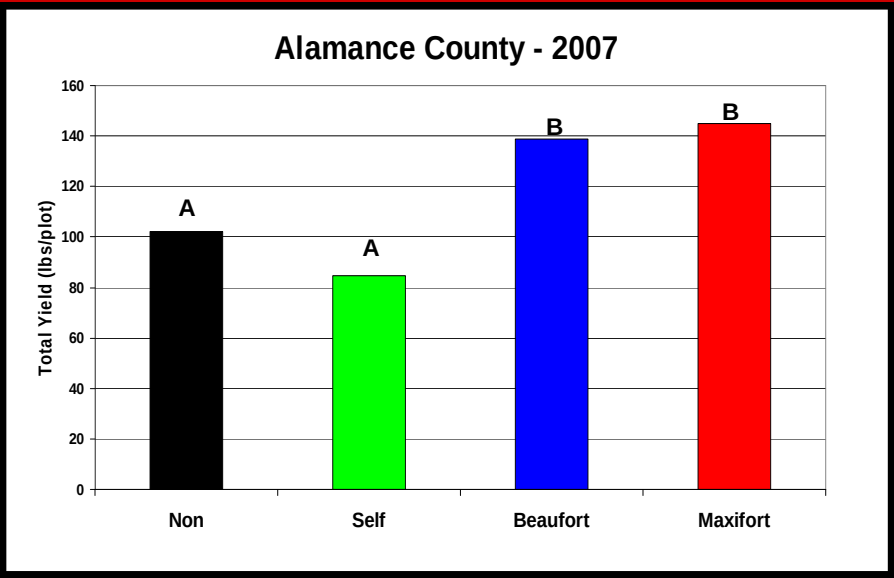
Southern Stem Blight

- Southern stem blight is caused by *Sclerotium rolfsii*.
  - Colonizes stem and crown
  - Vascular wilt
  - Chlorosis
  - Sclerotia
  - Hot weather
  - Good saprophyte
  - No known resistance in tomato

Southern Stem Blight



Southern Stem Blight



Least Significant Difference at P=0.05

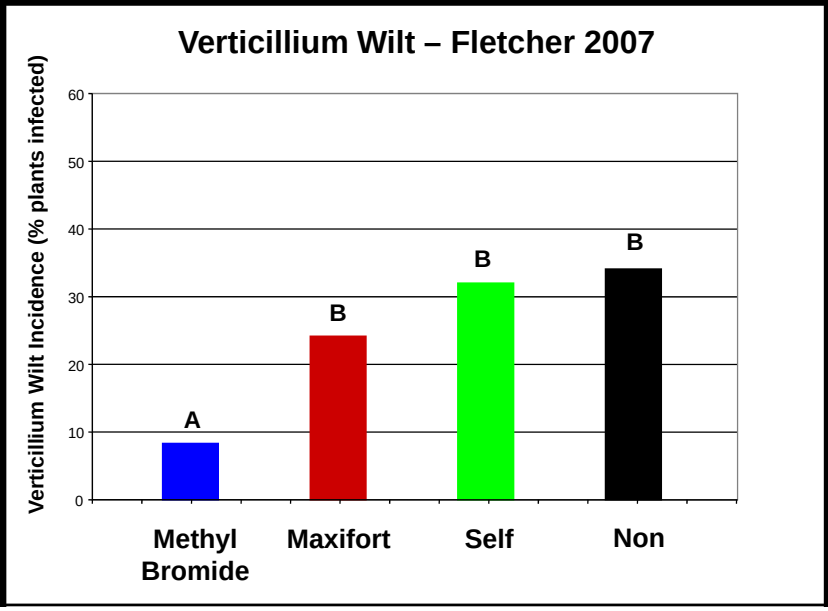
Verticillium Wilt

- *Verticillium dahliae*
  - Loss of vigor
  - Wilting and leaf necrosis
  - Cool wet weather
  - race 2 resistance

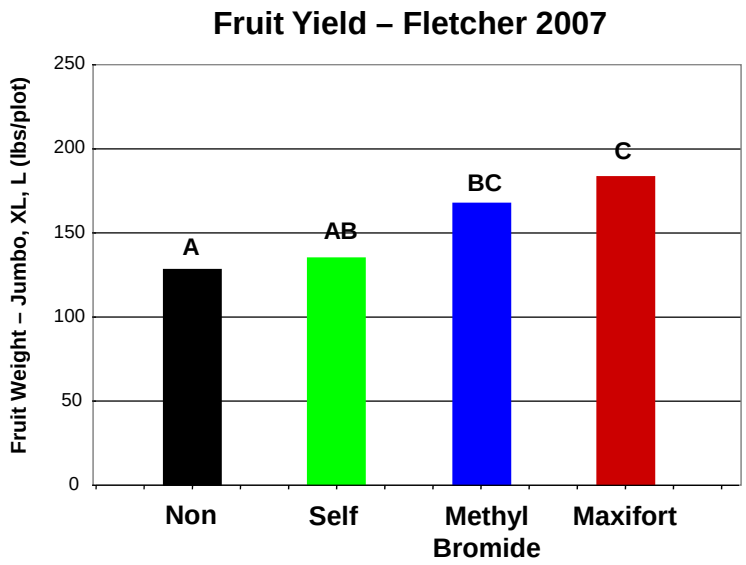
Verticillium Wilt

Verticillium Wilt

Verticillium Wilt



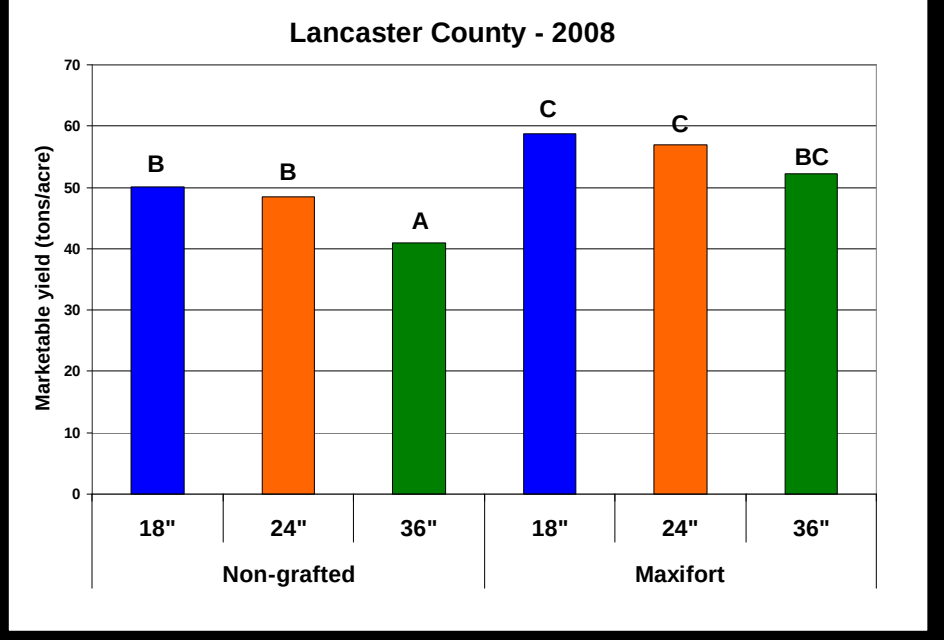
Verticillium Wilt



2008 Cedar Meadow Farm

2008 Cedar Meadow Farm

Lancaster County - Main Effects			
	Marketable yield (tons/acre)	Marketable fruit number	Average fruit size (lbs)
Non-grafted	46.53 A	347.83 A	0.449 A
Maxifort	55.92 B	394.17 B	0.473 B
18 " Spacing	54.44 Y	405.75 Y	0.447 Z
24" Spacing	52.69 YZ	376.63 Y	0.467 Z
36" Spacing	46.54 Z	330.63 Z	0.469 Z



LSD based on P=0.05

Commercial Rootstock Selection

Rootstock	TMV	Corky Root	Fusarium Wilt Race 1	Fusarium Wilt Race 2	Verticillium Wilt	Bacterial Wilt	Nematodes
Maxifort *	HR	HR	HR	HR	HR	S	MR
Beaufort *	HR	HR	HR	HR	HR	S	MR
Anchor-T **	HR	S	HR	HR	HR	MR	HR
Survivor **	HR	S	HR	HR	HR	MR	HR
Asahi ***	HR	HR	HR	S	HR	MR	HR
RST-04-105 ****	HR	HR	HR	HR	HR	HR	HR
Big Power *****	HR	HR	HR	HR	HR	S	HR
Robusta ******	HR	HR	S	HR	HR	S	S

HR =Highly Resistant, MR=Moderately Resistant, S =Susceptible

* = De 'Ruiter Seed Co. ** = Takii Seed Co. *** = Dai Honmei

**** = D Palmer Seed Co. ***** =Rijk Zwaan ****** = Bruinsma Seed Co.

Conclusions

- Grafting provides a site-specific management tool for soilborne disease.
  - Bacterial Wilt (*Ralstonia solanacearum*)
  - Fusarium Wilt (*Fusarium oxysporum* f.sp. *lycopersici*)
  - Root-knot Nematodes (*Meloidogyne* spp.)
  - Verticillium Wilt (*Vertcillium dahliae* (race 2))
  - Southern Stem Blight (*Sclerotium rolfsii*)
- Diagnosis and rootstock selection is key.
- Can yield be affected even without disease?
- Cultural management may reduce economic constraints.

QUESTIONS??
Por la sanidad de
las fincas aledañas:
Lavarse bien las
BOTAS en la ZONA
DE DESINFECCIÓN