Black Shank Collaborative Study (BKS) Study Group Report

Cancun, Mexico

14 October 2023

Coordinator: **Wei Ding**
Southwest University, Chongqing, China

SC Liaison: **Colin Fisher**

BKS SG: Agenda

1. Background
2. Current objectives
3. Current (2023) differential host series
4. 2023 test and results
5. Going forward
    1. Participants
    2. Review objectives
    3. Differential host modifications
    4. Test Protocol
6. New coordinator & secretary

BKS SG: Background

- Four races* (0, 1, 2 and 3) identified on tobacco

  * races defined by ability to infect cultivars with different resistance genes
- Resistance most effective strategy
- Reports of suspected shifts in race composition in some countries

  → increased losses in previously resistant varieties

  → need for renewed breeding effort

⟶ Black Shank Collaborative Study (# 2)

(BKS # 1 study terminated c. 25 years ago)

Current Objectives

1. To test available black shank resistant tobacco varieties in a global collaborative study
2. To establish the relative resistances of various varieties in different locations
3. To establish the causal pathogen race composition
4. To determine conclusively that data received relate to black shank and not Fusarium wilt

2023 Differential Host Series: Black shank

Resistance	Race 0	Race 1	Variety
Suscept	0	0	KY 14
	0	0	Hicks
phl	10	0	KY14 x L8
php	10	0	NC 1071
quant (Q)	4	4	TN90
	6	6	K346
	10	10	Beinhart
phl/Q	10	8	KT 209
	10	9	KT 215
WZ			WZ
php/Q/WZ	High	High	NC 1226

2023 Differential Host Series: Black shank

Resistance	Race 0	Race 1	Variety	Type
Suscept	0	0	KY 14	Bu
	0	0	Hicks	FC
phl	10	0	KY14 x L8	Bu
php	10	0	NC 1071	FC
quant (Q)	4	4	TN90	Bu
	6	6	K346	FC
	10	10	Beinhart	DAC
phl/Q	10	8	KT 209	Bu
	10	9	KT 215	Bu
WZ			WZ	FC
php/Q/WZ	High	High	NC 1226	FC

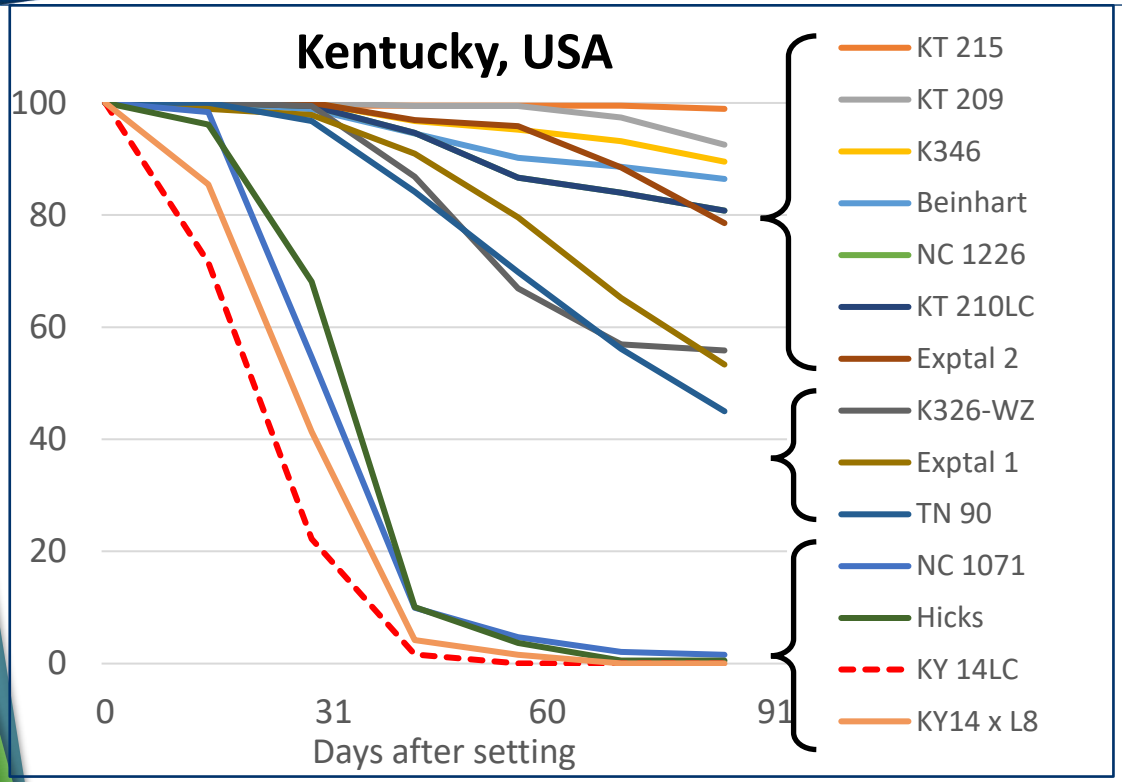
2023 Differential Host Series: Fusarium

Resistance	Race 0	Race 1	Variety	Type	Fusarium
Suscept	0	0	**KY 14**	Bu	**High**
	0	0	Hicks	FC	Sus?
phl	10	0	**KY14 x L8**	Bu	**6**
php	10	0	NC 1071	FC	Sus?
quant (Q)	4	4	TN90	Bu	Sus
	6	6	K346	FC	Sus?
	10	10	Beinhart	DAC	?
phl/Q	10	8	**KT 209**	Bu	**1**
	10	9	**KT 215**	Bu	**8**
WZ			WZ	FC	
php/Q/WZ	High	High	NC 1226	FC	?

2023 Collaborators

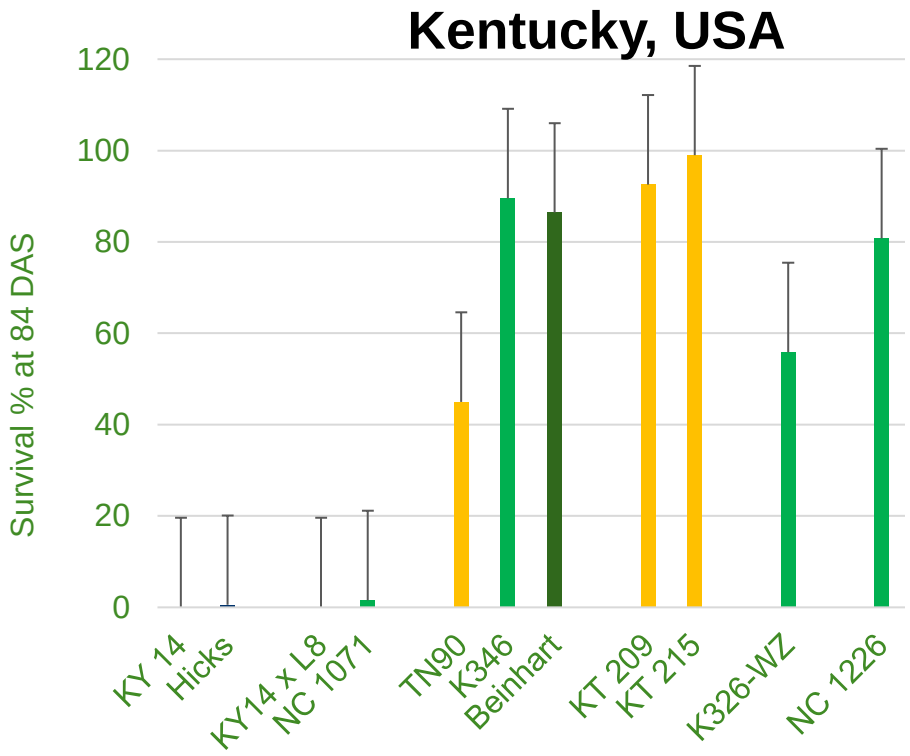
- **Tests done by:**
  - **University of Kentucky**
  - **Virginia Tech**
  - **University of Tennessee**
    - No specified protocol

2023 Results: Disease Progress



Variety	Resistance	Race 0	Race 1
KT 215	phl/Q	10	9
KT 209	phl/Q	10	8
K346	Q	6	6
Beinhart	Q	10	10
NC 1226	php/Q/WZ	High	High
WZ	WZ	?	?
TN90	Q	4	4
NC 1071	php	10	0
Hicks	Suscept	0	0
KY 14	Suscept	0	0
KY14 x L8	phl	10	0

2023 Results: Final Count



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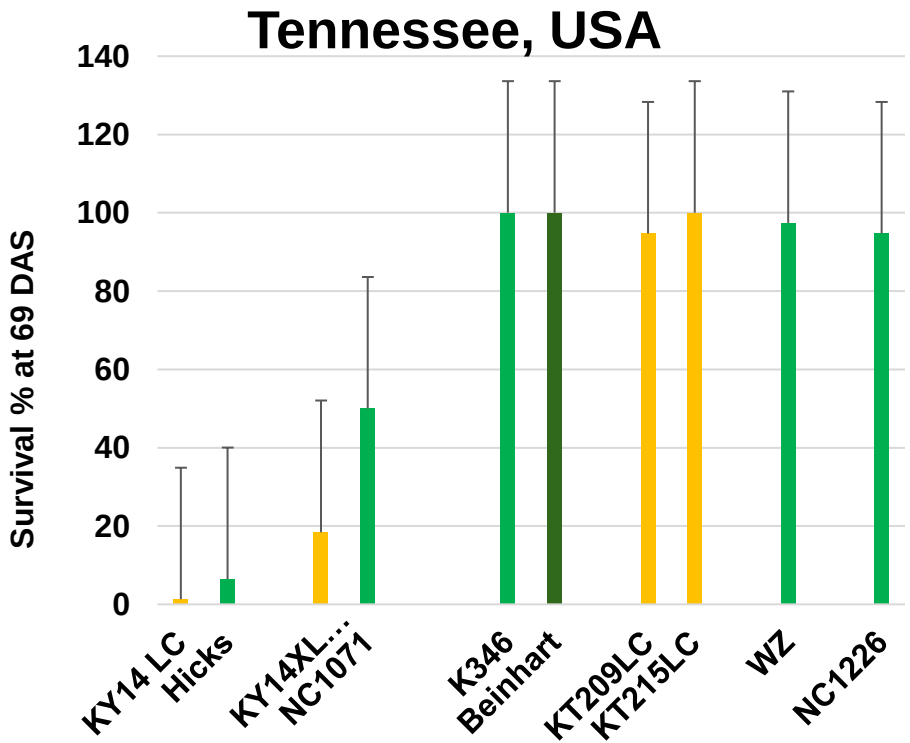
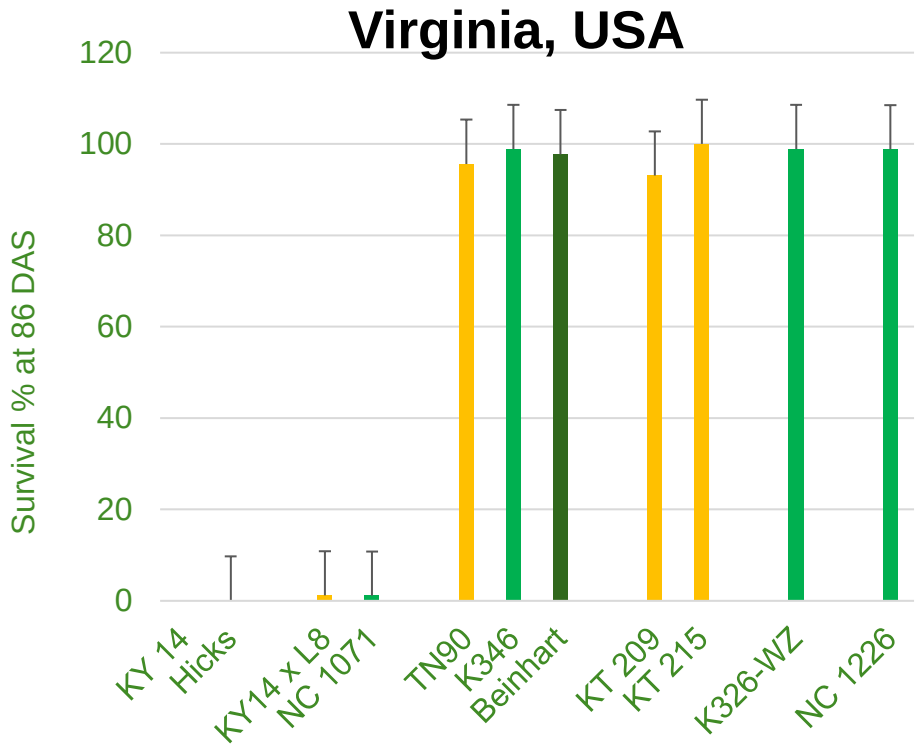
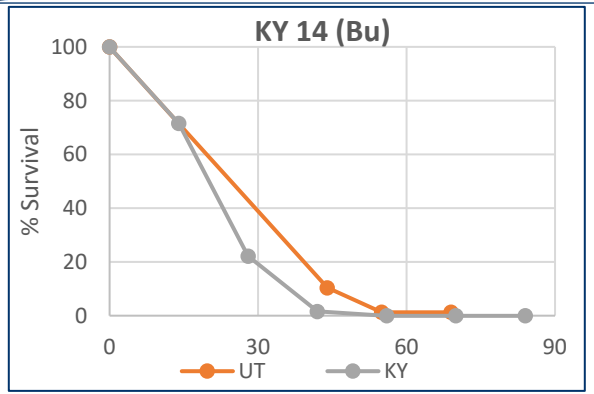
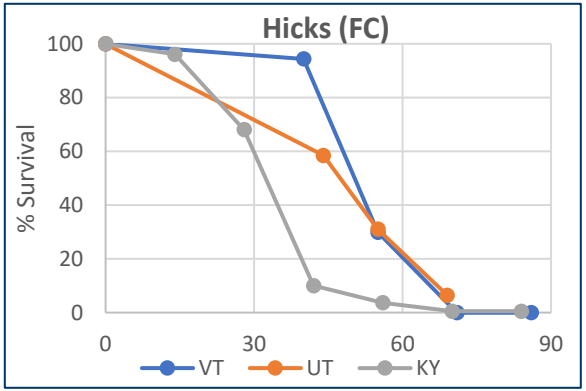


2023 Results: Final Count



Comparison between locations





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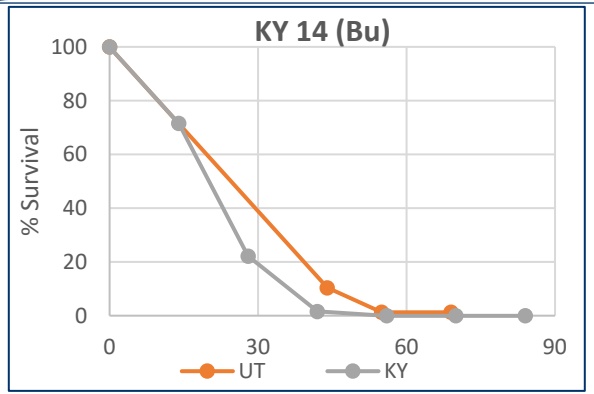

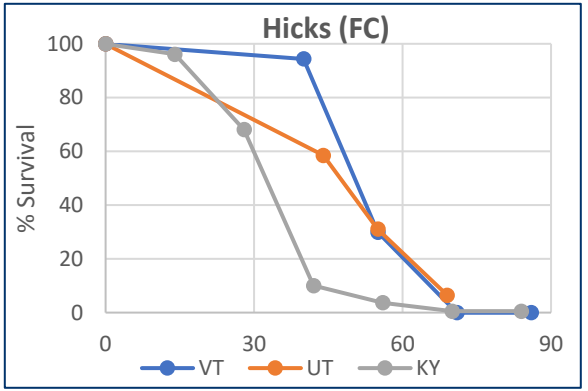

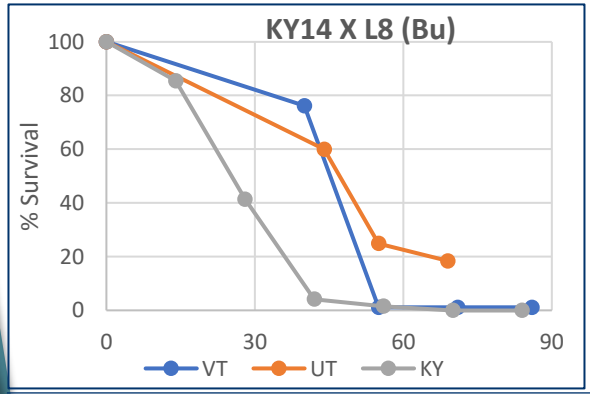

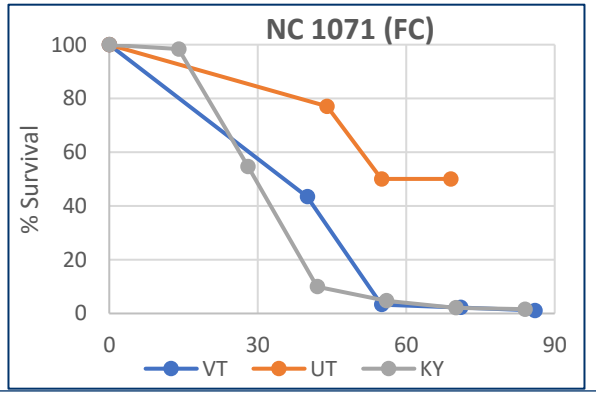

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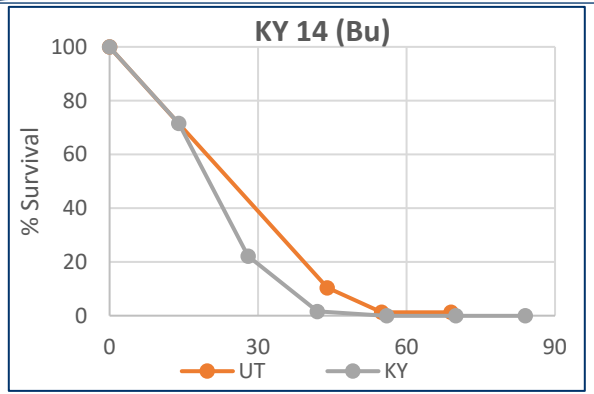

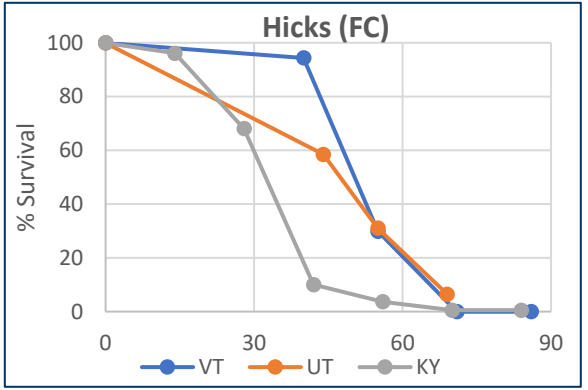

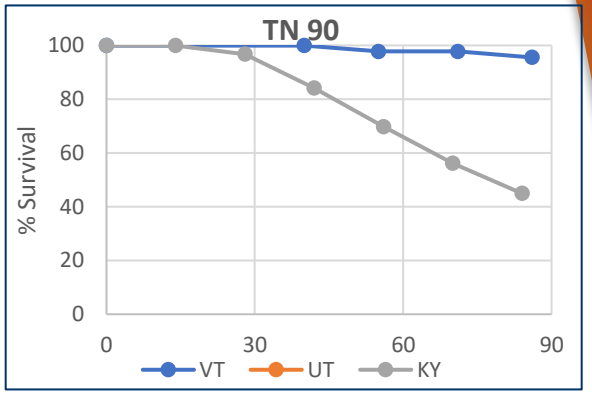

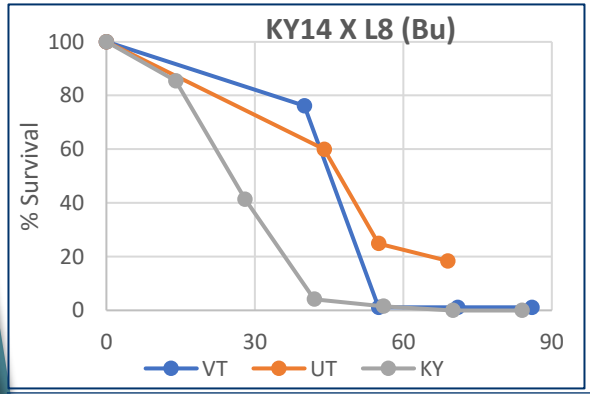

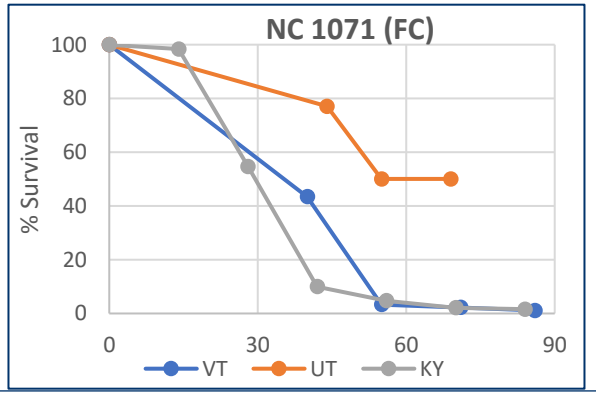

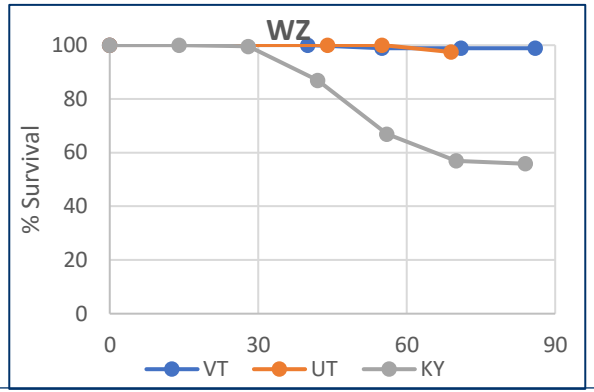

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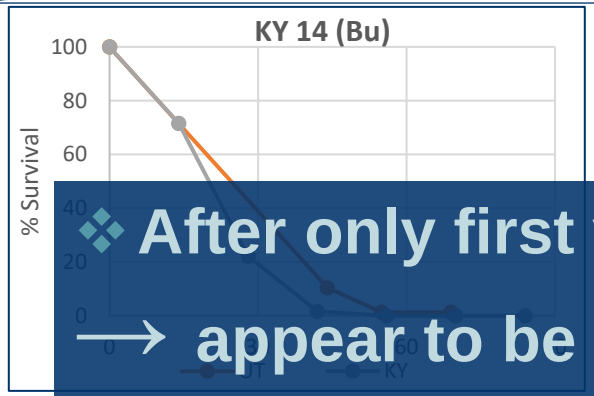

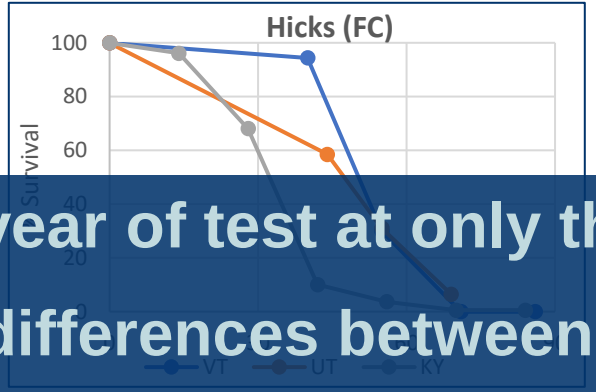

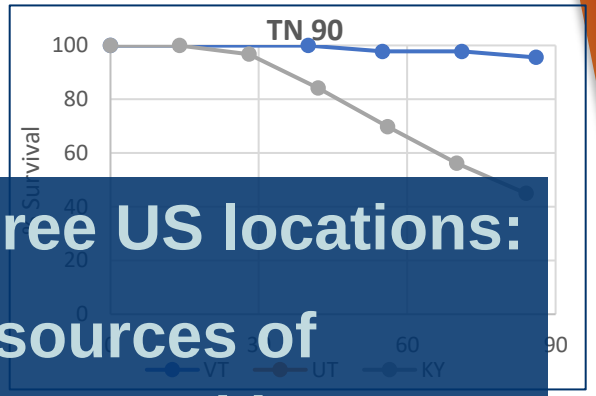

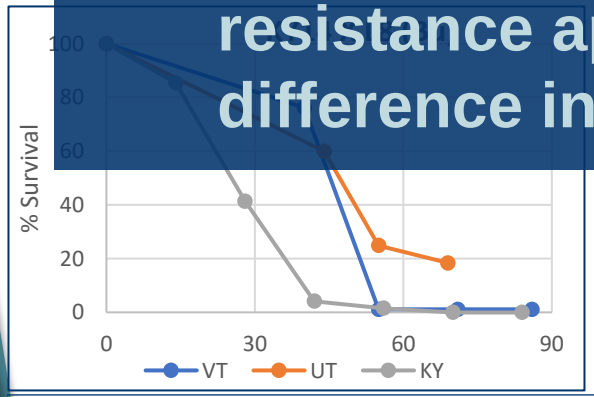

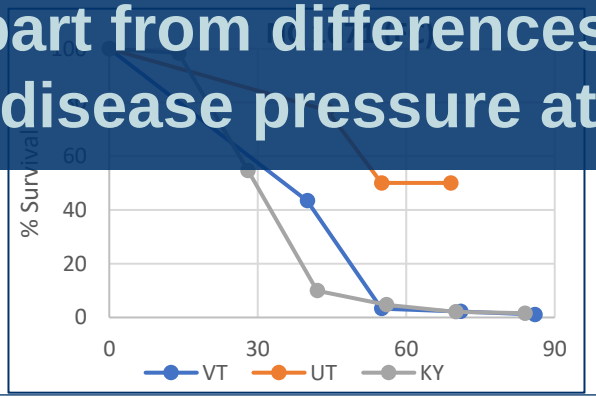

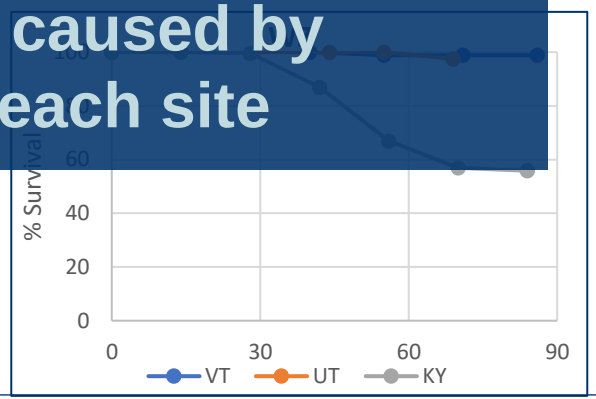

- After only first year of test at only three US locations:

→ appear to be differences between sources of resistance apart from differences caused by difference in disease pressure at each site

Discussion

Going forward

- **Sufficient interest in continuing study**

- **Current & prospective collaborators**
  - Virginia
  - Kentucky
  - Tennessee
  - North Carolina
  - China
  - Zimbabwe

Revision of Objectives

Current Objectives

1. To test available black shank resistant tobacco varieties in a global collaborative study
2. To establish the relative resistances of various varieties in different locations
3. To establish the causal pathogen race composition
4. To determine conclusively that data received relate to black shank and not Fusarium wilt

Revision of Objectives

1. **To test available black shank resistant varieties in a global collaborative study**

- *To test available sources of black shank resistance in a global collaborative study*

Revision of Objectives

- Objectives

1. To test available sources of black shank resistance in a global collaborative study
2. To establish the relative resistances of various varieties in different locations
   - Collaborators can choose to include local varieties for comparison but not really relevant to collaborative study
     - **Remove Objective 2**

Revision of Objectives

1. To test available sources of black shank resistance in a global collaborative study
2. To establish the relative resistances of various varieties in different locations
3. To establish the causal pathogen race composition
   - This would require soil sampling, isolation and characterization of individual isolates –

     beyond scope of many collaborators
     - **Remove Objective 3**

Revision of Objectives

1. To test available sources of black shank resistance in a global collaborative study
2. To establish the relative resistances of various varieties in different locations
3. To establish the causal pathogen race composition
4. To determine conclusively that data received relate to black shank and not Fusarium wilt

Still relevant –

- **Objective remains unchanged**

Objectives as Revised

1. To test available sources of black shank resistance in a global collaborative study
2. To determine conclusively that data received relate to black shank and not Fusarium wilt

Modify Differential Host Series

Resistance	Race 0	Race 1	Fusarium	Type	Variety
Suscept	0	0	High	Bu	KY 14
	0	0	Sus?	FC	Hicks
phl	10	0	6	Bu	KY14 x L8
php	10	0	Sus?	FC	NC 1071
quant (Q)	2	2	?	Bu	KY 907
	4	4	Sus	Bu	TN90
	6	6	Sus?	FC	K346
	10	10	?	DAC	Beinhart
Ph/Q	10	4	Sus	Bu	TN90ph
	10	8	1	Bu	KT 209
	10	9	8	Bu	KT 215
WZ				FC	WZ
php/Q/WZ	High	High	?	FC	NC 1226

Seed sources and distribution

Variety	OP/MS/Hybrid	Source
KY 14, KY907, Hicks, NC 1071, TN90, K346, Beinhart	OP	Univ. KY
KY14 x L8	Hybrid	Profigen/Foley
TN90ph	MS	RJR
KT 209, KT 215	Hybrid	Werkman Seed
WZ	MS	Zimbabwe/NC
NC 1226	Hybrid	NC

Seed sources and distribution

Variety	OP/MS/Hybrid	Source
KY 14, KY907, Hicks, NC 1071, TN90, K346, Beinhart	OP	Univ. KY
KY14 x L8	Hybrid	Profigen/Foley
TN90ph	MS	RJR
KT 209, KT 215	Hybrid	Werkman Seed
WZ	MS	Zimbabwe/NC
NC 1226	Hybrid	NC

Seed distribution internationally can be challenging –

LNTP SG experience in coordination with Bergerac Seed and Breeding, France

Protocol

- **Protocol** (optimized)
  - **>4 replications** (up to 8)
  - **20-25 plants/plot**
  - **Baseline stand count at 7-14 days after transplanting**
  - **Count of <u>surviving</u> plants at 14-day intervals**
    - For as long as possible, even later than normal harvest if possible
    - Alternate rows of susceptible variety if possible
  - **Return Excel file of raw survival counts to coordinator**

BKS SG Coordinator*

Yuan Zeng

Assistant Professor

- B,Sc. Forest Protection, Beijing Forestry University
- M.Sc. Forest Health and M.Sc. Statistics; Auburn University, Alabama
- Ph.D. Microbiology/Entomology, Auburn University, Alabama
- Postdoctoral Fellow in Plant Pathology, Colorado State University
- School of Plant and Environmental Sciences, Virginia Tech. August 2022
  Southern Piedmont Agricultural Research and Extension Center
  Soilborne diseases in tobacco and soybean

* subject to confirmation by SC

BKS SG Secretary*

Daisy Ahumada

Assistant Professor and Extension Plant Pathologist

- California State Polytechnic University, Environmental Biology
- University of California, Davis, Ph.D.
- Dept. Entomology Plant Pathology, North Carolina State University. August 2023
  Tobacco black shank, bacterial wilt, target spot

* subject to confirmation by SC

Thank you …

…… to all who contribute, in any form, to the SG:

- Field tests
- Seed suppliers
- Seed distribution
- Discussion, ideas & suggestions