

# Cotton diseases & management considerations



**Dr. Chris Little**

Professor of Plant Pathology  
Kansas State University

# Topics for this presentation:



## 1. Seedling disease complex

Several ubiquitous fungi gang up on cotton

## 2. Fusarium and Verticillium wilts

## 3. Cotton root rot

Potential importance for the Great Plains?

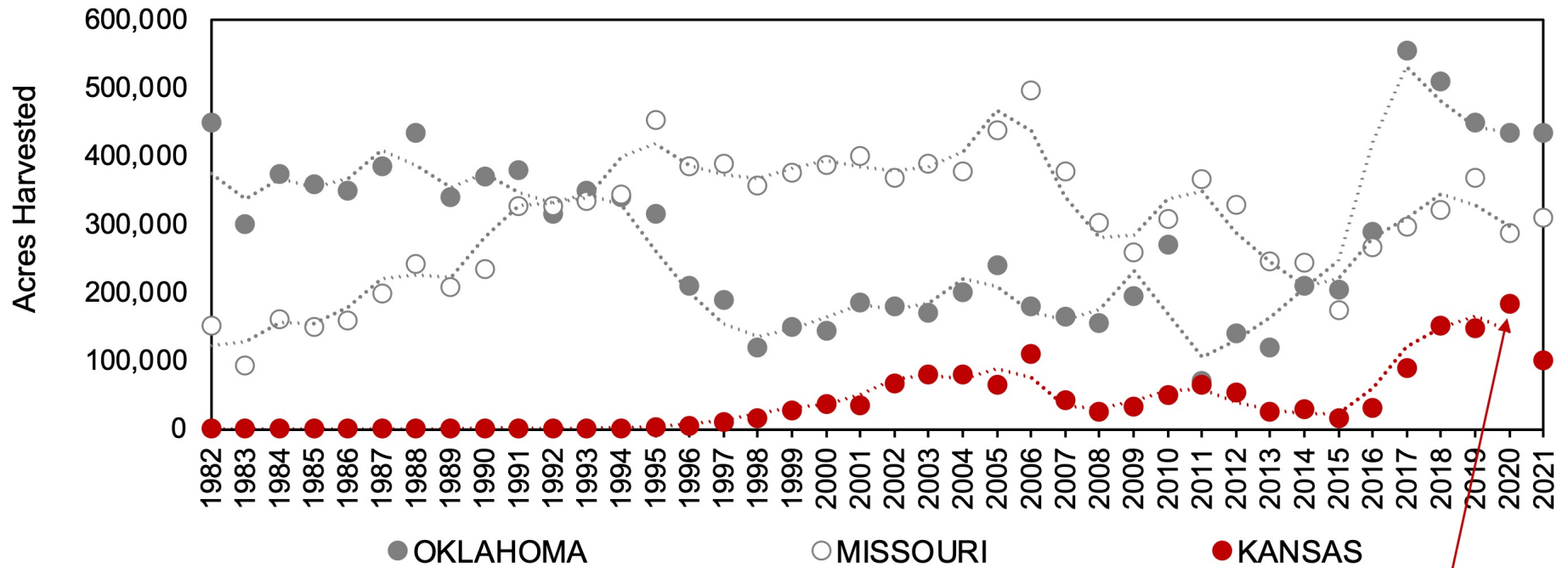
## 4. Other important diseases

Foliar diseases

Cotton nematodes & interactions

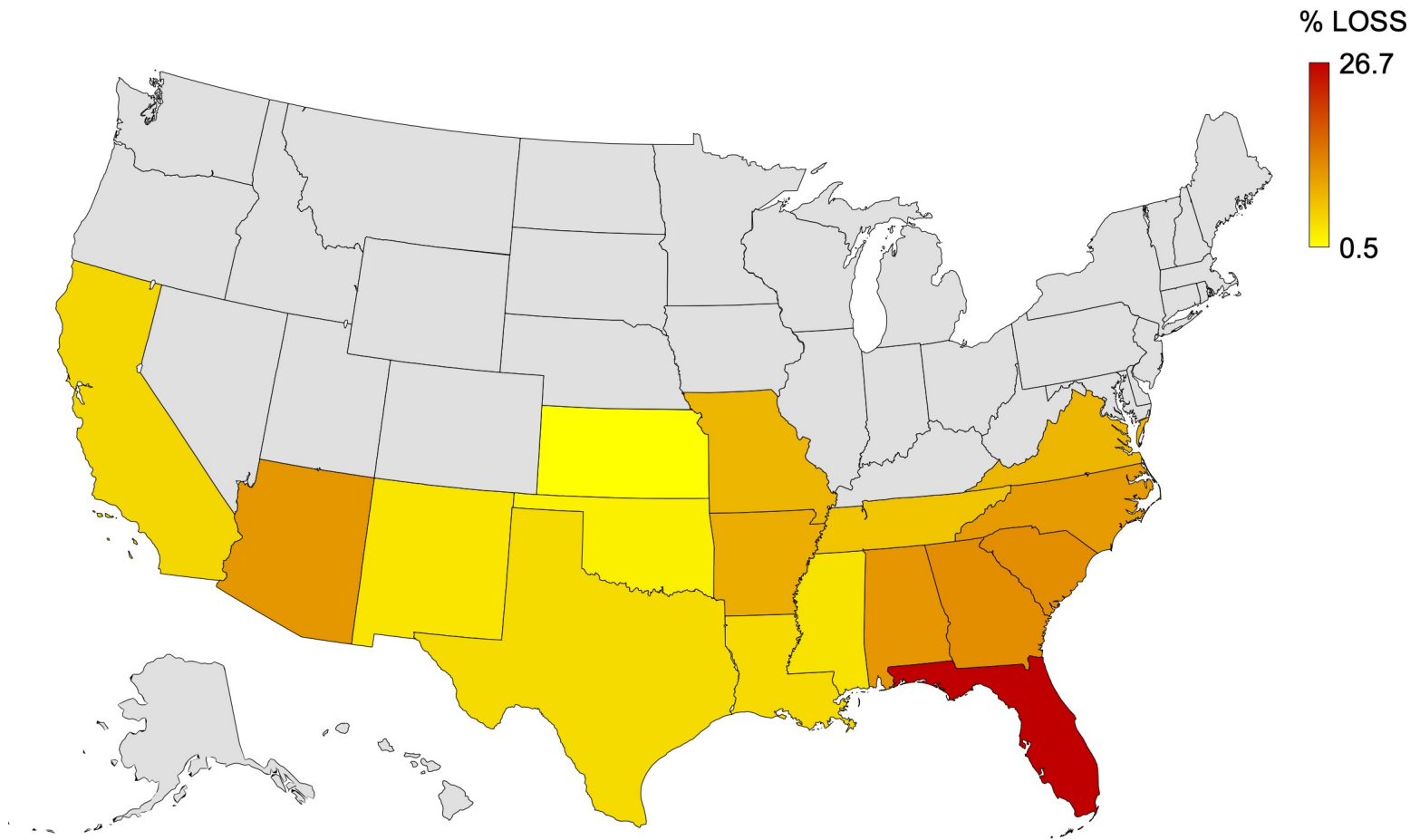
Cotton leaf roll dwarf virus (CLRDV)

# Central Great Plains cotton acreage trends 1982 - 2020

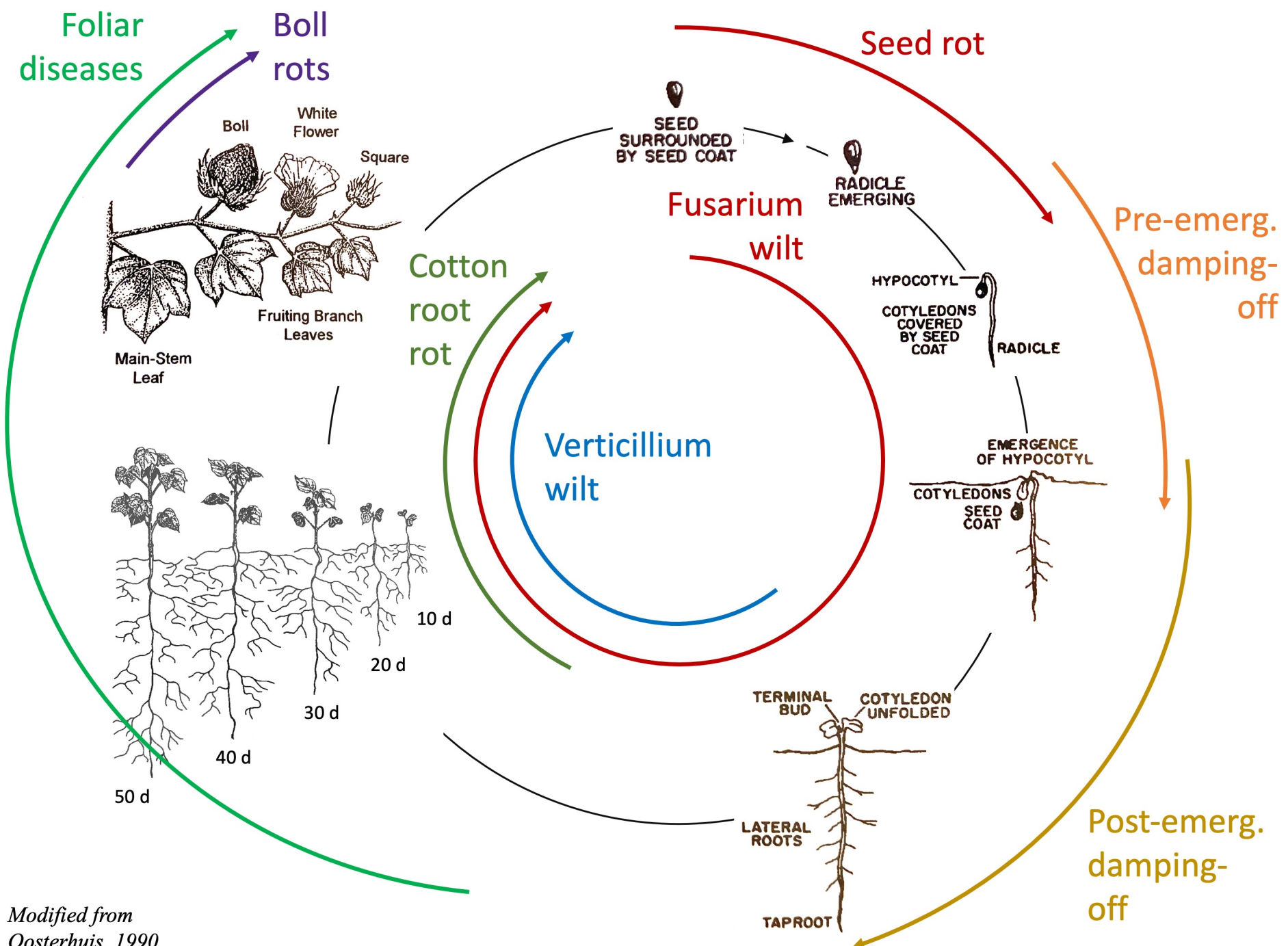


~184k acres  
in 2020

# Reported impact of **cotton diseases** in the United States cotton belt, 2020



*Modified from the National Cotton  
Council Disease Loss committee, 2021*



Modified from Oosterhuis, 1990

# Seedling diseases



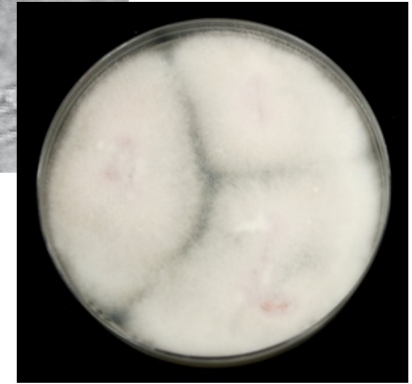
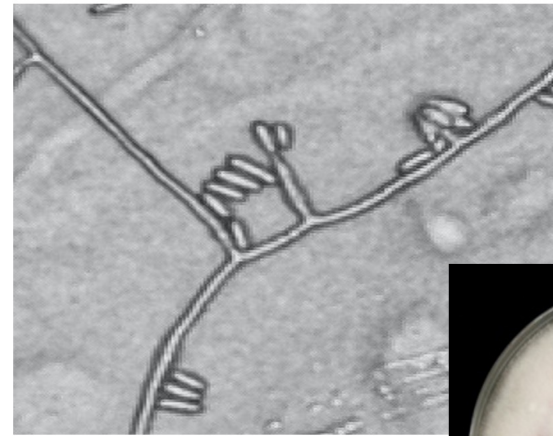
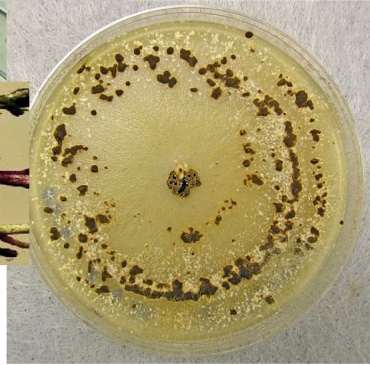
Discoloration, necrosis  
Stem constriction



“Skips in the row.” = PRE-EMERGENT DAMPING-OFF  
Stunting, vigor loss

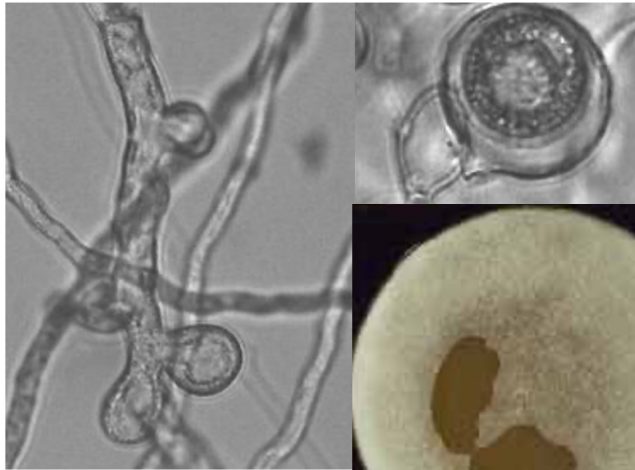


*Rhizoctonia solani*

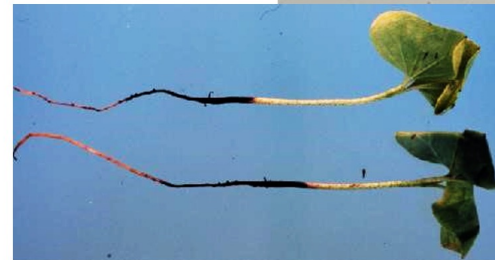
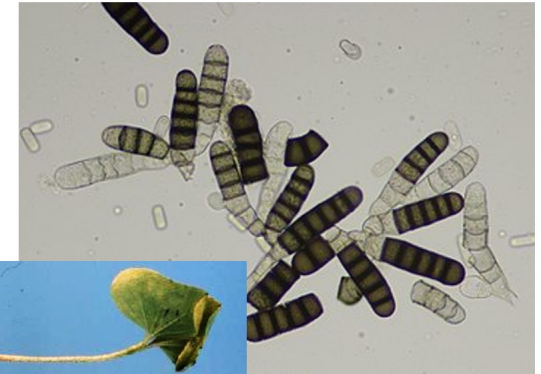


*Fusarium species*

**Seedling disease complex**



*Pythium species*



*Thielaviopsis basicola*

# *Fusarium* species associated with *Gossypium* in the United States.

What do we know? Here is a partial picture.

<i>FUSARIUM</i> SPP.	AZ	CA	FL	GA	KS	LA	MS	NC	NM	OK	SC	TN	TX	#
<i>F. acuminatum</i>					?					✓				1
<i>F. chlamydosporum</i>					?					✓				1
<i>F. equiseti</i>					?		✓			✓				2
<i>F. fujikuroi</i>					?				✓					1
" <i>F. moniliforme</i> "*				✓	?	✓	✓	✓		✓	✓		✓	7
<i>F. oxysporum</i>		✓	✓	✓	?		✓		✓				✓	6
FOV**	✓	✓	✓		?		✓	✓	✓	✓		✓	✓	8
<i>F. proliferatum</i>					?				✓					1
<i>F. roseum</i>				✓	?						✓			2
<i>F. scirpi</i>					?					✓				1
<i>F. incarnatum</i>					?		✓			✓				2
<i>F. solani</i>				✓	?		✓		✓	✓			✓	5

\*Now separated into numerous individual species.

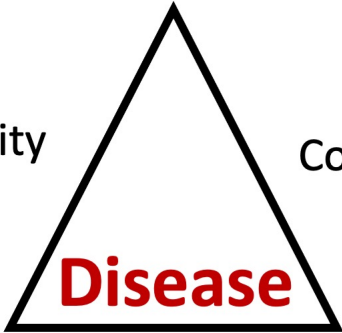
\*\**Fusarium oxysporum* f.sp. *vasinfectum*



**HIGH  
QUALITY  
SEED**

**DELINTED,  
TREATED  
SEED**

Poor quality  
seed



Cold, wet soil

Seedling  
pathogen  
complex

**PLANT AT  
MINIMUM  
DEPTH**

**> 65°C  
> 3-4 days**

**CONTROL  
PLANT  
POPULATION**



Improved  
pathogen  
growth



Poor  
cotton  
growth

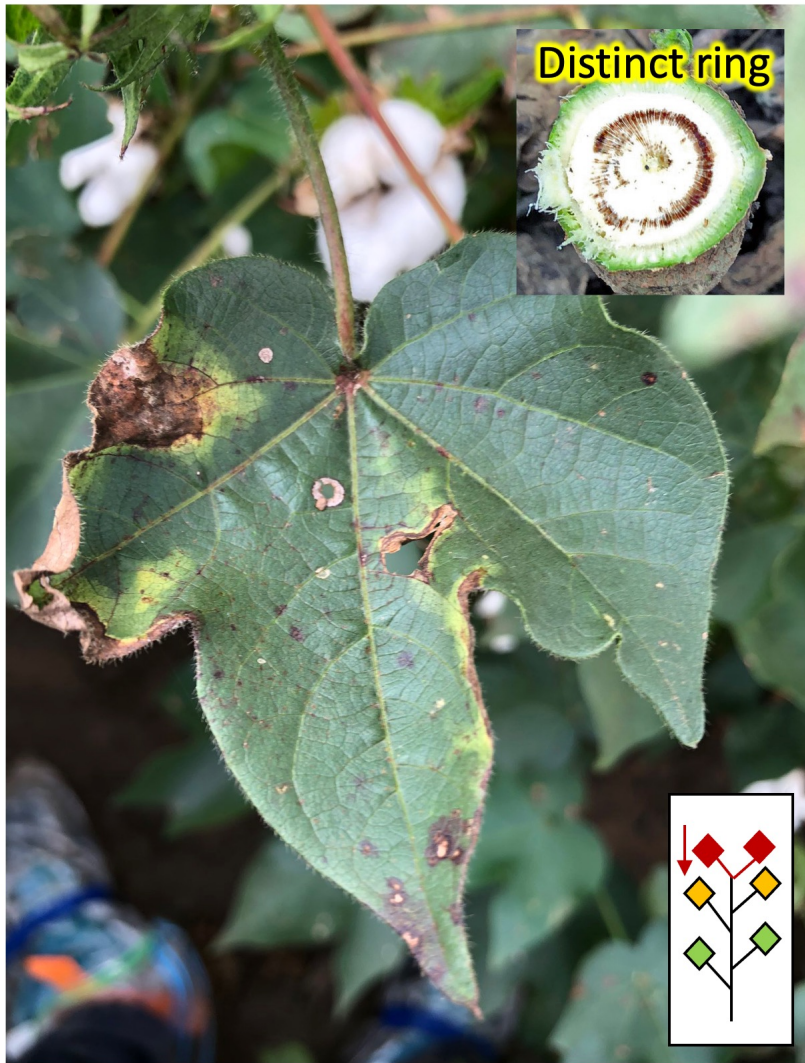
# Seed treatment options for seedling disease control.

	Chemical	R	F	P	T	
Nusan 30 EC	Benzothiazole	■	■	■		
Vitavax 34	Carboxin	■				
Maxim 4 FS	Fludioxonil	■	■			***
Acceleron DX-612	Fluxapyroxad	■				
Vortex, Accel. DX509	Ipconazole	■	■	■	■	
Dithane M-45	Mancozeb	■	■	■	■	
Apron XL-LS	Mefenoxam			■		***
Allegiance FL, LS; Accel. DX-309	Metalaxyl			■		* **
Nu-Flow CT, Accel. DT-510	Myclobutanil	■			■	
Acceleron DX-109	Pyraclostrobin	■				
Thiram 42-S, 480 DP	Thiram	■	■	■	■	
Baytan 30 flow.	Triadimenol	■			■	**
Rizolex	Toclofos-methyl	■	■			
Trilex flow., Accel. DX-709	Trifloxystrobin	■				* **

R = *Rhizoctonia*  
 F = *Fusarium*  
 P = *Pythium*  
 T = *Thielaviopsis*

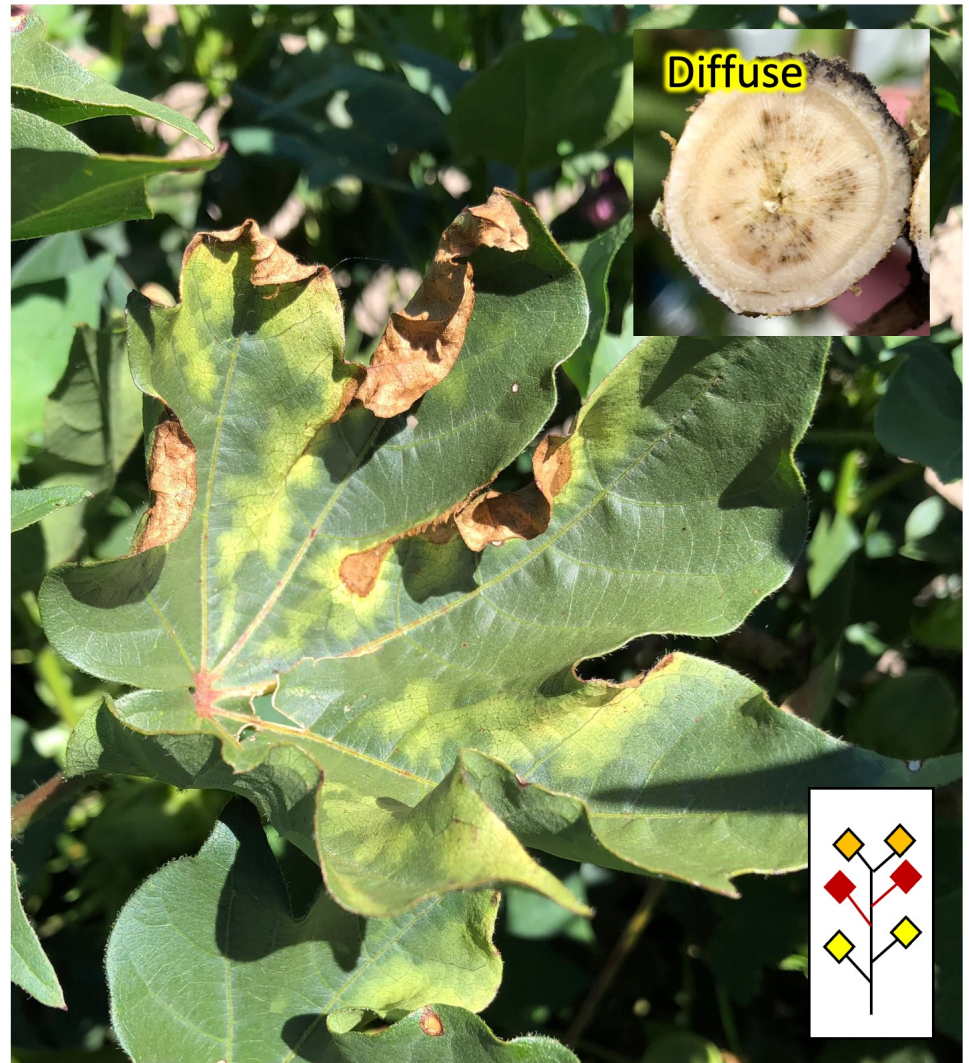
\*Trilex 2000; \*\*Trilex Advanced; \*\*\*Dynasty CST (incl. azoxystrobin)

# Cotton wilts



## Fusarium wilt

*Fusarium oxysporum* f.sp.  
*vasinfectum*

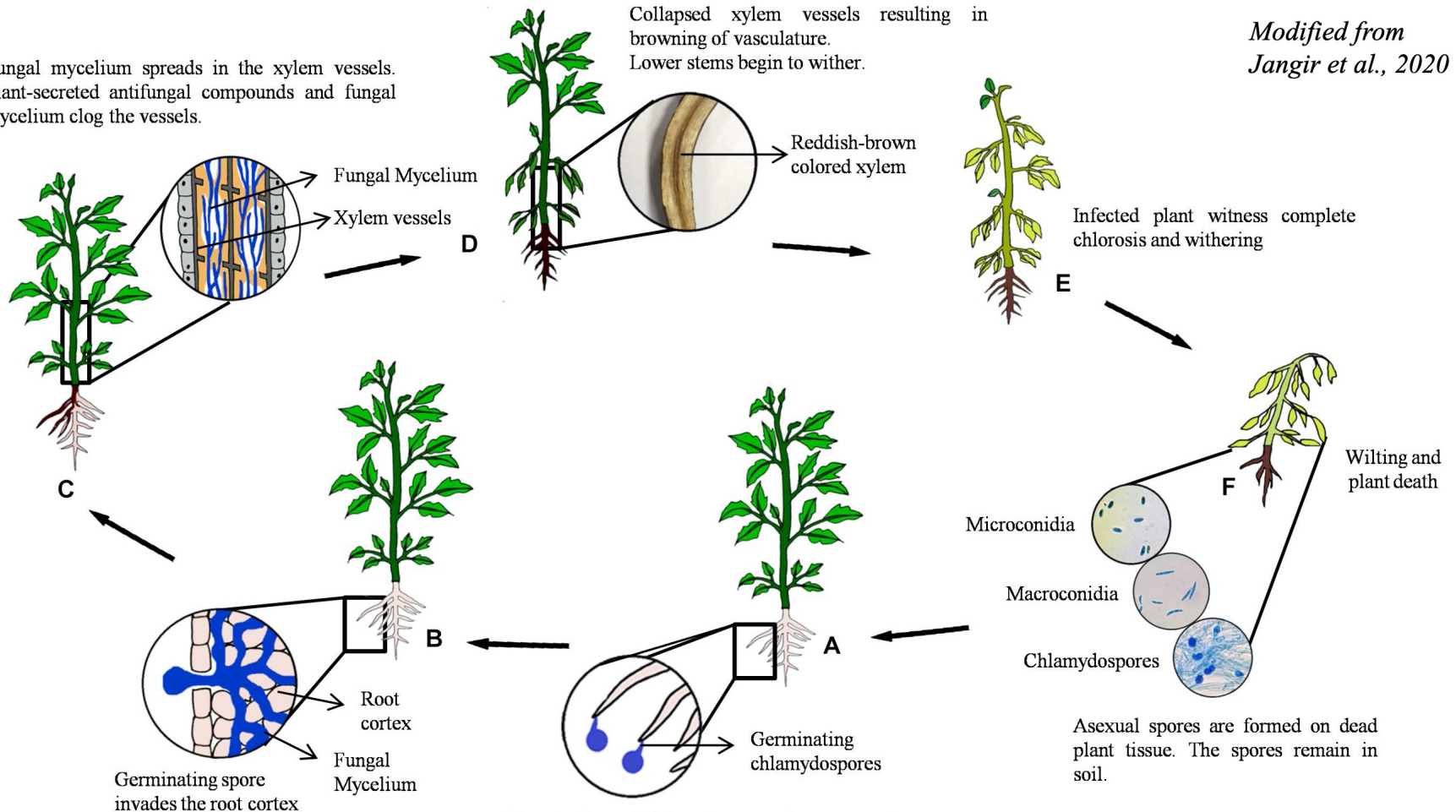


## Verticillium wilt

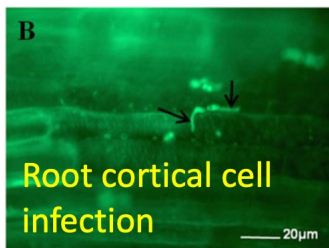
*Verticillium dahliae*

# Disease cycle of *Fusarium oxysporum* f.spp.

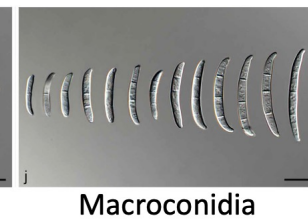
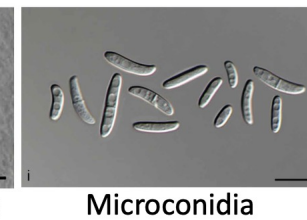
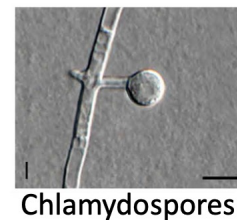
Fungal mycelium spreads in the xylem vessels. Plant-secreted antifungal compounds and fungal mycelium clog the vessels.



Modified from Jangir et al., 2020

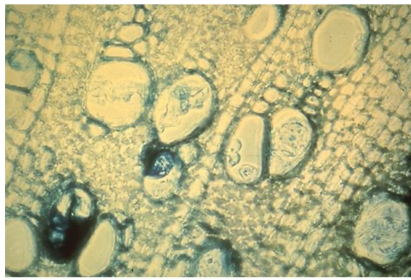


*F.o. f.spp.*  
*vasinfectum*

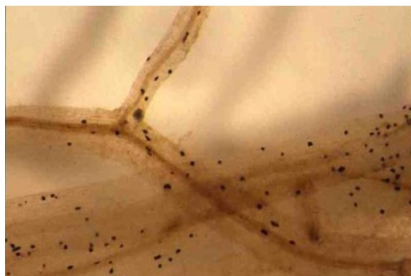
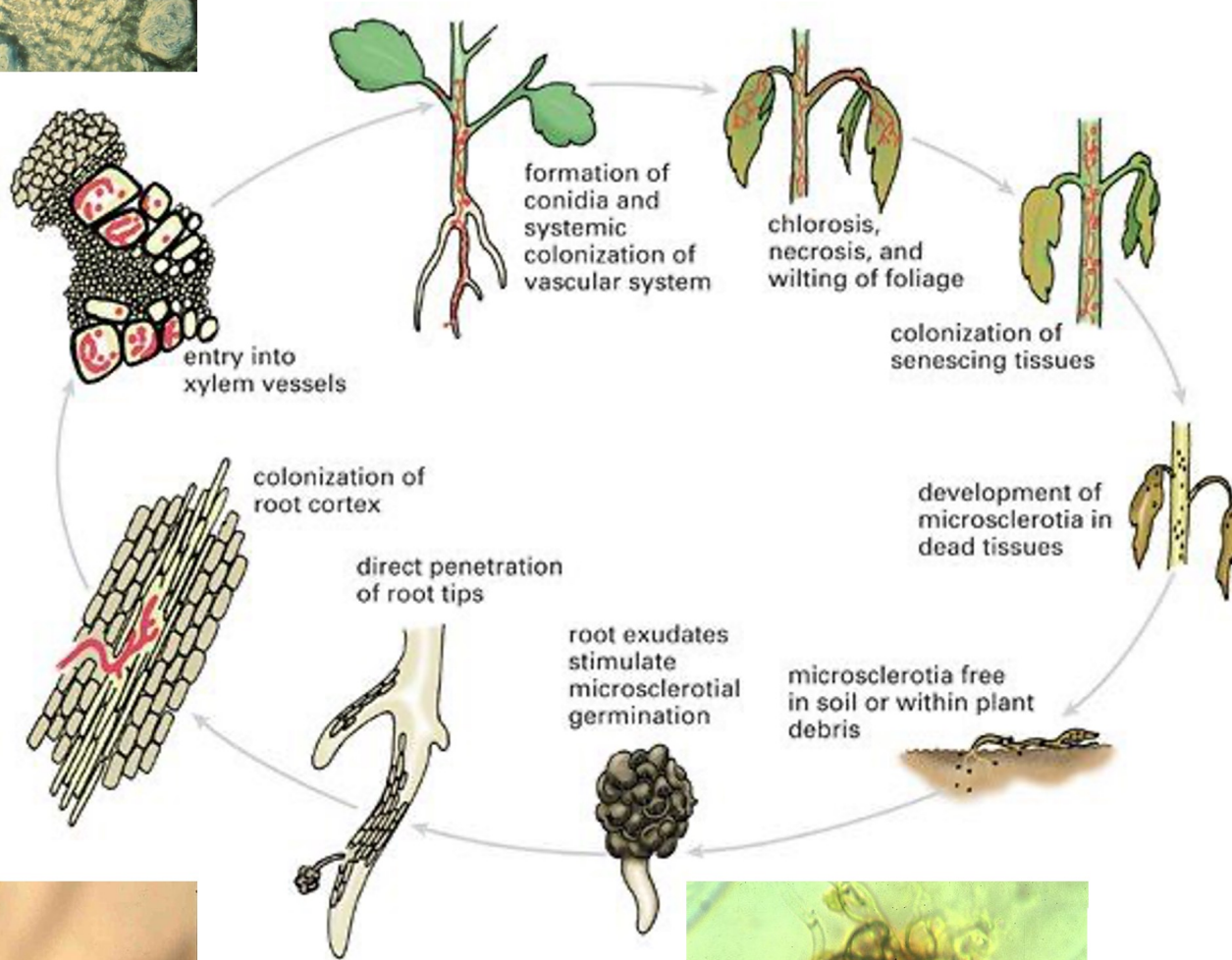


Modified from Lombard et al., 2019

# Disease cycle of *Verticillium*



hyphae colonize  
xylem vessels



microsclerotia  
in root tissue

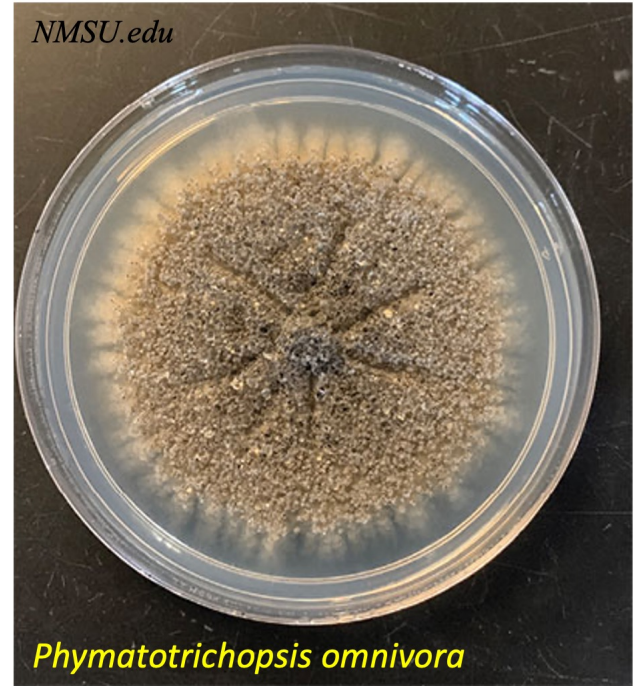


microsclerotium

Cotton, Inc.

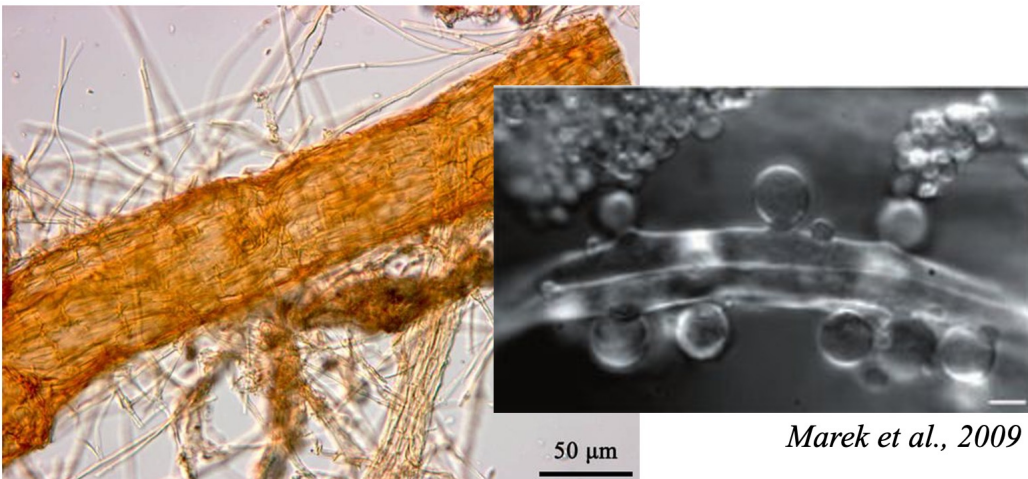


NMSU.edu



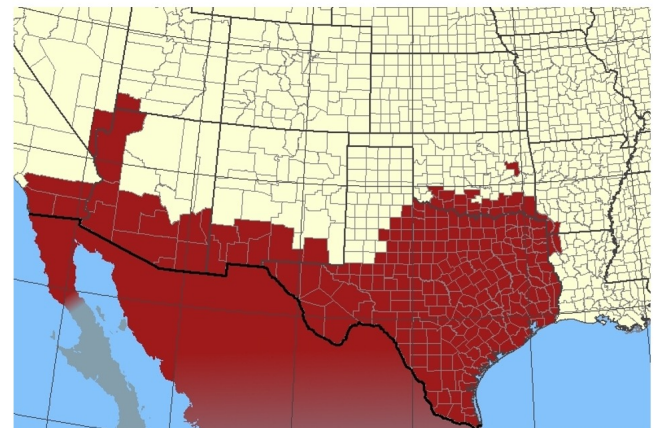
*Phymatotrichopsis omnivora*

## What about cotton root rot in the Great Plains?



Marek et al., 2009

PaDIL, 2022

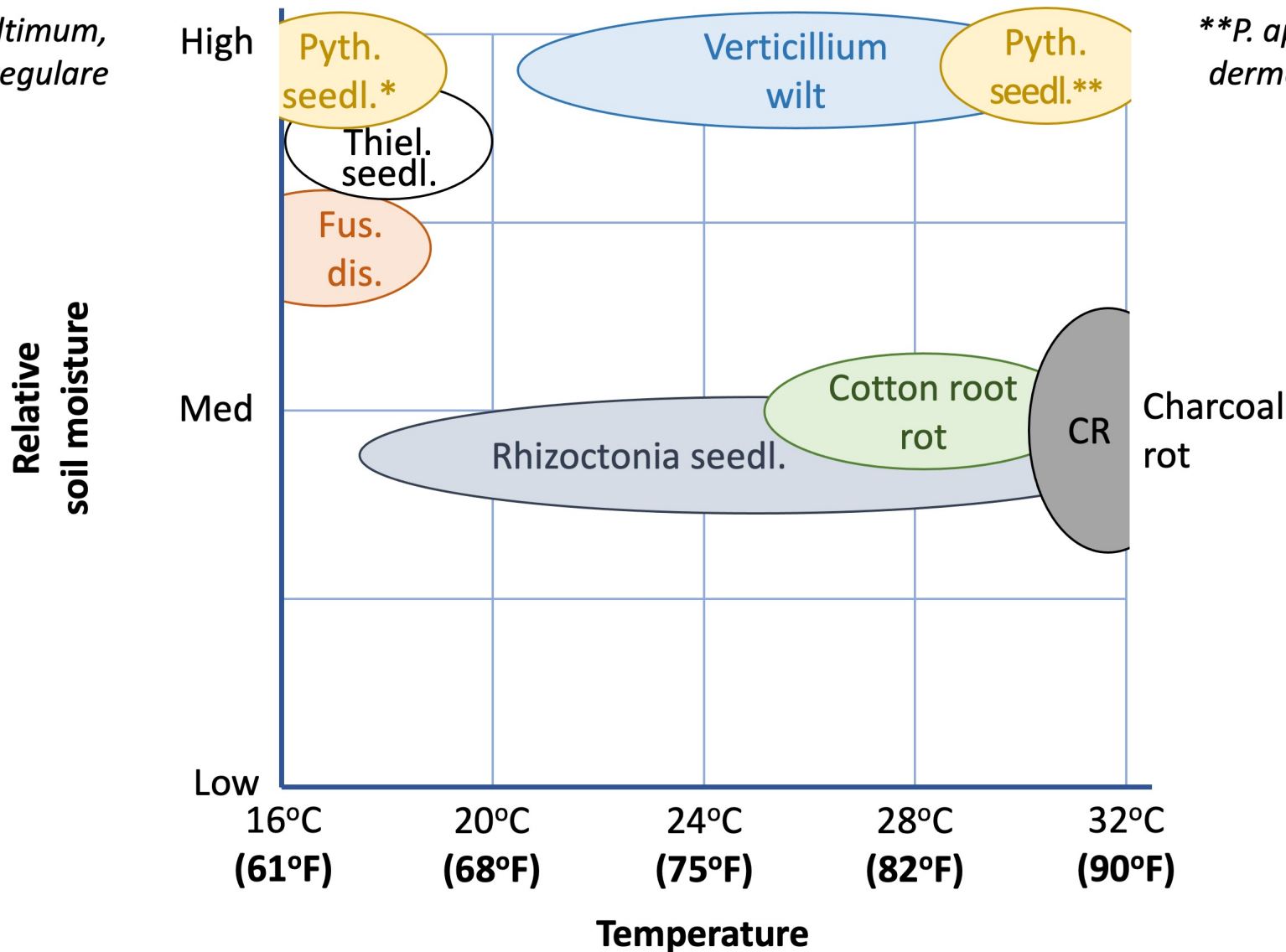


NCSU.edu

# Impact of **temperature** and **moisture** on seedling diseases, wilts, and cotton root rot.

\**P. ultimum*,  
*P. irregulare*

\*\**P. aphanidermatum*



# Summary of controls for seedling, wilt, and root rots

	Seedling diseases	Fusarium wilt	Verticillium wilt	Cotton root rot	Charcoal rot
<b>Resistance</b>	Poor	MR+RKN R	Yes	No	Poor
<b>Rotations</b>	No	Yes	Yes	>4-years	No
<b>Cover crops</b>	Yes	No	No	Yes	???
<b>Solarization</b>	Yes	No	Yes	No	No
<b>Seed treatments</b>	Yes	Yes	No	No	Yes
<b>Biocontrol</b>	No	No	Yes	No	
<b>Quality seed</b>	Yes	Yes	No	No	
<b>Planting &amp; develop.</b>	Yes	No	No	Early devel. cultivars	Early
<b>Tillage</b>	Yes	No	No	No	
<b>Avoid injury</b>	Yes	No	No	No	
<b>Irrigation</b>	No	No	No	No	Yes

\*In furrow fungicides are available as well; Biological fungicides w/ activity against *R. solani*.



# Rainy July/August usually results in foliar diseases



Ascochyta blight  
(*Ascochyta gossypii*)



Target spot  
(*Corynespora cassicola*)



Stemphylium leaf spot  
(*Stemphylium solani*)



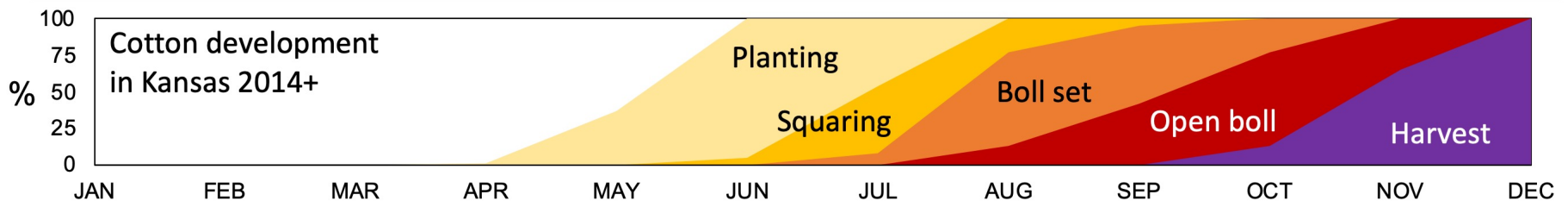
Cercospora leaf spot  
(*Cercospora gossypina*)



Alternaria leaf spot  
(*Alternaria alternata*, *A. macrospora*)



Bacterial blight *Xanthomonas citri*  
(angular leaf spot) pv. *malvacearum*



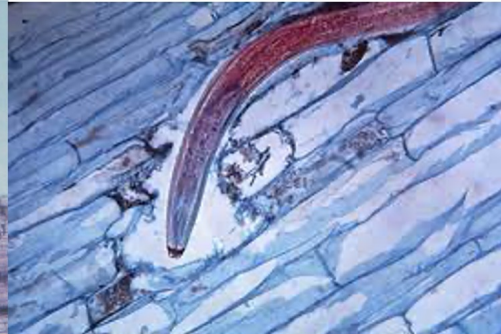
**When are foliar diseases problematic?**

# Cotton nematodes

Root-knot



c



Lance



Reniform



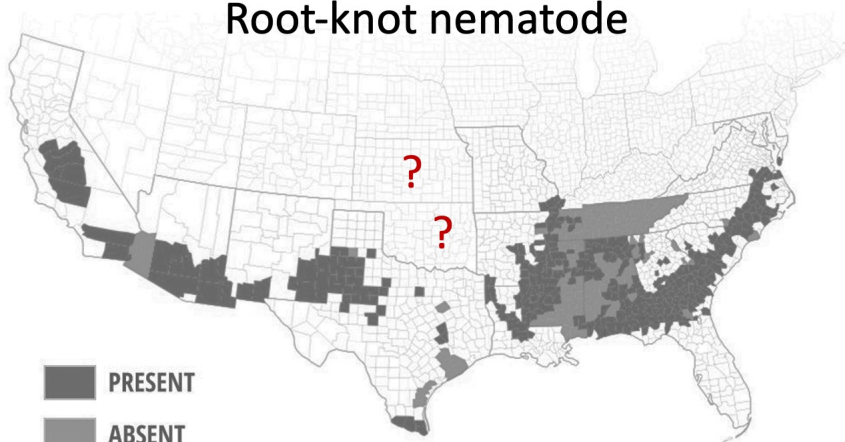
Sting

Nematode	<i>Genus</i>	<i>species</i>	Lifestyle
<b>Root-knot nematode*</b>	<i>Meloidogyne</i>	<i>incognita</i>	Endoparasitic/Sedentary
<b>Reniform nematode</b>	<i>Rotylenchus</i>	<i>reniformis</i>	Endoparasitic/Sedentary
<i>Other:</i>			
Lance nematode**	<i>Hoplolaimus</i>	<i>columbus</i>	Endoparasitic/Migratory
Sting nematode	<i>Belonolaimus</i>	<i>longicaudatus</i>	Ectoparasitic/Migratory

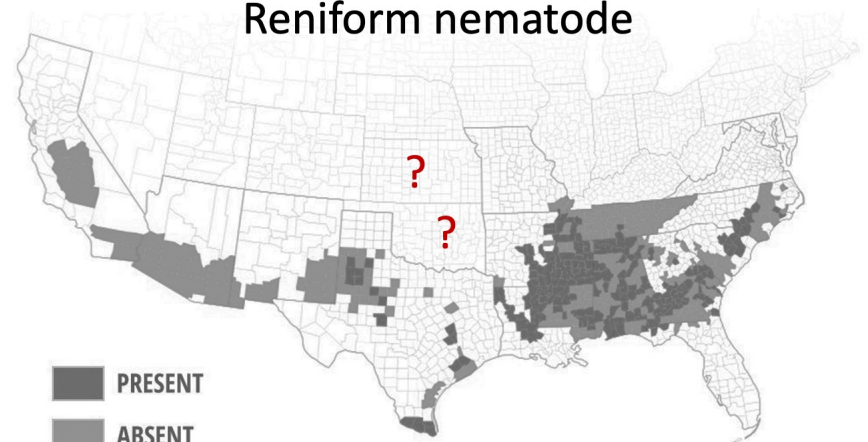
\*Southern RKN; \*\*Columbus lance nematode (CLN)

# Distribution of important cotton nematodes

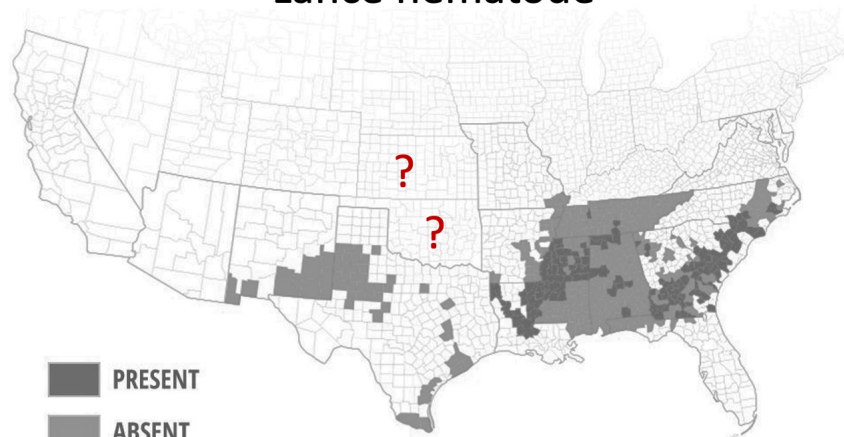
## Root-knot nematode





























## Reniform nematode



## Lance nematode



# Interactions between fungal and nematode diseases

Seedling disease complex	 <i>Fusarium</i>				
	<i>Pythium</i>				
	<i>Rhizoctonia</i>				
	<i>Thielaviopsis</i>				
	 Fusarium wilt				
	Verticillium wilt				
		Root-knot	Reniform	Lance	Sting



Synergism for reduced yield and/or increased disease

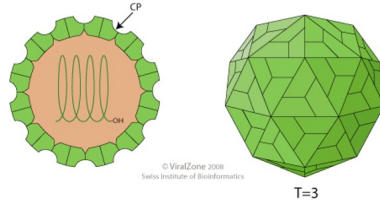


Interaction not known

# CLRDV

Virus	Morphology	Genome	Vector
-------	------------	--------	--------

**Cotton leafroll dwarf virus (POLEROVIRUS)**



Modified from  
ViralZone, 2008

+ssRNA

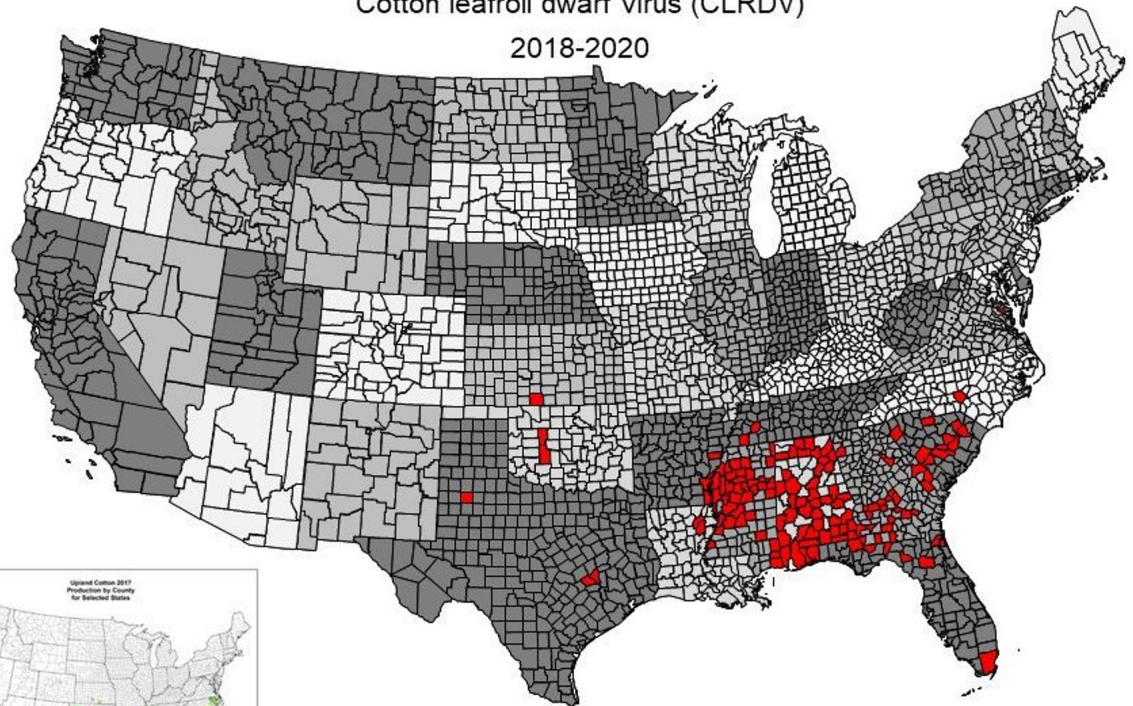
Aphid spp.  
*Aphis gossypii*  
(Feng et al., 2017)



Modified from  
Alabama Extension, 2021

## Cotton Leafroll Dwarf Disease Distribution

Cotton leafroll dwarf virus (CLRDV)  
2018-2020



Ali et al., 2021 (OK)

Modified from  
ViralZone, 2021



# Got Crop Questions?

Contact the **Kansas State Univ.**  
**Plant Disease Diagnostic Lab**

**clinic@ksu.edu**  
**(785)-532-6176**

Ship samples overnight using UPS  
or FedEx to:

1712 Claflin Rd  
4032 Throckmorton PSC  
Manhattan, KS 66506



Visit our webpage for more info