



SDS

Epidemiology

Leonor Leandro

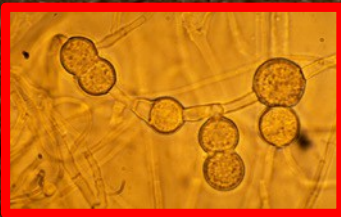
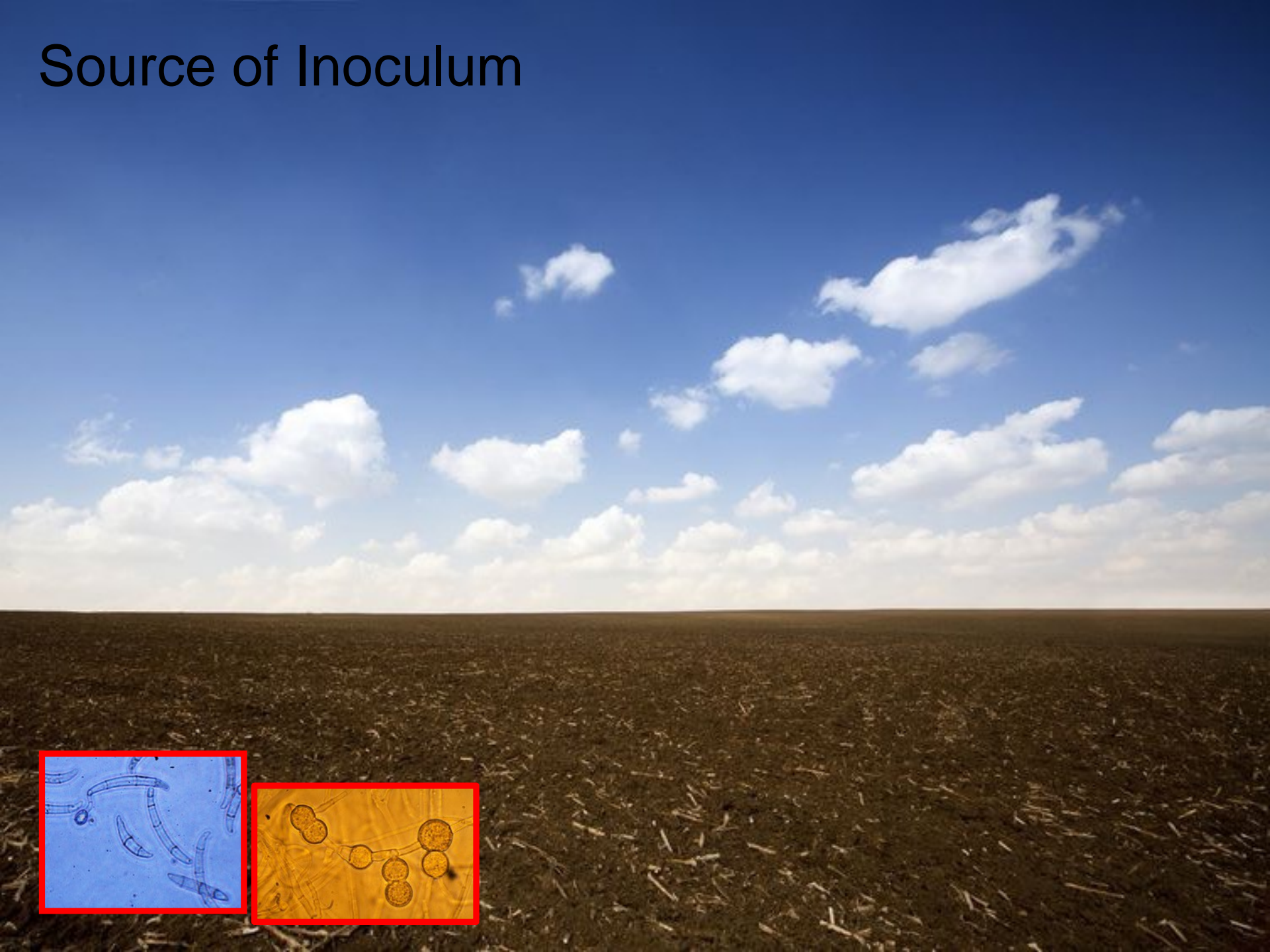
Dept. Plant Pathology and
Microbiology

Iowa State University

SDS Disease Cycle



Source of Inoculum

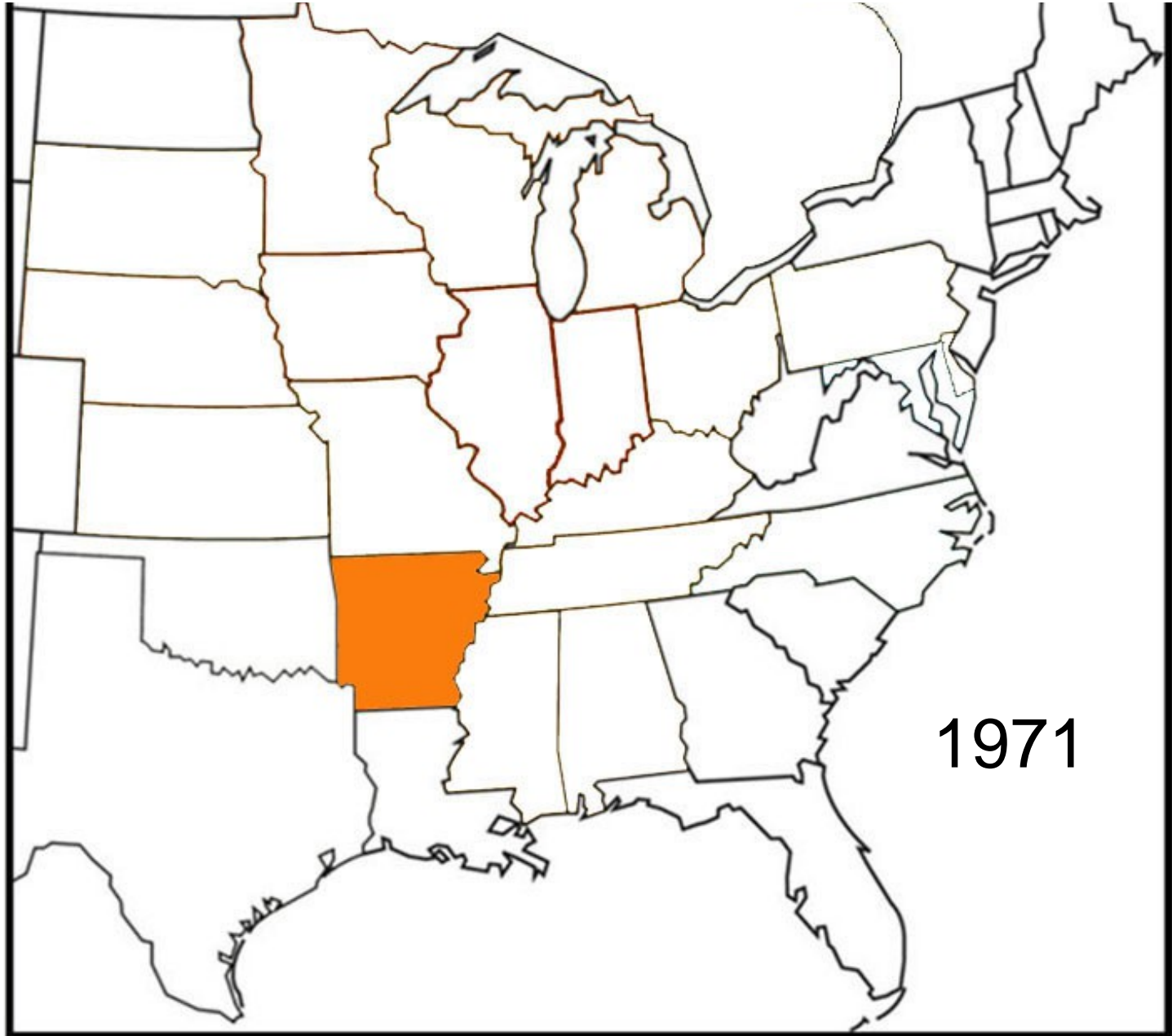


Inoculum Source and Spread

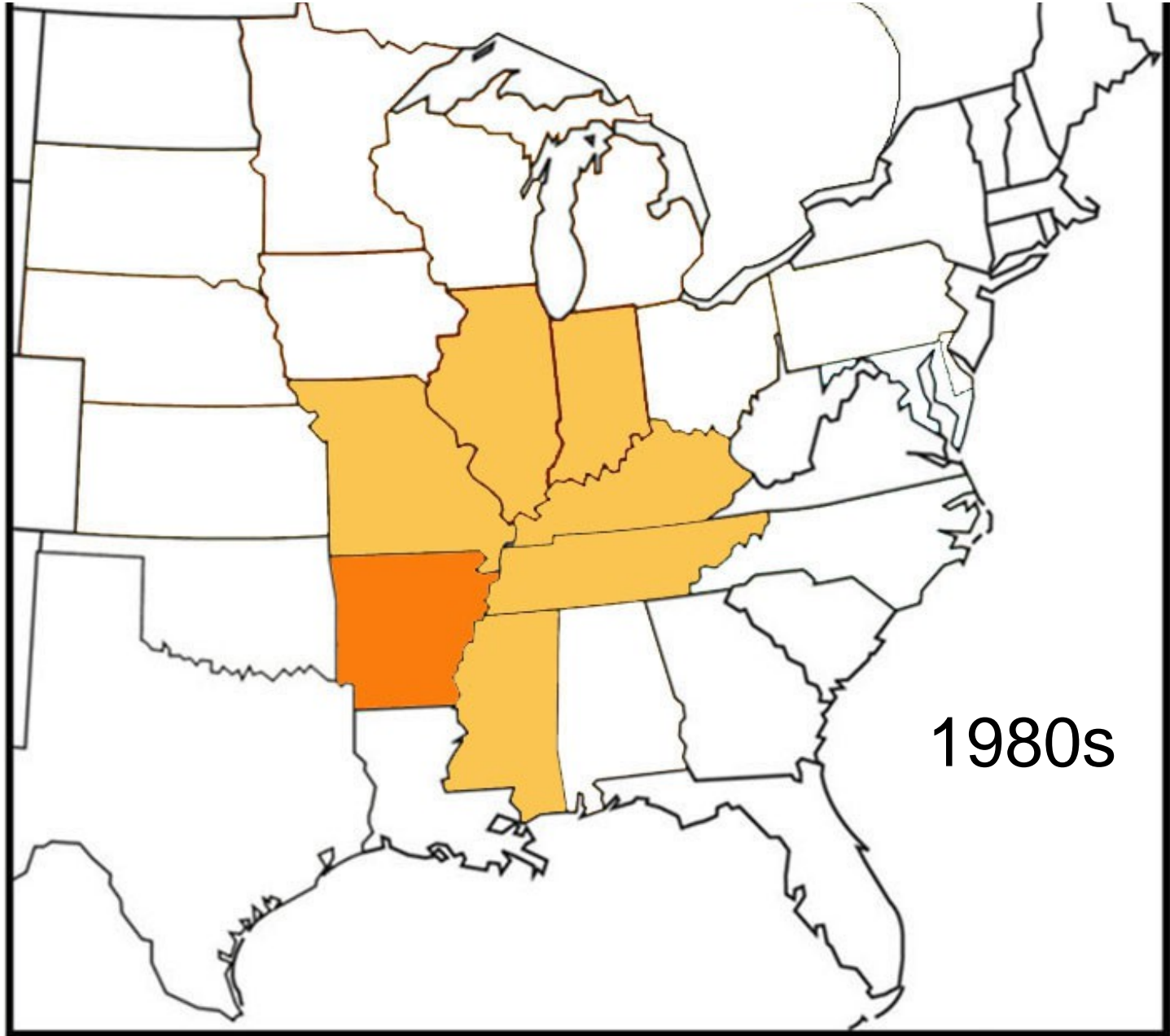
- Chlamydospores in plant residue and soil (Melgar et al. 1994)
- Macroconidia on decomposing roots (Rupe et al., 1999)
- Survival in SCN cysts (Melgar et al., 1994, Roy et al. 1993)
- Spread through movement of soil (Rousselle et al., 1999)



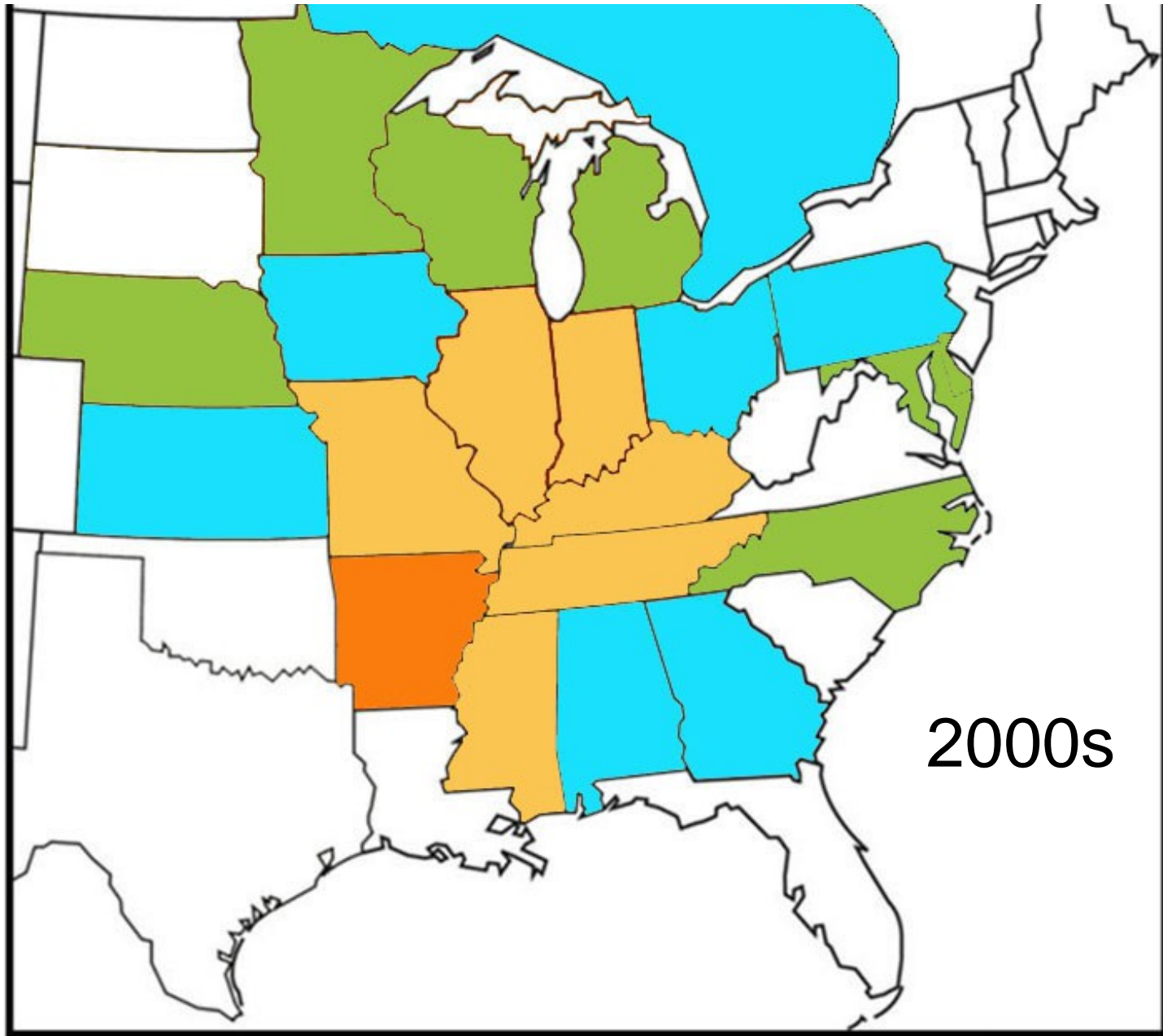
Spread of SDS in North America



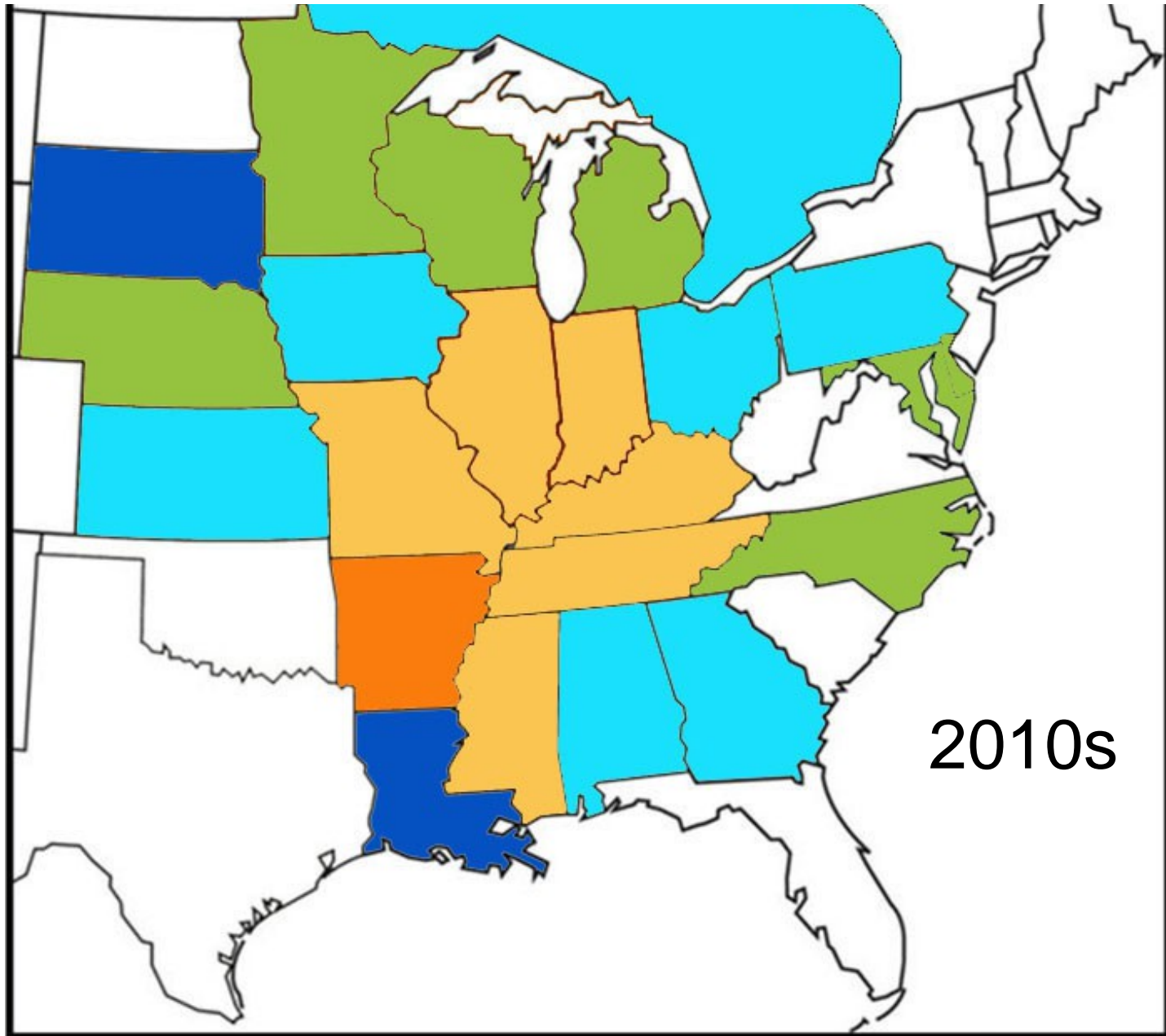
Spread of SDS in North America



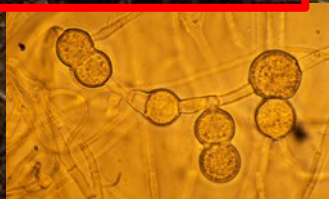
Spread of SDS in North America



Spread of SDS in North America

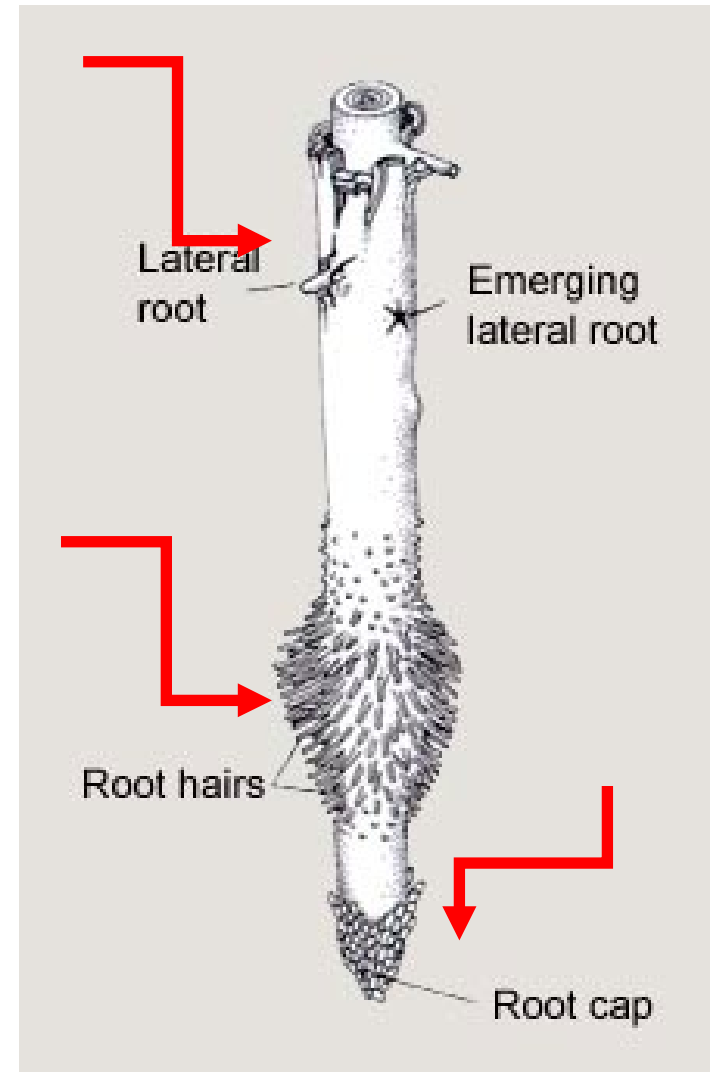


Root Infection



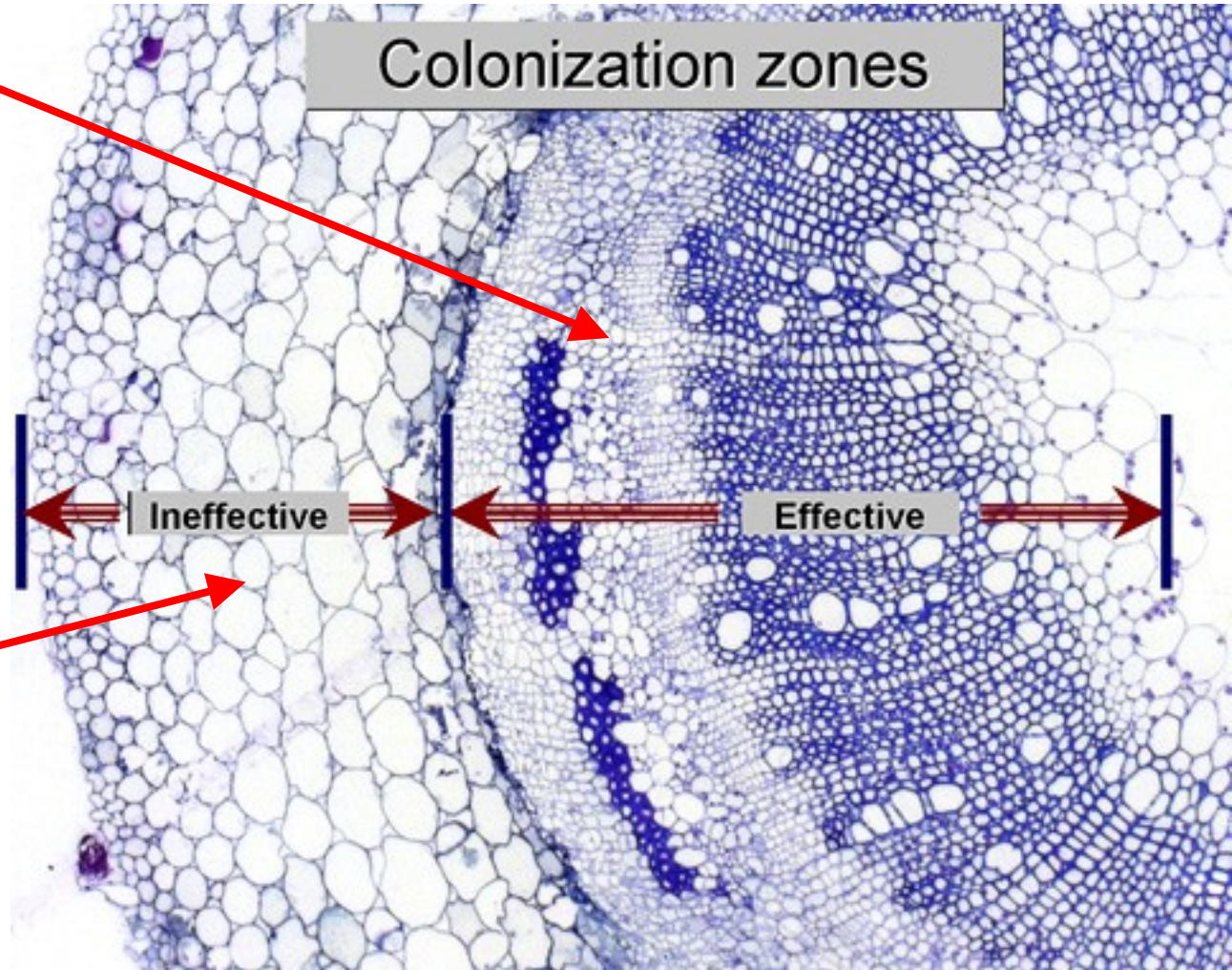
Root Infection

- Occurs in young seedlings (Gao et al., 2006)
- Penetration through root cap, root hairs and emerging lateral roots (Navi and Yang, 2008; Roy et al., 1997, Tatalovic, 2015)
- Colonization of vascular tissue needed for foliar symptoms (Navi and Yang, 2008)



Colonization of the vascular tissue needed to move Fv toxins to leaves (Navi and Yang, 2008)

Vascular tissue



Cortex

Effect of plant age on seedling root rot

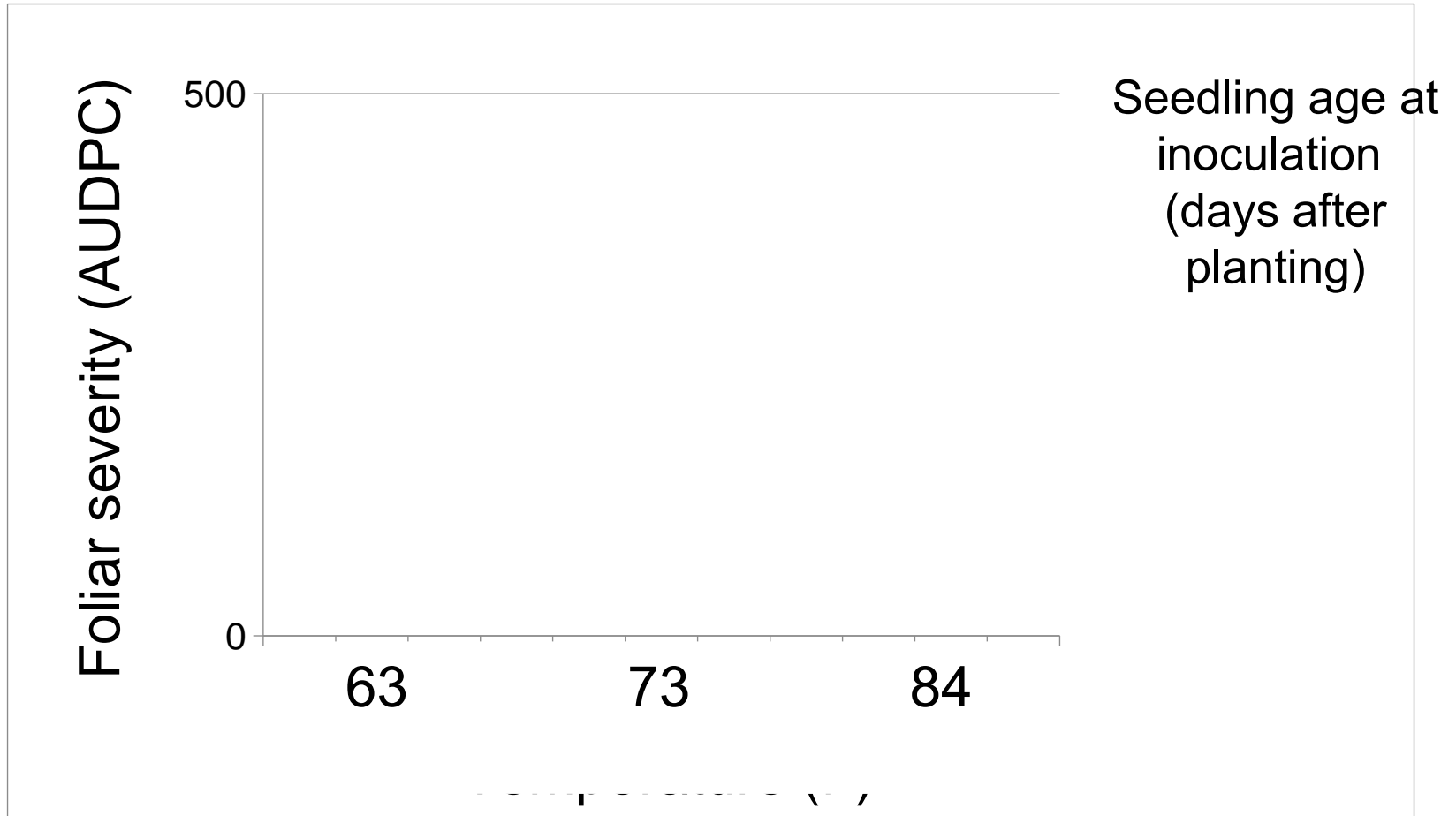
Seedling age at inoculation (days after planting)

63

73

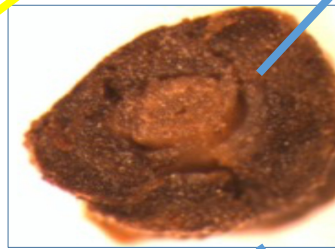
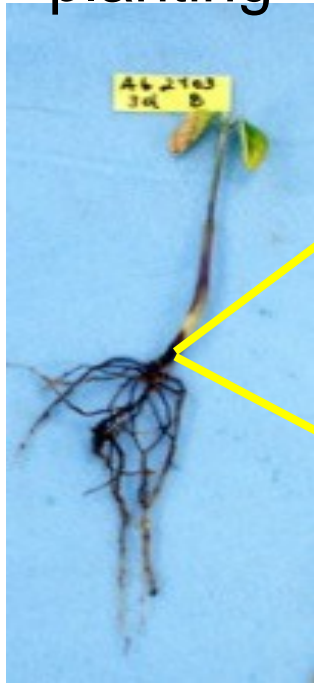
84

Effect of plant age on seedling foliar symptoms



Effect of plant age on seedling disease

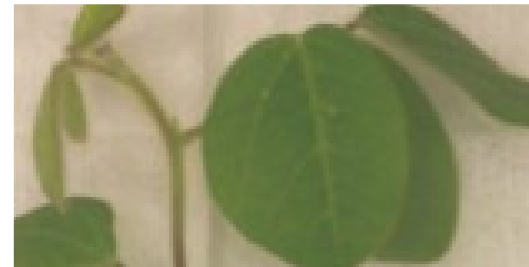
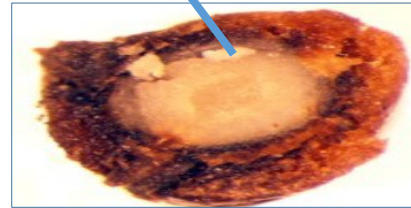
Infected 3 days after planting



Vascular

Cortex

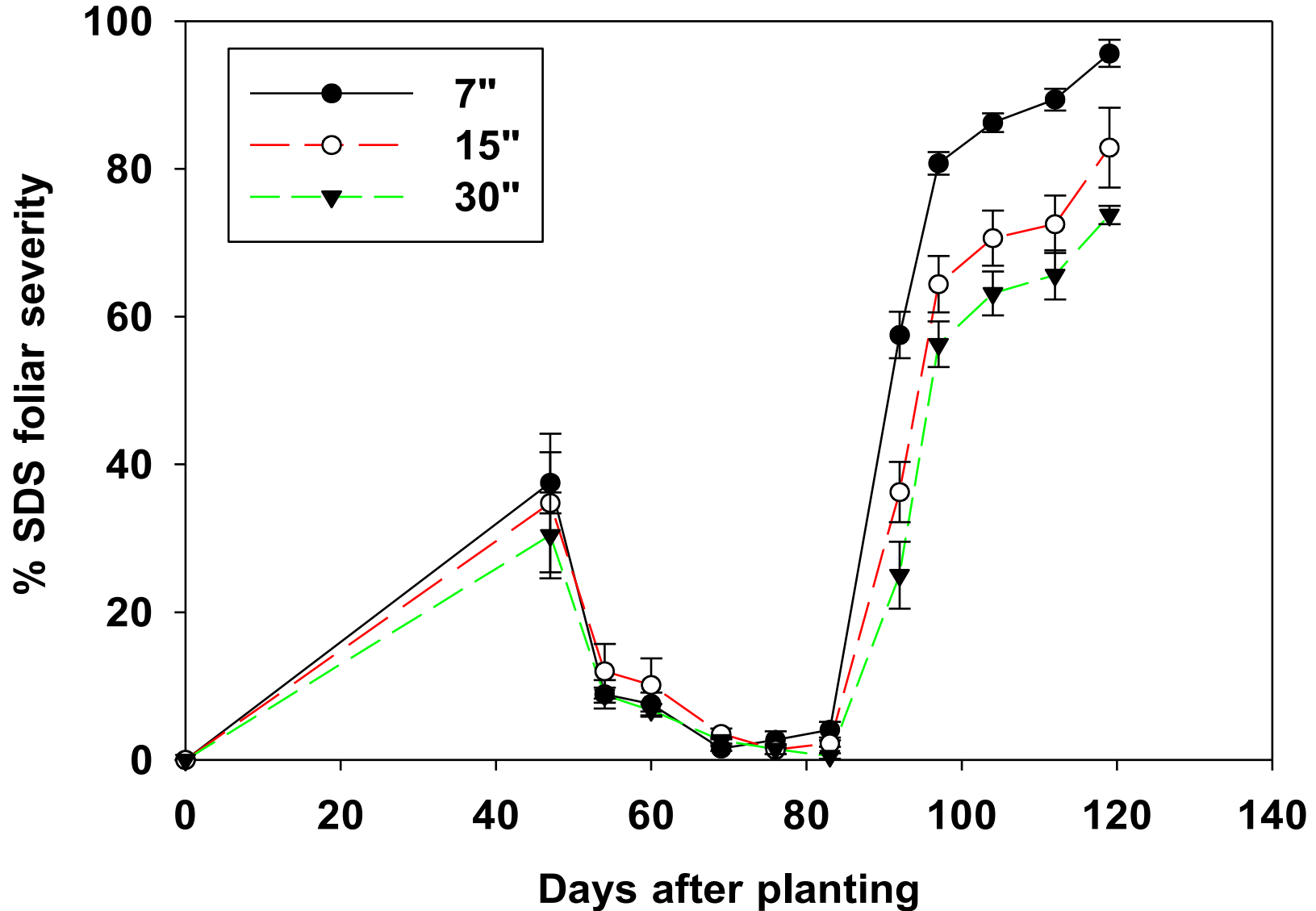
Infected 14 days after plating



Foliar Symptoms

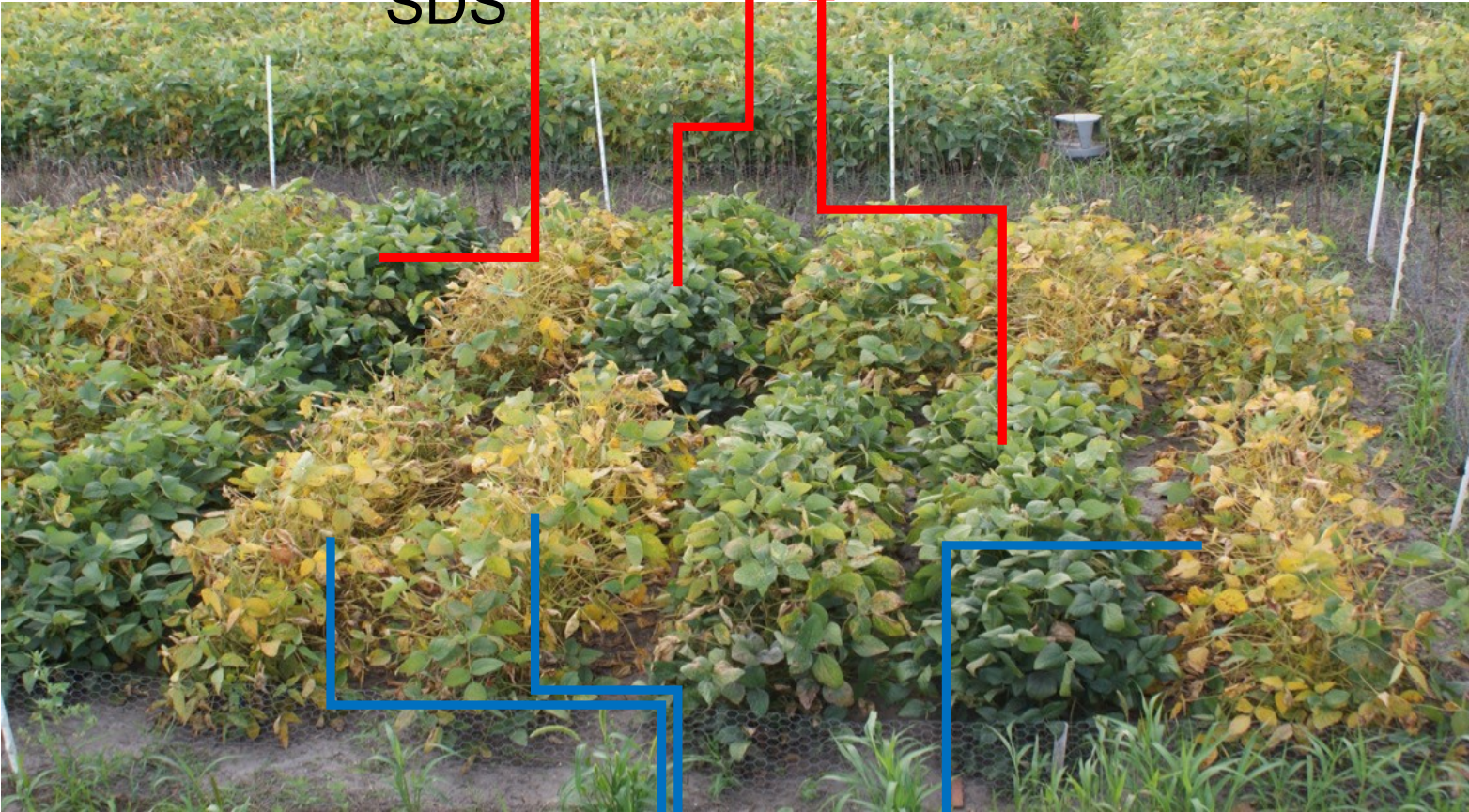


Timing of foliar symptoms



Effect of f bwer removal on SDS

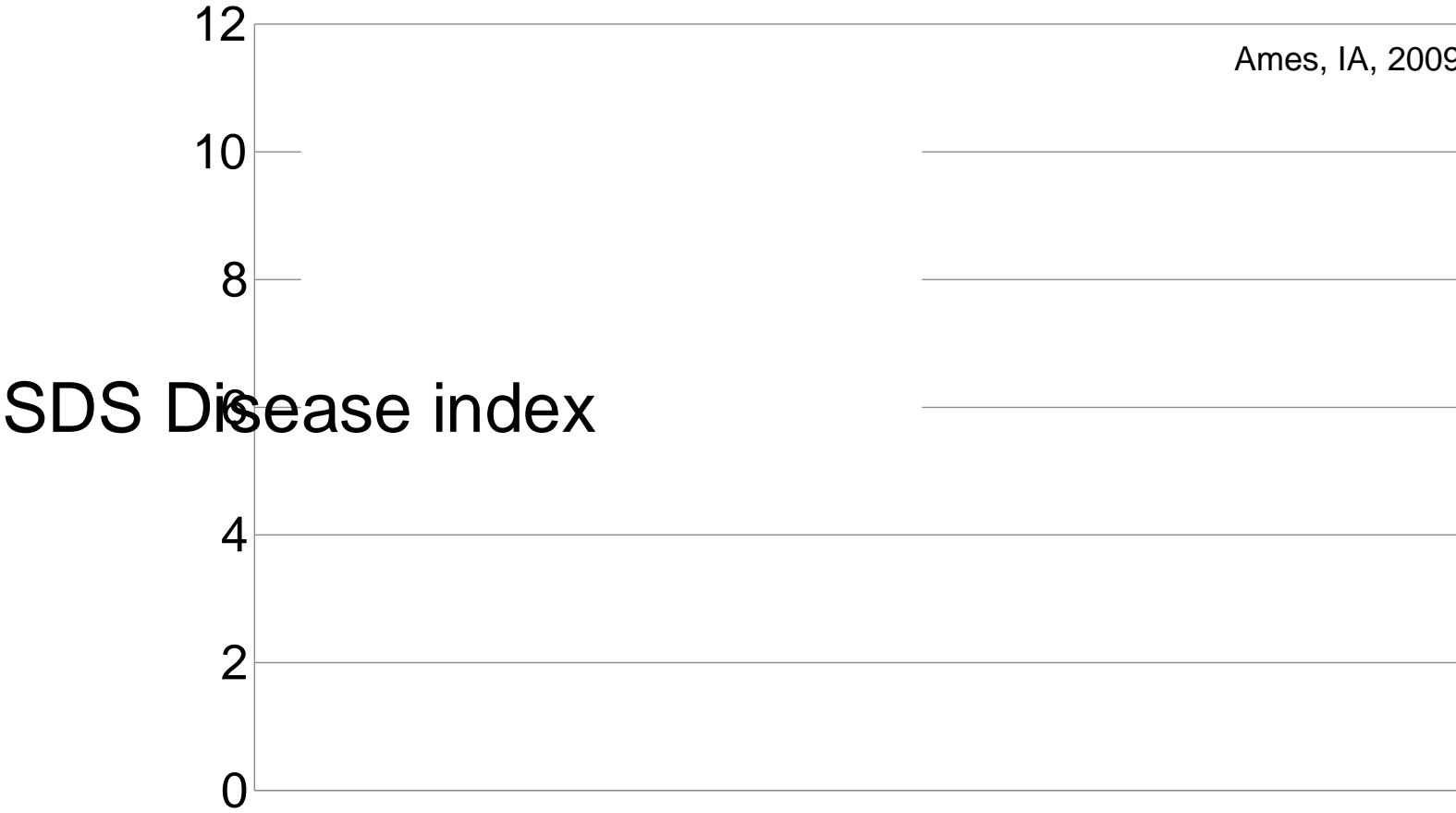
Forced vegetative stage = less SDS



Ames, IA, 2009

Reproductive stage = more SDS

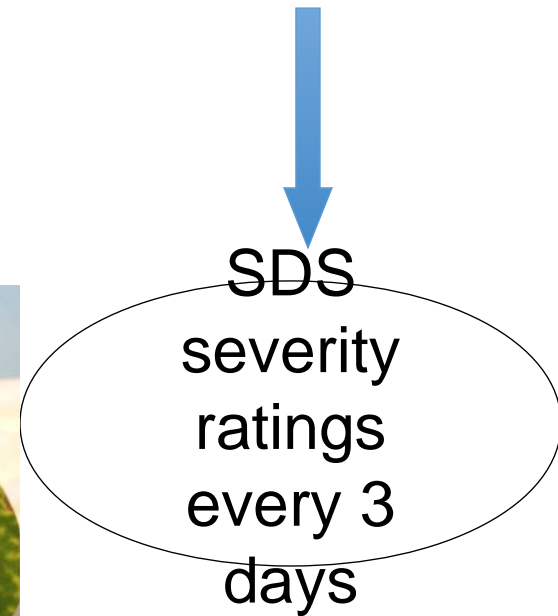
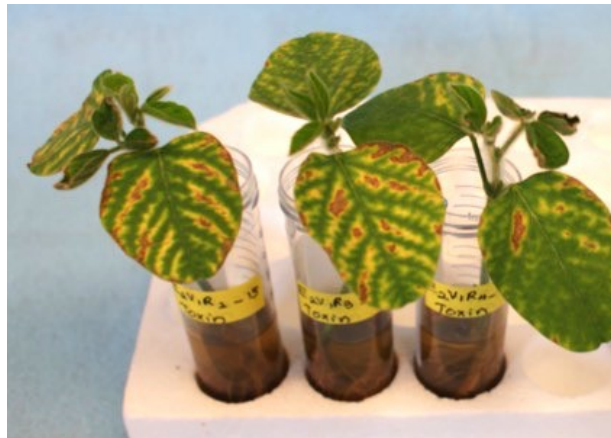
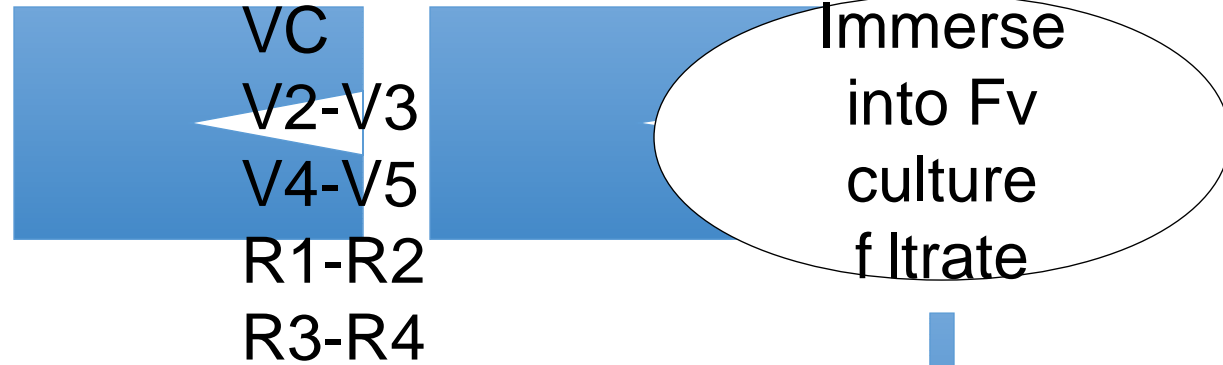
Effect of f bwer removal on SDS



Effect of growth stage on susceptibility to Fv f ltrates

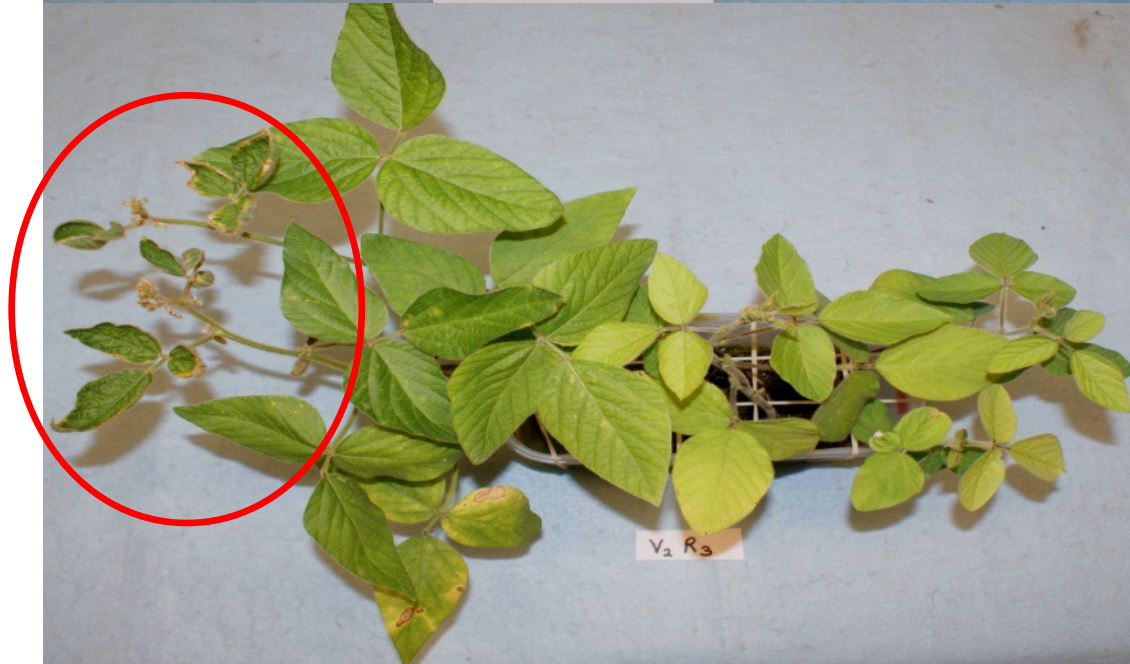


Staggered planting
Ag2403 (susceptible)
MN1606 (resistant)





AG 2403
(Susceptible)



MN 1606
(Resistant)

Effect of growth stage on susceptibility to Fv f ltrates

MN 1606 - Day 15

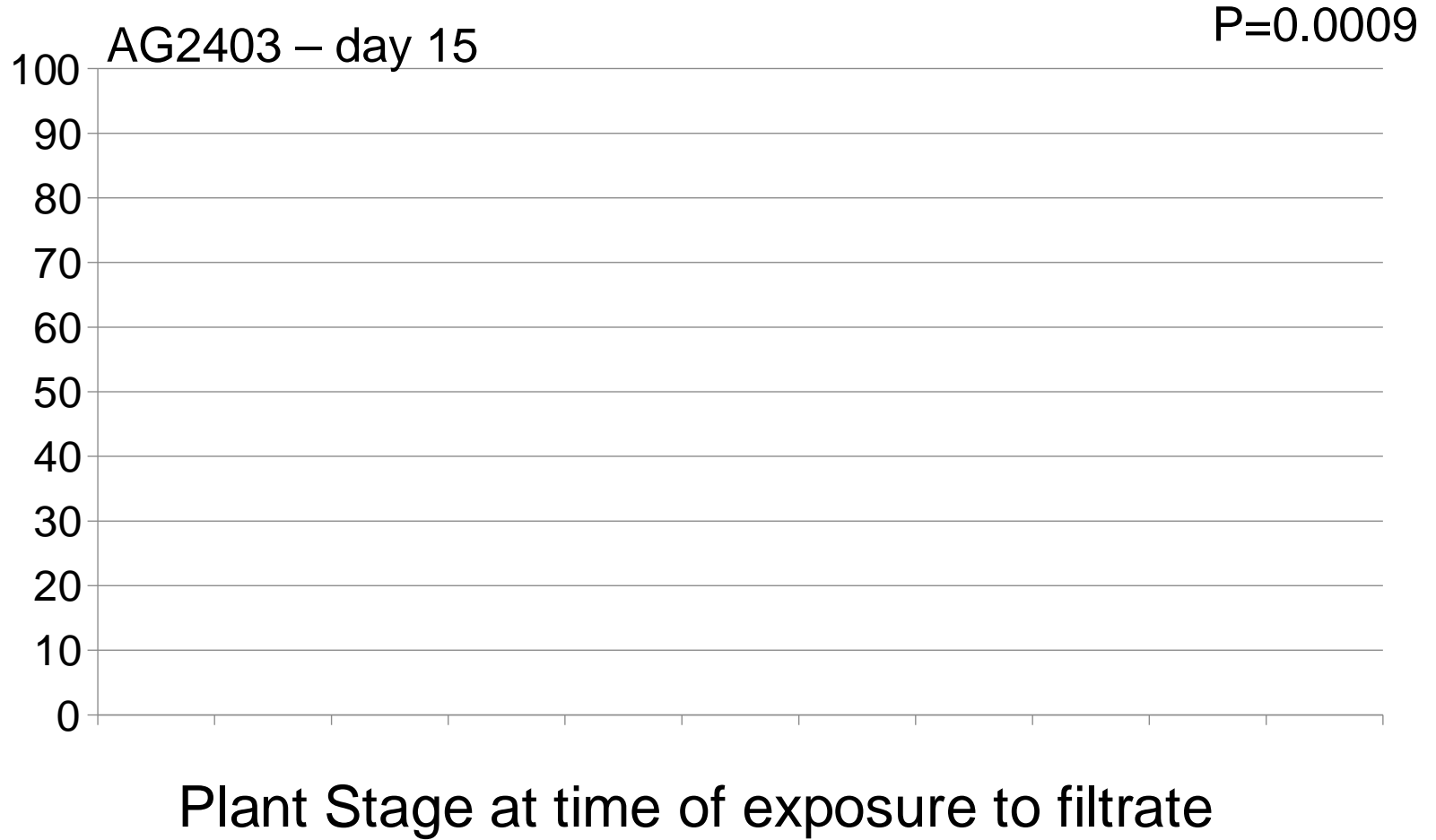
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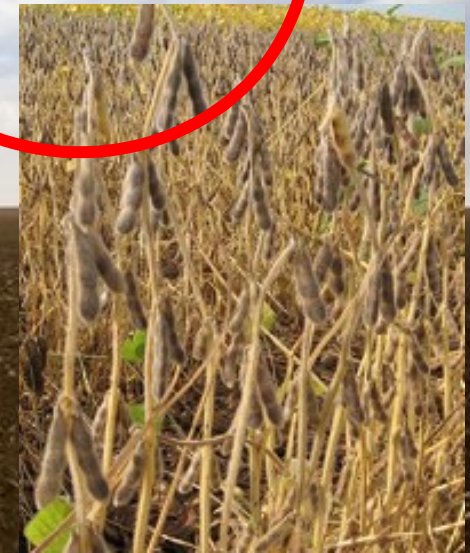
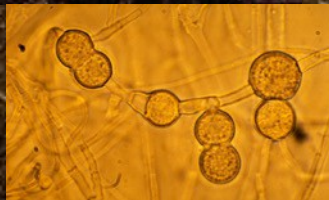
Plant Stage at time of exposure to culture filtrate

Effect of growth stage on susceptibility to Fv f ltrates

Susceptible variety



Environmental factors



Soil moisture effects on SDS

High soil moisture favors SDS (Scherm and Yang, 1996)

SDS epidemic years are usually wetter, especially during reproductive stages (Leandro et al. 2013)

Year	SDS Incidence	Total Precipitation (inches) – Ames, IA				
		Apr	May	Jun	Jul	Aug
2010	High	3.8	4.6	10.3	8.1	4.5
2011	Low	3.0	4.5	4.9	3.5	1.7
2012	Low	4.8	2.5	2.9	1.5	2.9
2013	Low	6.5	11.6	3.3	1.5	0.8
2014	High	5.3	5.4	8.1	4.7	5.8
2015	High	4.5	4.4	7.3	8.0	9.6
Mean	30-year	3.0	4.1	4.6	3.8	3.8

Effect of timing of irrigation on SDS

Irrigation during R stages increased SDS; most significant increase when irrigated both V and R stages (Neto et al. 2006)

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Ames, IA, 2011

Soybean Variety

Hartman et al, unpublished

Temperature effects on SDS

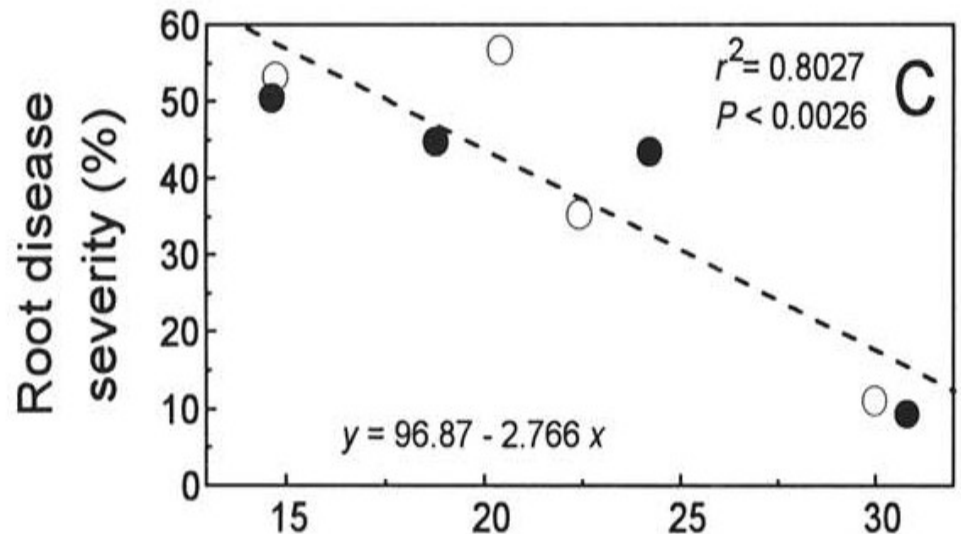
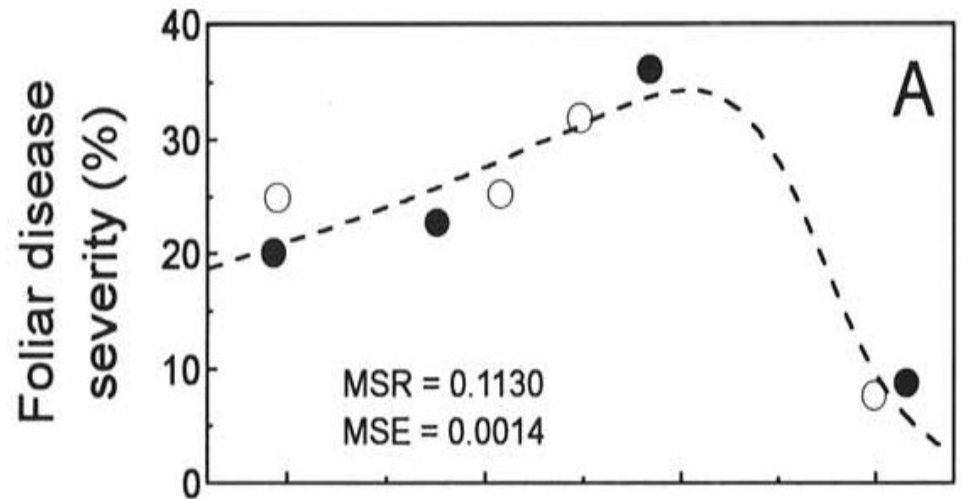
Optimum for root rot is 15-17°C

Optimum for foliar symptoms is 22-24°C

(Scherm and Yang, 1996)

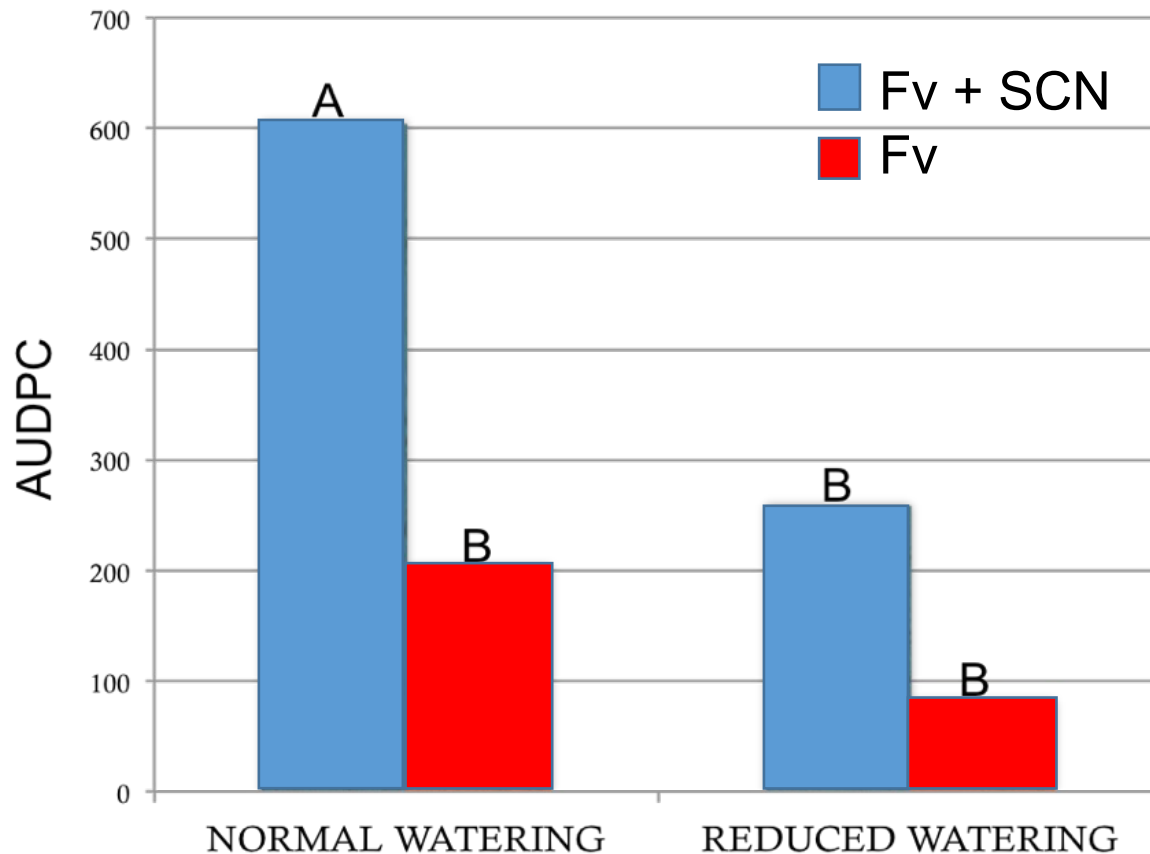
SDS epidemic years are generally cooler

(Leandro et al. 2013)



SDS - SCN interaction

SDS is more severe in plants infected with SCN (Roy et al, 1989; Mclean et al., 1993, Gao et al, 2006)



Plant Senescence



Survival on crop residue

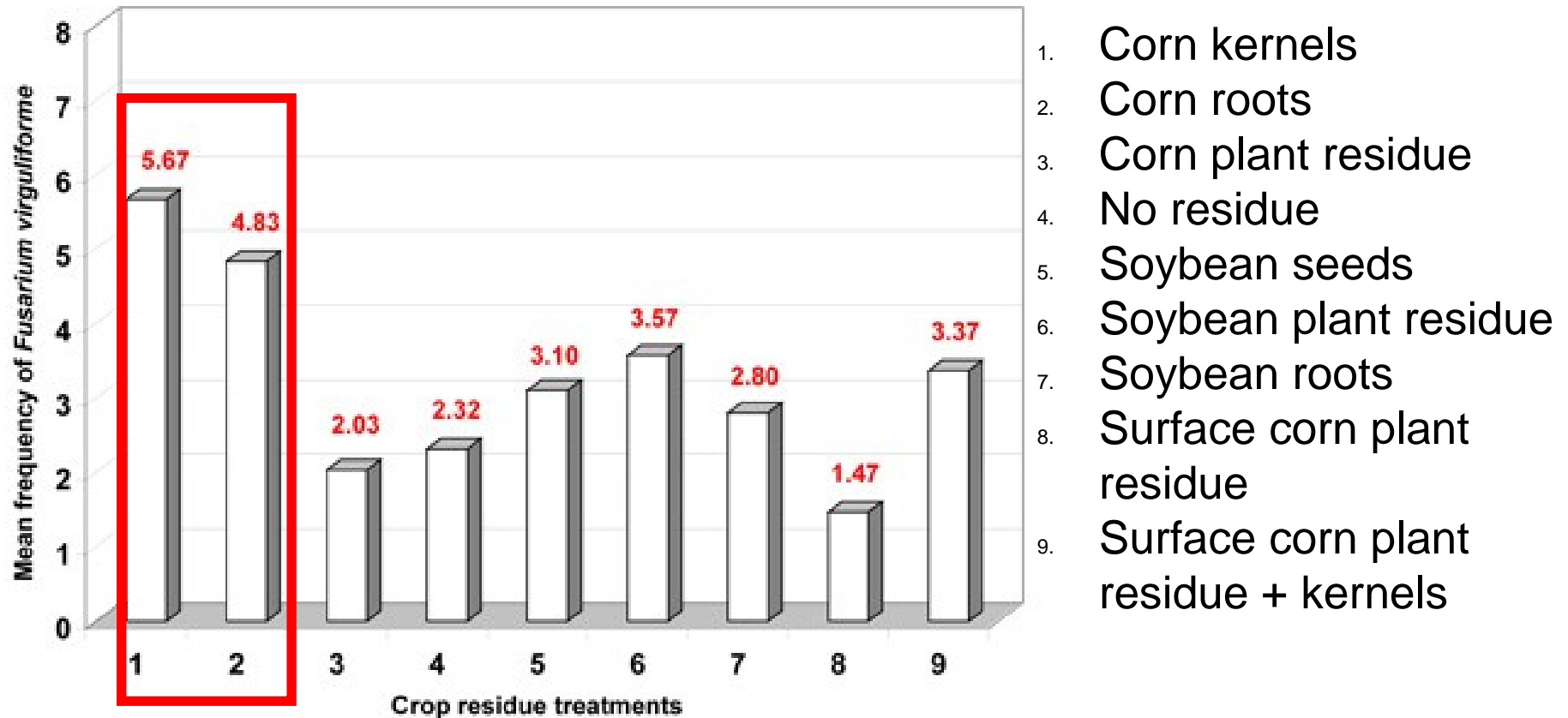


Figure 1. Frequency of SDS fungus (*Fusarium virguliforme*) isolated from field plots that had a mixture of crop residues and the SDS fungus

Host range of Fv

Several leguminous plants can get infected and develop root rot (Melgar et al., 1994, Kolander et al., 2010)

Phaseolus spp: green beans, lima beans

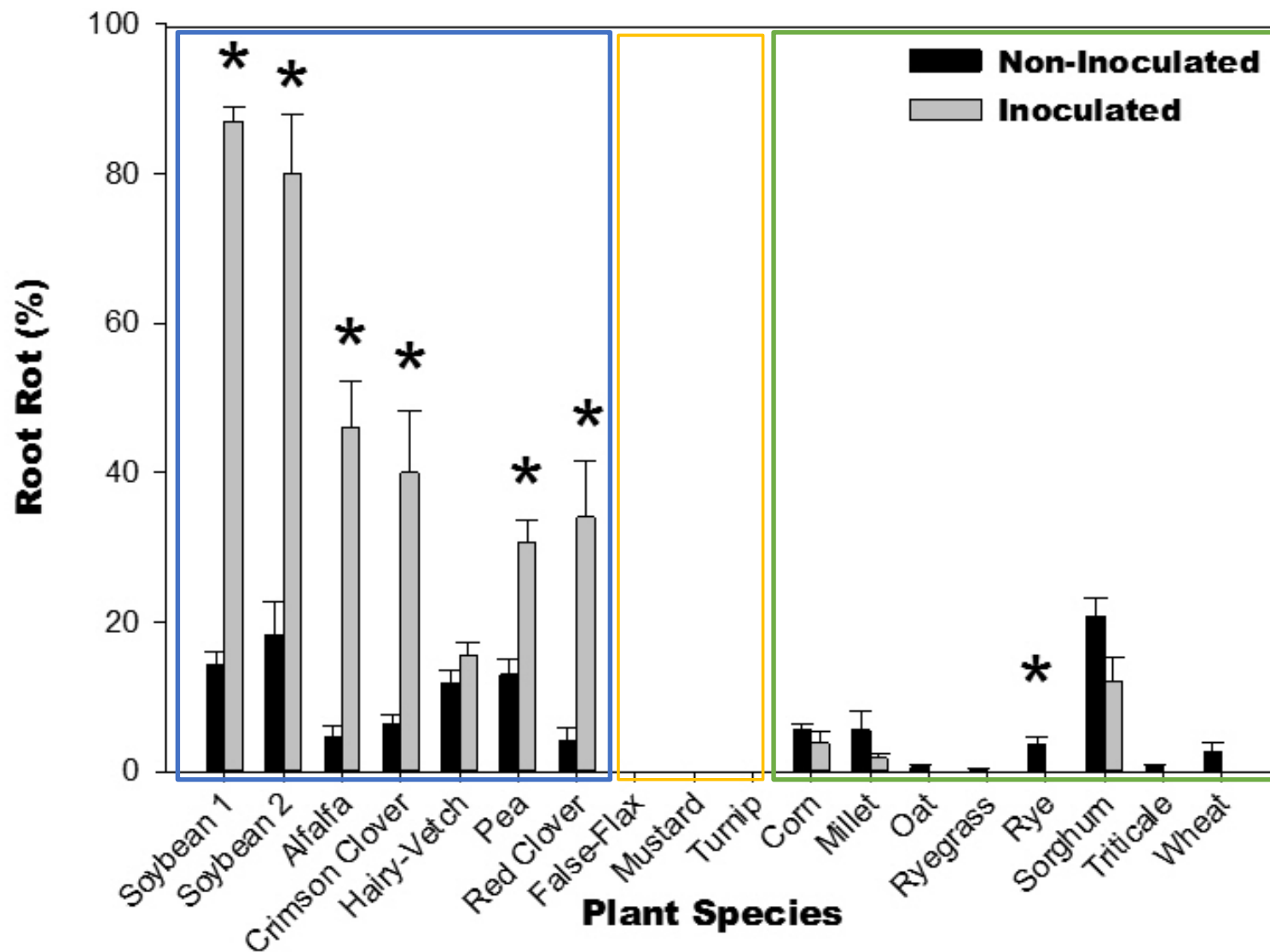
Vigna spp: mung beans, cowpea

Medicago sativa: alfalfa

Trifolium spp.: white and red clover



Cover crop species as hosts to Fv



Acknowledgements

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