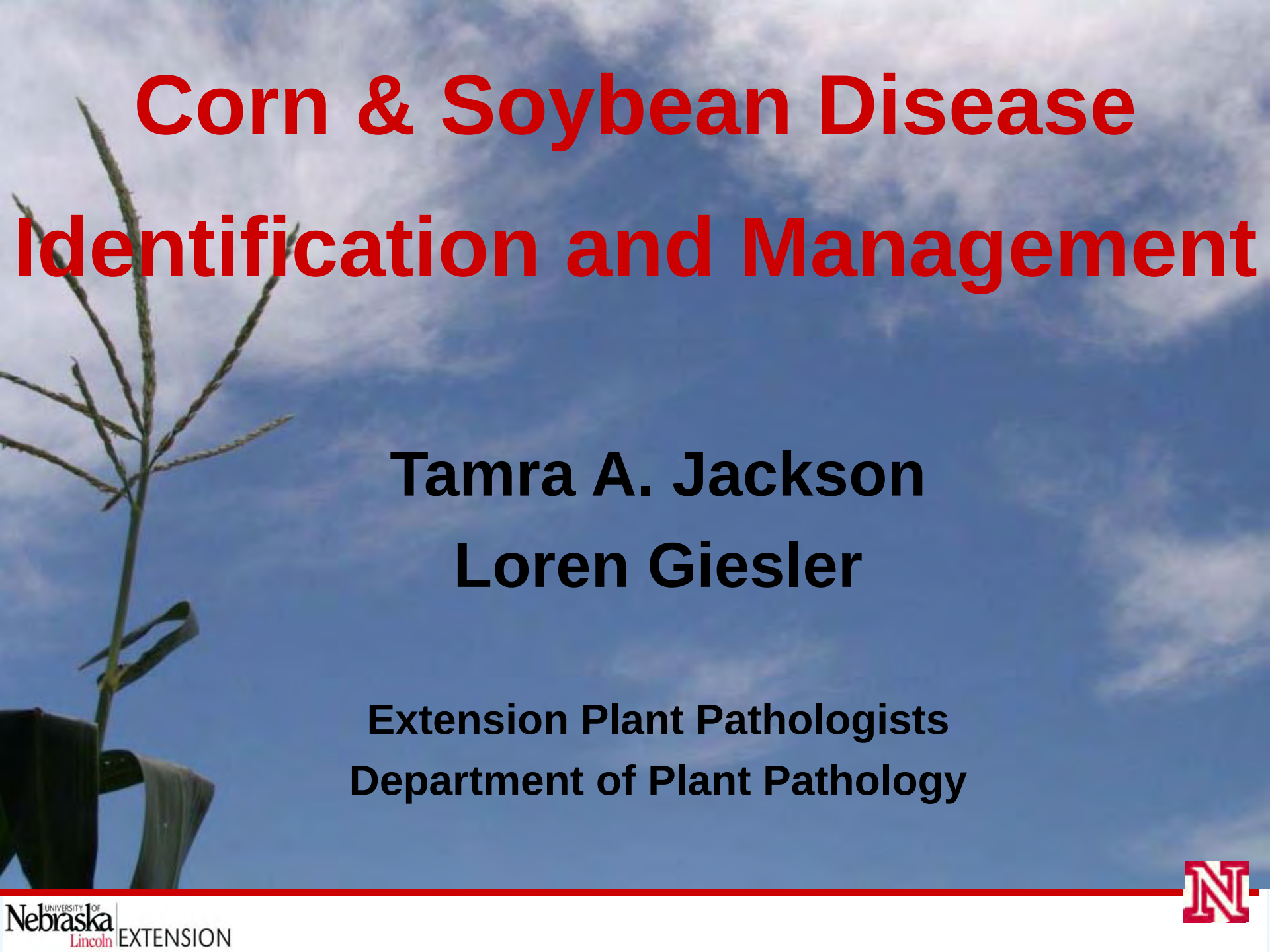


Corn & Soybean Disease Identification and Management

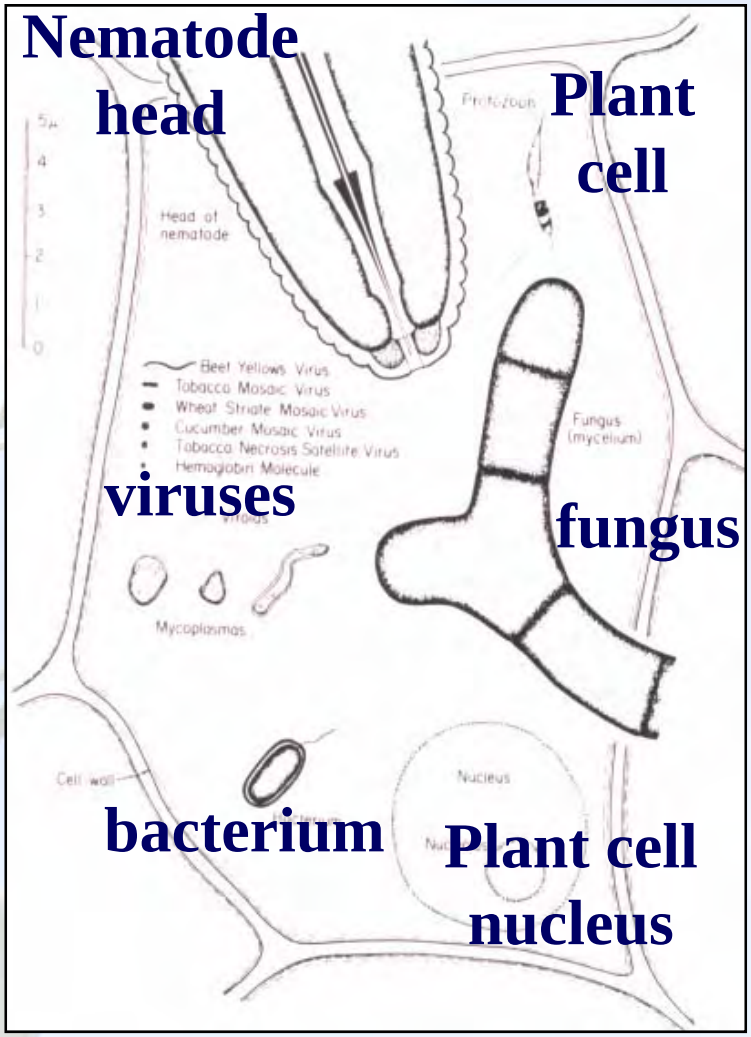
Tamra A. Jackson

Loren Giesler

Extension Plant Pathologists

Department of Plant Pathology

How big are Plant Pathogens?



Common plant pathogens and their size relative to each other and to a plant cell

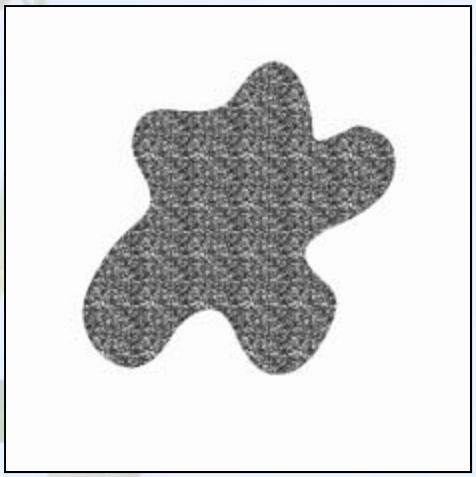
Environment

Many pathogens require moisture for sporulation and infection.

Some pathogens require wounds!

Symptom Distribution

By assessing symptom distribution at three scales, your diagnosis will come much easier.

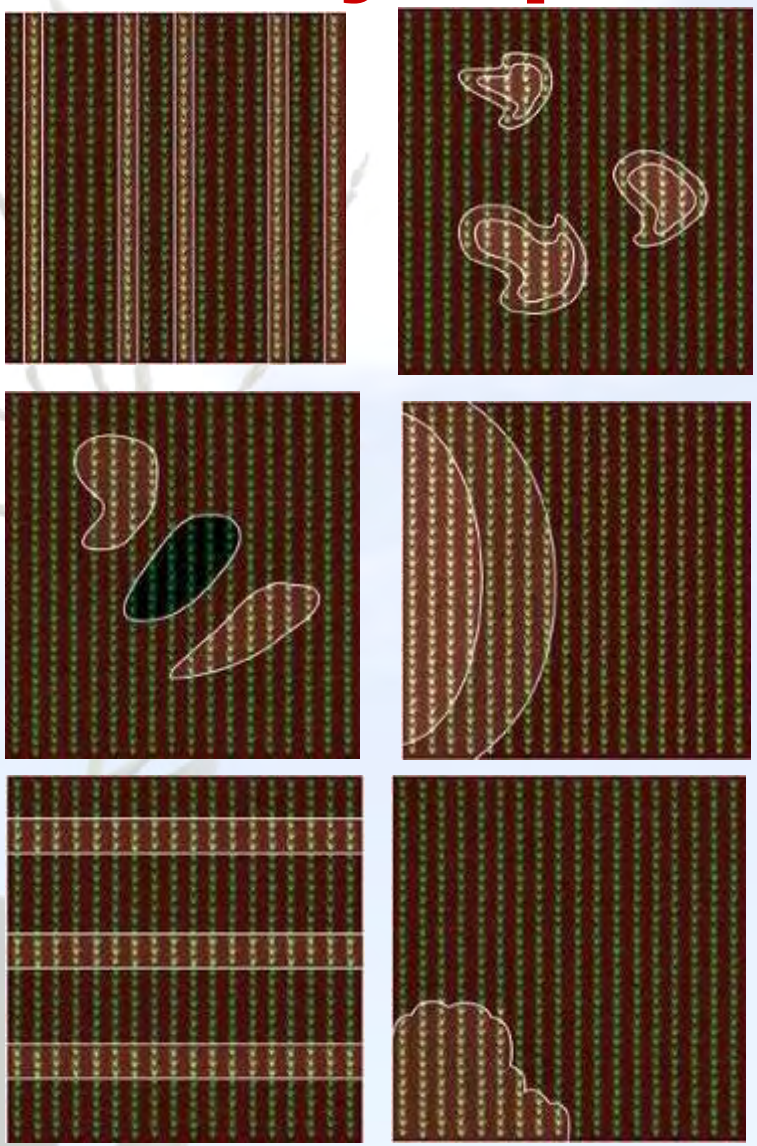


Field

Plant

Plant Parts

Symptom Distribution

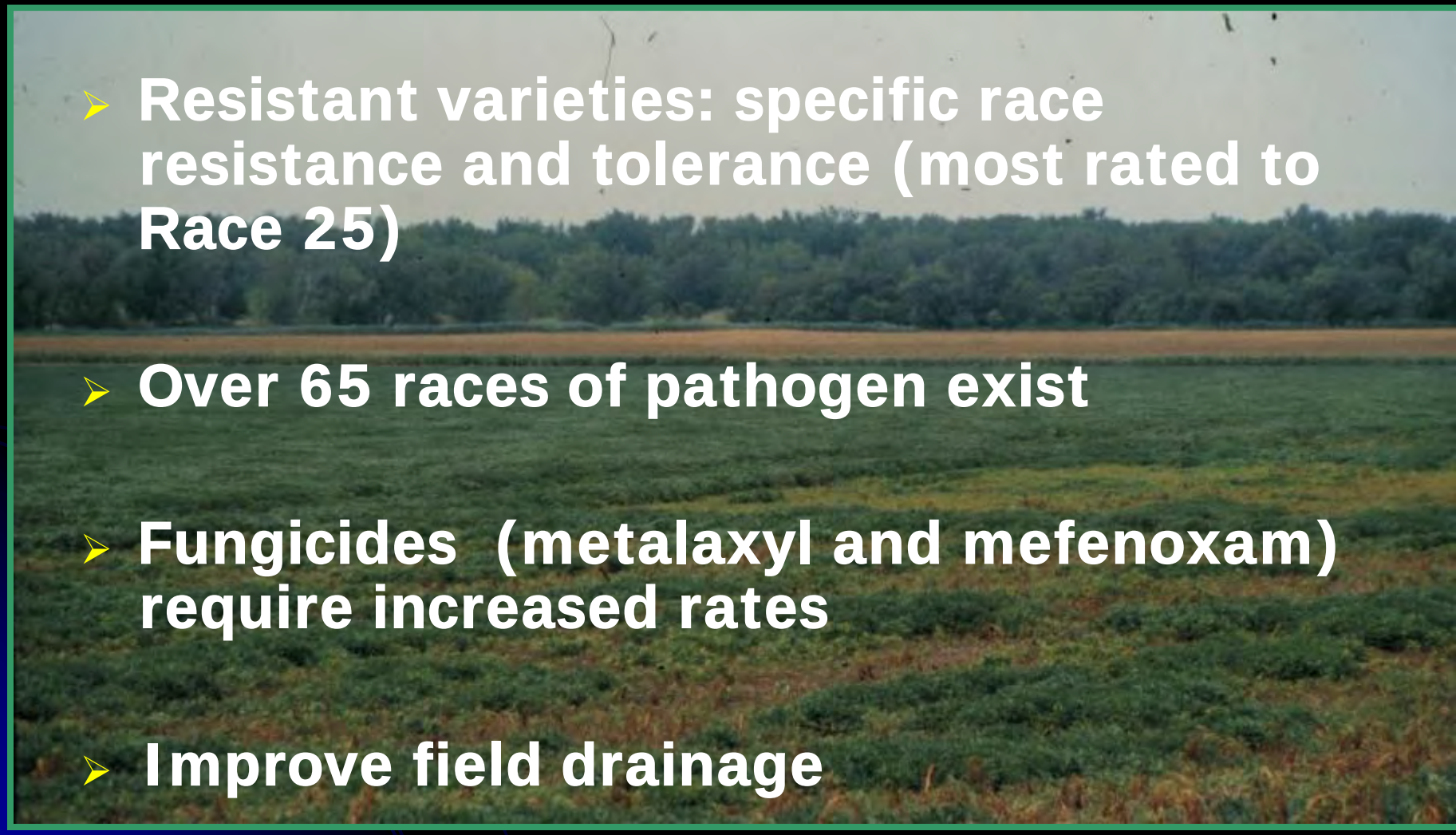


Step 1:

Determine the distribution in the field.

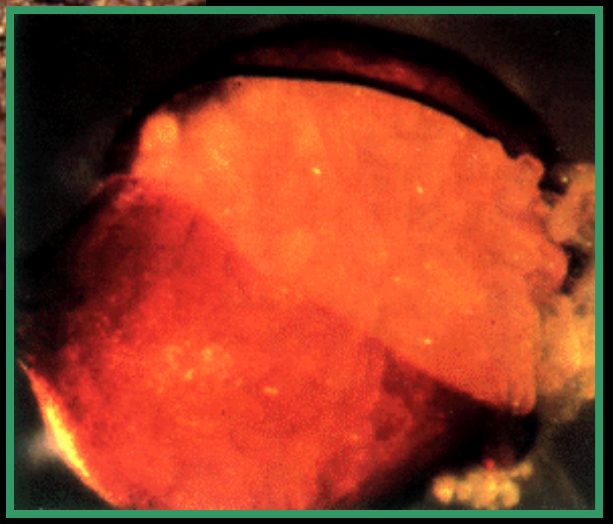
Phytophthora Root & Stem Rot

Phytophthora Management



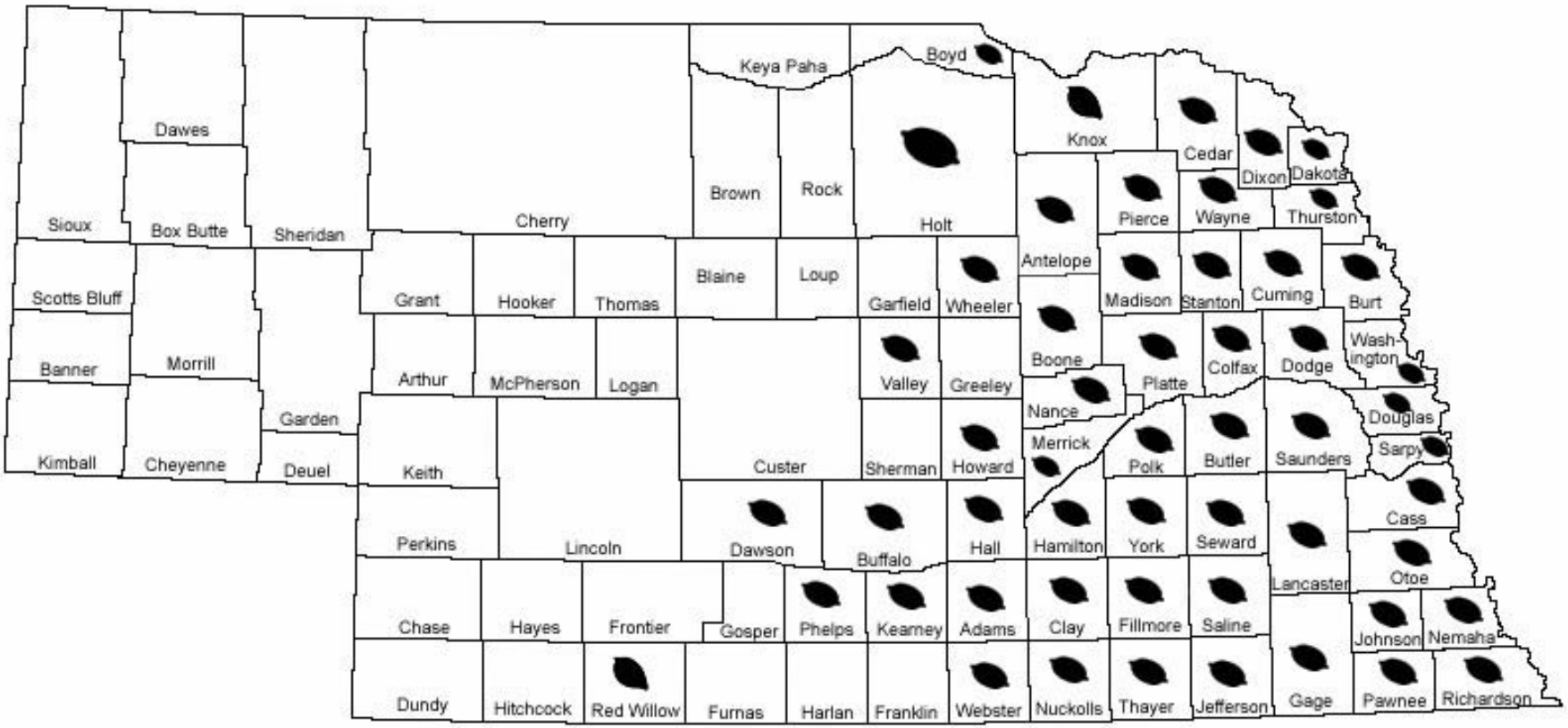
- **Resistant varieties: specific race resistance and tolerance (most rated to Race 25)**
- **Over 65 races of pathogen exist**
- **Fungicides (metalaxyl and mefenoxam) require increased rates**
- **Improve field drainage**

SCN Life Cycle



Soybean Cyst Nematode

Distribution as of December 2011



Rhizobium

SCN

ROTATION

Year 1 – Non-Host Crop

Year 2 – Resistant Variety

Year 3 – Non-Host Crop

Year 4 – Resistant Variety

Year 5 – Non-Host Crop

Year 6 – Resistant Variety

Know your source of resistance and rotate with other sources.

RESISTANT VARIETIES

- Know your source of resistance
  - **PI 88788 *(most common)***
  - **Peking (PI 54840)**
  - **Hartwig (PI 437654)**
  - **Cyst-X *(selection from Hartwig)***
  - **Others**
- Rotate Source of Resistance

SCN Demonstration Sites

		Yield (Bu./A)		
		Infested		Non-infested
Variety	Resistance	Brunswick	Cedar Bluffs	SCAL
Pioneer 93m11	Susceptible	38.8	65.3	73.3
Asgrow 3005	Susceptible	39.6	65.0	77.0
NK-S28-B4	Susceptible	40.7	64.5	75.9
Asgrow 3139	PI88788	53.9	66.2	66.8
Pioneer 93m13	PI88788	52.0	69.1	70.6
NK S27-C4	PI88788	59.2	68.3	70.8
NK S26-P1	Peking	46.2	69.3	74.9
Latham 2620	Cyst-X	50.5	65.7	64.4
LSD (P=0.05)		9.64	2.9	5.03
Spring SCN Pop. Field Avg		502	480	0

SCN Management

- Sanitation: SCN can be moved with anything which moves soil
- Host Resistance
- Rotation: control weeds to have full effect of rotation. Infects many weed species (Henbit, Common Mullen, Wild Mustard, Pokeweed, Chickweed)
  - Does not affect alfalfa, corn, wheat, or sorghum

Some Common Nematodes of Corn

- Needle — *Longidorus* spp.
- Sting — *Belonolaimus* spp.
- Dagger — *Xiphinema* spp.
- Spiral — *Helicotylenchus* spp.
- Stunt — *Tylenchorrhynchus* spp.
- Stubby-root — *Paratrichodorus* spp.

Ectoparasites

Courtesy S. W. Westcott III , APSnet

- Lance — *Hoplolaimus* spp.
- Root-lesion — *Pratylenchus* spp.

Endoparasites

Courtesy of D. Wixted, APSnet

Relative Sizes of Plant Parasitic Nematodes

Needle

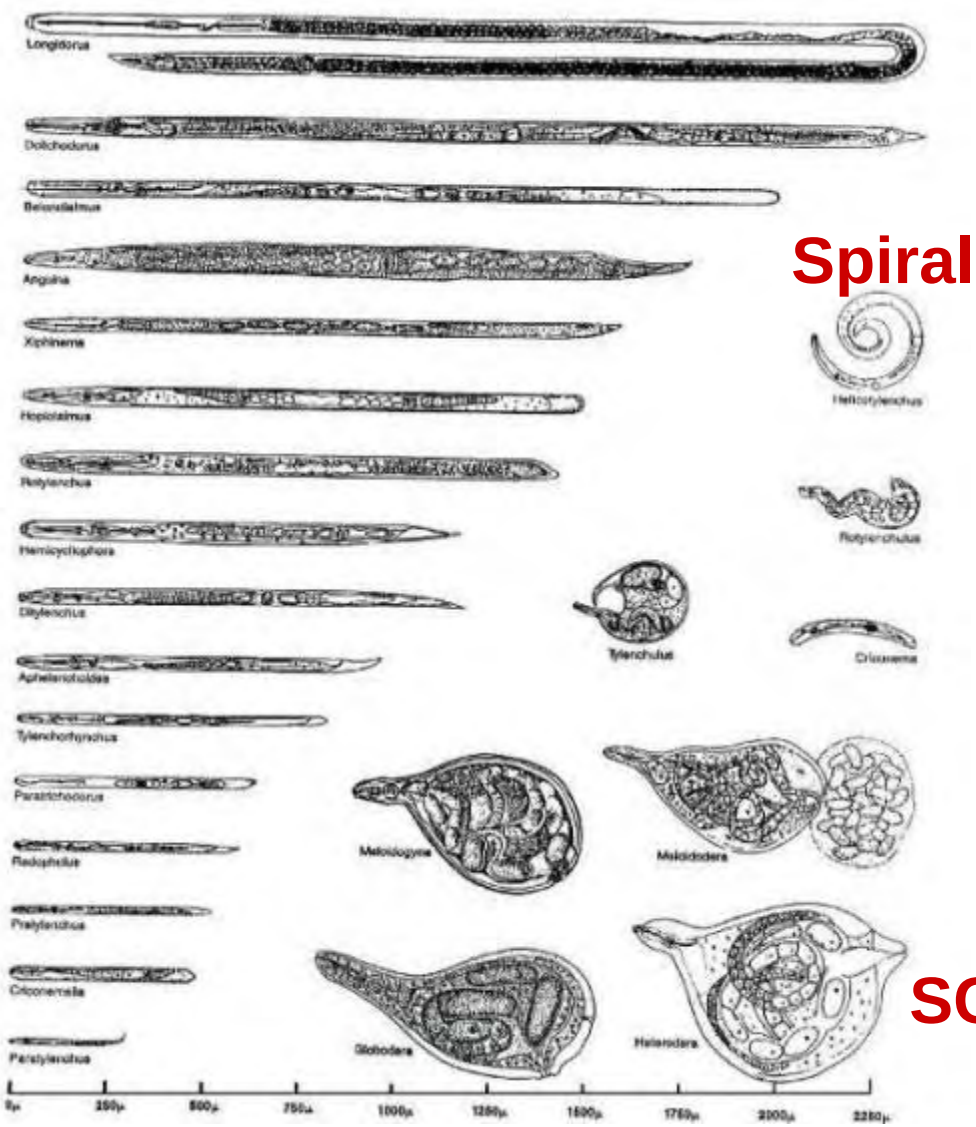
Sting

Dagger

Lance

Stubby root

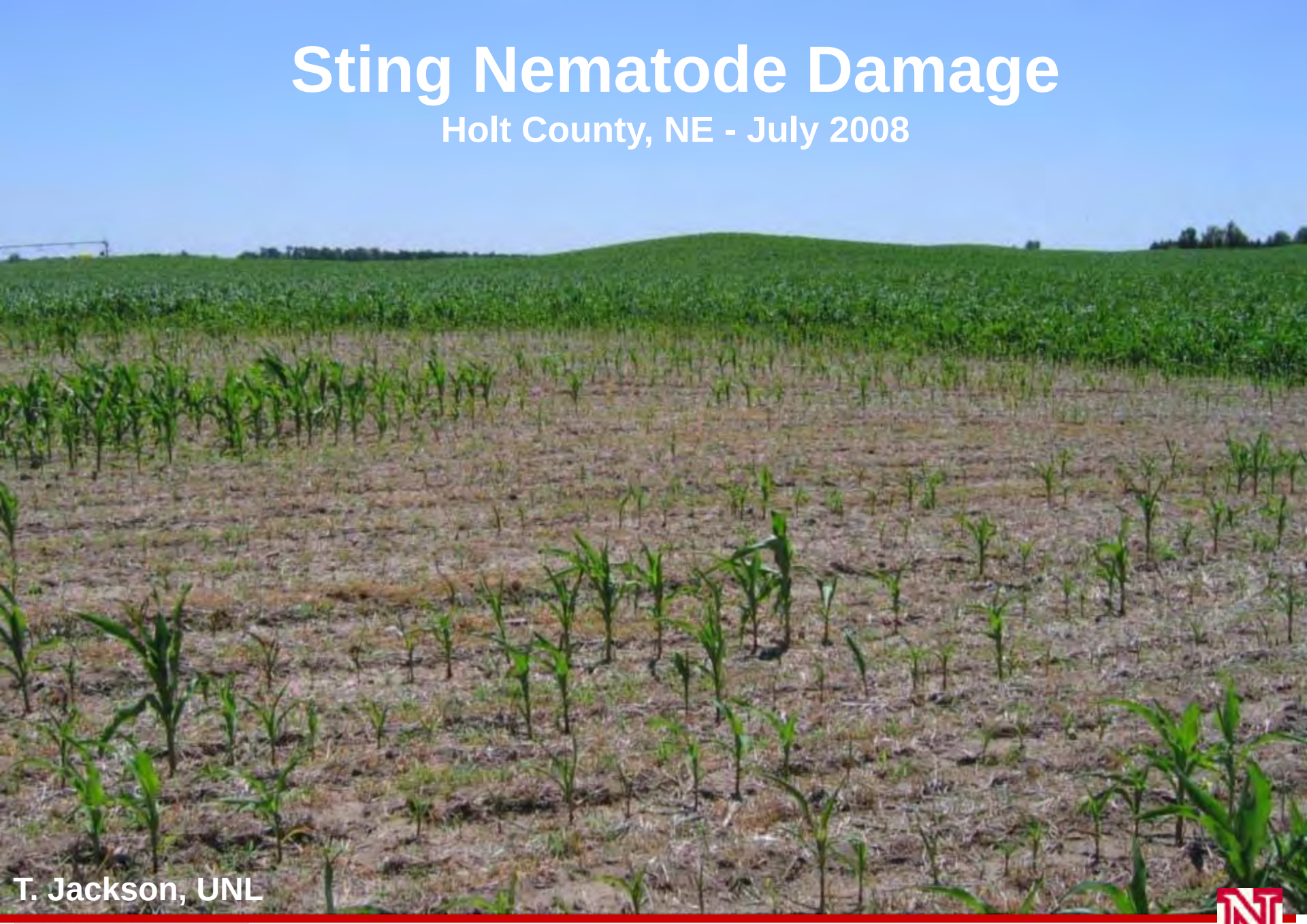
Lesion



(1997. Agrios, Intro. To Plant Pathology)

Sting Nematode Damage

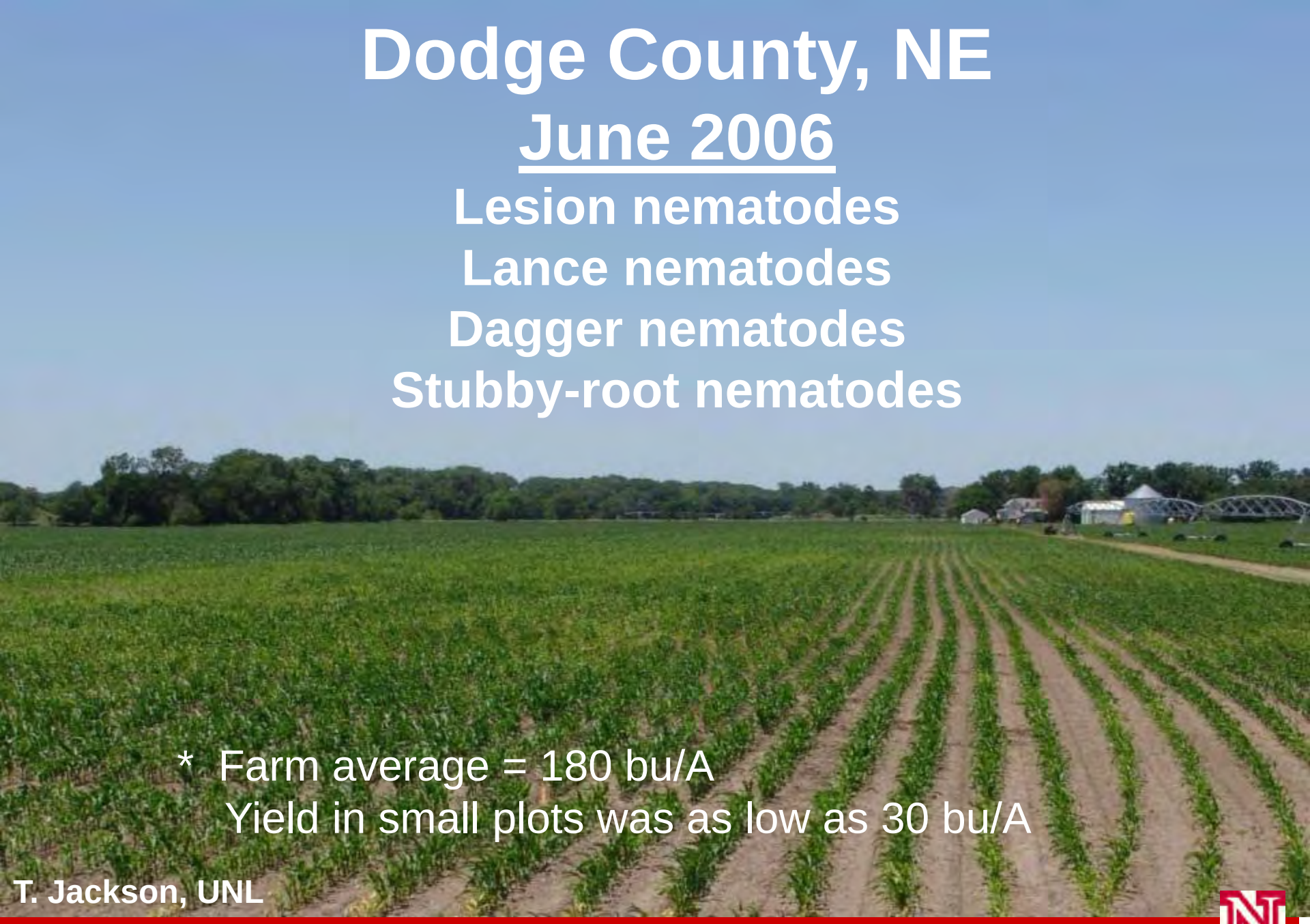
Holt County, NE - July 2008



T. Jackson, UNL

Dodge County, NE
June 2006

Lesion nematodes
Lance nematodes
Dagger nematodes
Stubby-root nematodes



* Farm average = 180 bu/A
Yield in small plots was as low as 30 bu/A

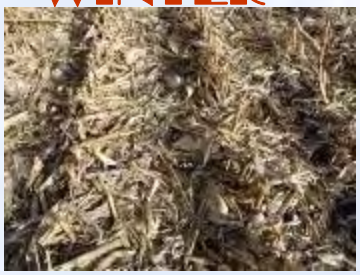
T. Jackson, UNL

New Seed Treatment Nematicides

- **Avicta Complete Corn®**
  - Syngenta
  - Abamectin
- **Poncho VOTiVO ®**
  - Bayer CropScience
  - *Bacillus firmus* I-1582
- **Acceleron™ HX-209**
  - Monsanto Company
  - Harpin alpha beta protein

Disease Cycle: Residue-borne Pathogens

WINTER



Pathogens overwinter in infected residue

SPRING

Planting

Some require injury

Infection

Repeated Infections

SUMMER

Disease Development

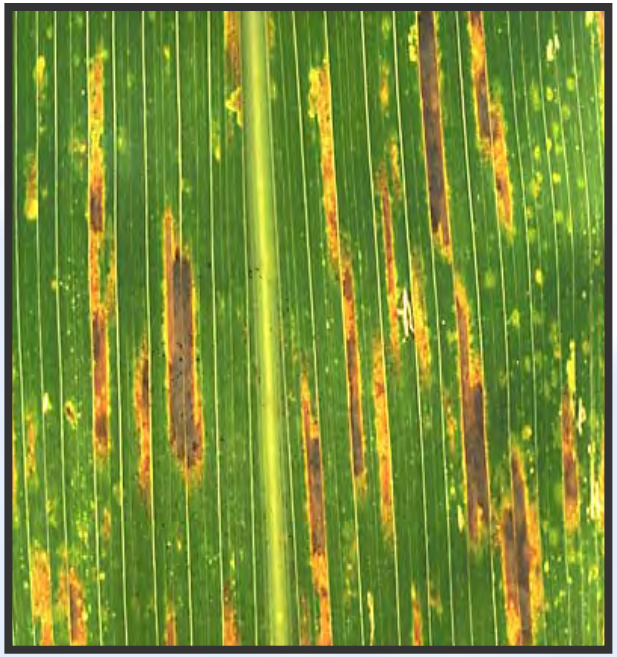
FALL

Gray Leaf Spot

- Caused by the fungus, *Cercospora zeae-maydis*
- Most common disease in Corn Belt
- Overwinters in Nebraska in crop residue
- Fungus requires 12+ hours of ≥90% RH
- 2007 early season rain
- Early disease development (pre-tassel)
- Wider geographic area
  - Fungal inoculum already present

Gray Leaf Spot

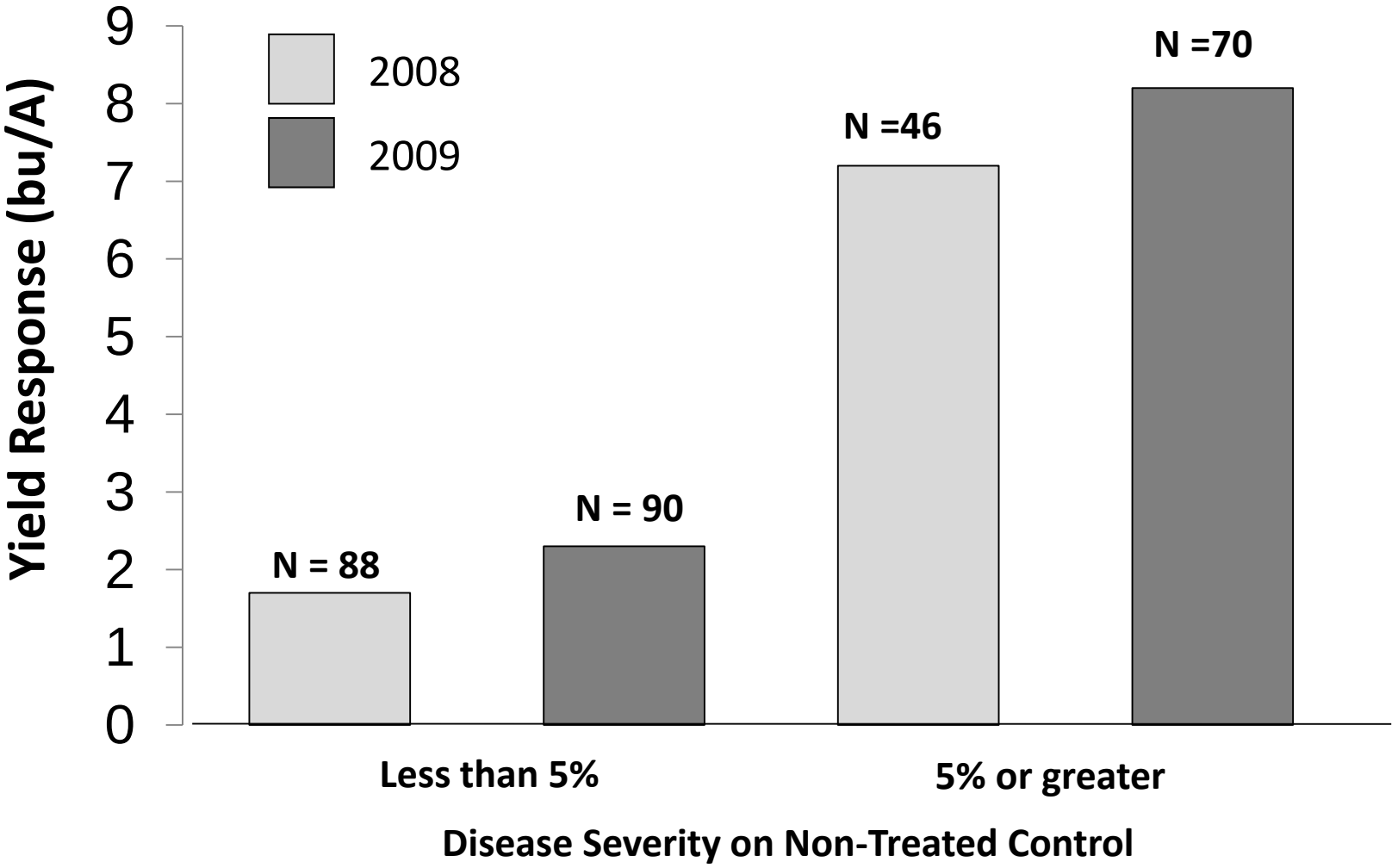
- Most common foliar disease
- Up to 50% yield losses if it develops early
- Tolerance available



- Rectangular lesions

- Leaf wetness or >95% humidity for 11+ hours

2008-09 Regional Corn Foliar Fungicide Trial Results



* Taken from: Foliar Fungicides for Corn: Targeting Disease (2010)

Regional Publication available today!

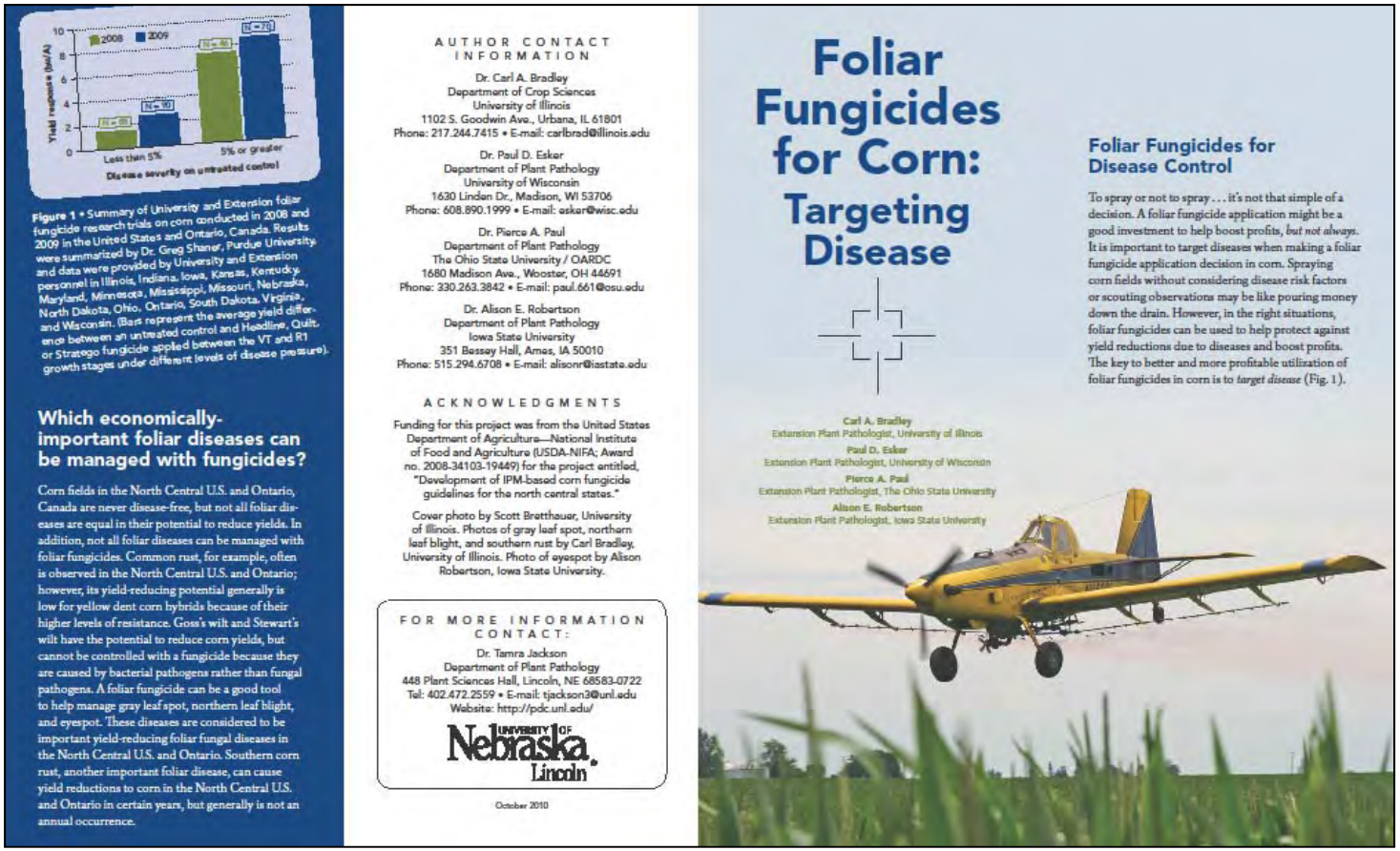


Figure 1 • Summary of University and Extension foliar fungicide research trials on corn conducted in 2008 and 2009 in the United States and Ontario, Canada. Results were summarized by Dr. Greg Shaner, Purdue University, and data were provided by University and Extension personnel in Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Ontario, South Dakota, Virginia, and Wisconsin. (Bars represent the average yield difference between an untreated control and Headline, Quilt, or Stratego fungicide applied between the VT and R1 growth stages under different levels of disease pressure).

Which economically-important foliar diseases can be managed with fungicides?

Corn fields in the North Central U.S. and Ontario, Canada are never disease-free, but not all foliar diseases are equal in their potential to reduce yields. In addition, not all foliar diseases can be managed with foliar fungicides. Common rust, for example, often is observed in the North Central U.S. and Ontario; however, its yield-reducing potential generally is low for yellow dent corn hybrids because of their higher levels of resistance. Goss's wilt and Stewart's wilt have the potential to reduce corn yields, but cannot be controlled with a fungicide because they are caused by bacterial pathogens rather than fungal pathogens. A foliar fungicide can be a good tool to help manage gray leaf spot, northern leaf blight, and eyespot. These diseases are considered to be important yield-reducing foliar fungal diseases in the North Central U.S. and Ontario. Southern corn rust, another important foliar disease, can cause yield reductions to corn in the North Central U.S. and Ontario in certain years, but generally is not an annual occurrence.

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ACKNOWLEDGMENTS

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Cover photo by Scott Bratthauer, University of Illinois. Photos of gray leaf spot, northern leaf blight, and southern rust by Carl Bradley, University of Illinois. Photo of eyespot by Alison Robertson, Iowa State University.

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October 2010

Foliar Fungicides for Corn: Targeting Disease

Carl A. Bradley
Extension Plant Pathologist, University of Illinois
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Pierce A. Paul
Extension Plant Pathologist, The Ohio State University
Alison E. Robertson
Extension Plant Pathologist, Iowa State University

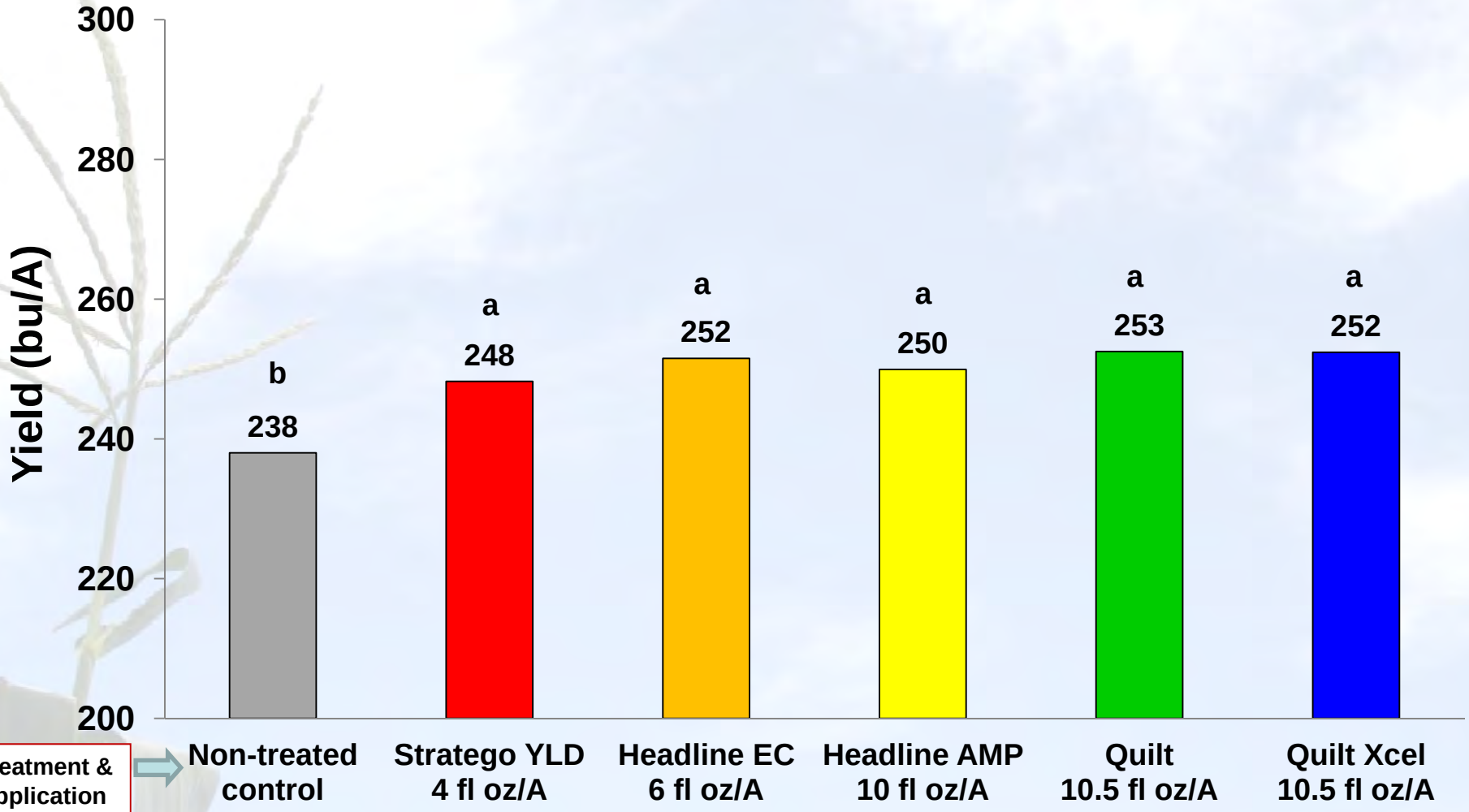
Foliar Fungicides for Disease Control

To spray or not to spray . . . it's not that simple of a decision. A foliar fungicide application might be a good investment to help boost profits, *but not always*. It is important to target diseases when making a foliar fungicide application decision in corn. Spraying corn fields without considering disease risk factors or scouting observations may be like pouring money down the drain. However, in the right situations, foliar fungicides can be used to help protect against yield reductions due to diseases and boost profits. The key to better and more profitable utilization of foliar fungicides in corn is to *target disease* (Fig. 1).

*** Also available online at PDC – Plant Disease Central under Management Trials**

2011 Fungicide Product Comparison Trial in NE

Yield (bu/A)



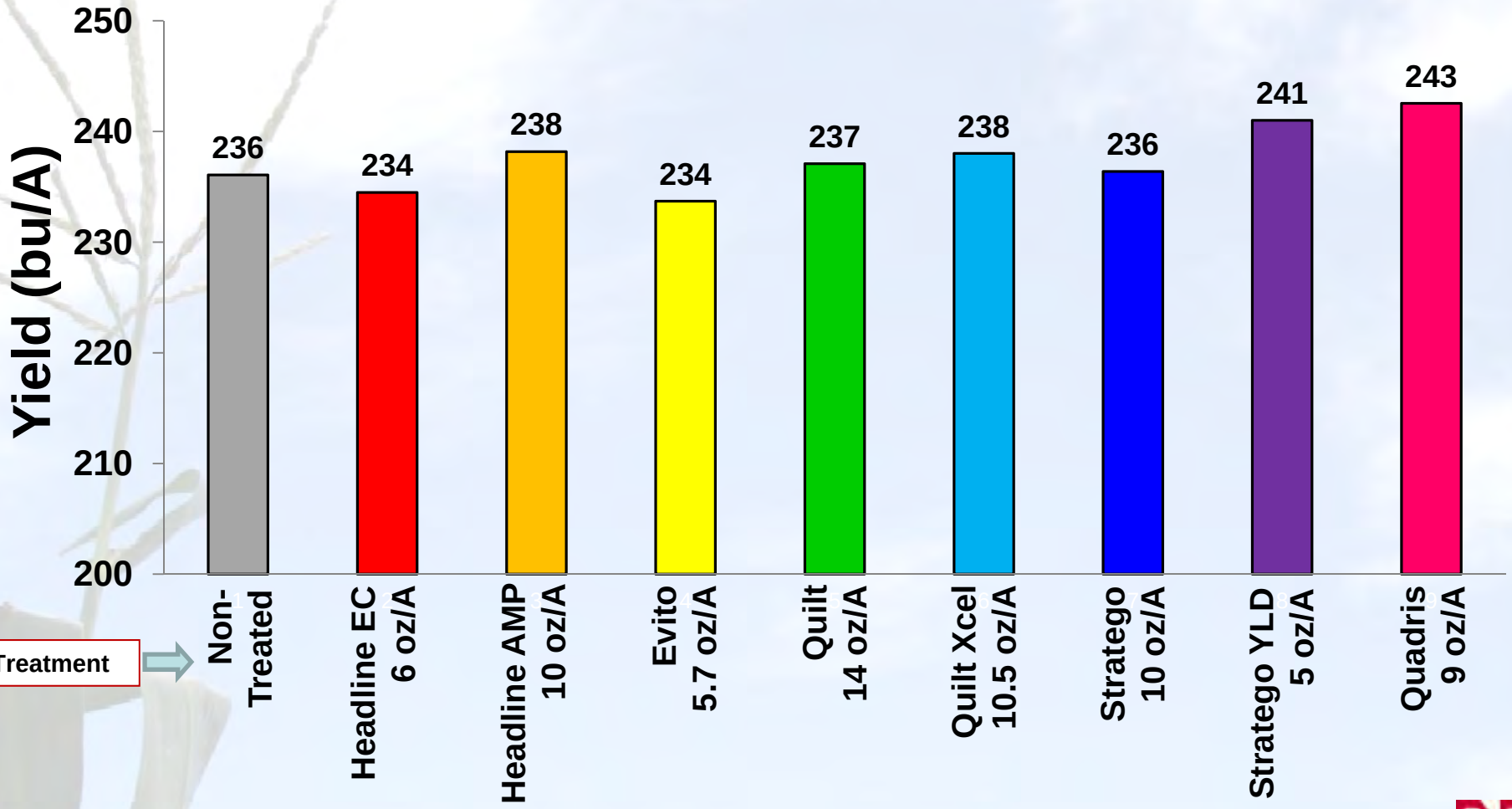
*Foliar fungicide applications made at reproductive stage R1.

*Treatments with different letters are statistically different. Coefficient of variation is 2.9%

2010 Fungicide Comparison Trial in NE

Yield (bu/A)

R1 Application 7/15/10 - DKC 61-69 (GLS rating = 5/good)

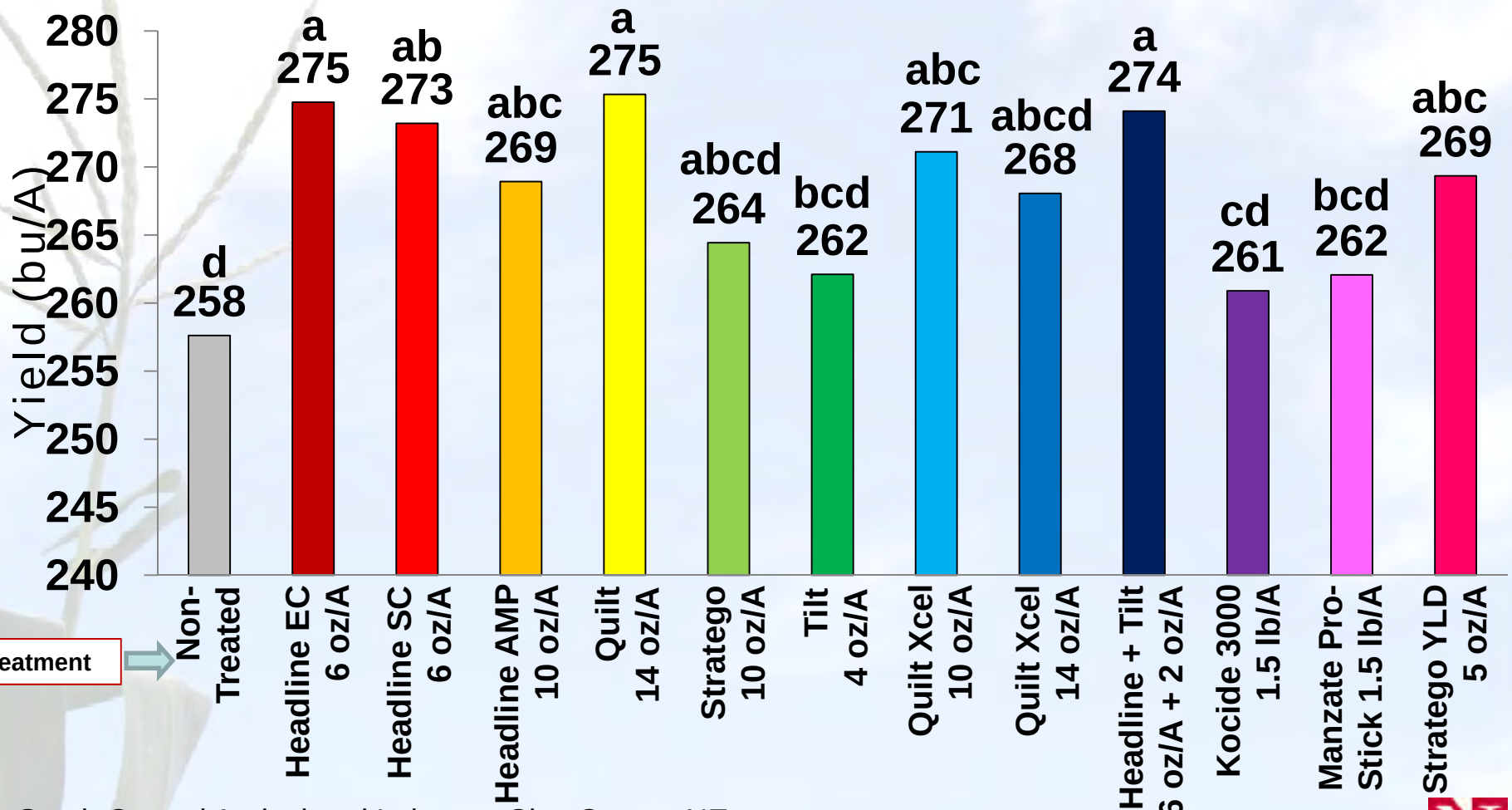


*No statistical differences between treatments. Coefficient of variation is 4.3%

2009 Fungicide Comparison Trial in NE

DKC 60-18 (GLS rating = 7/fair)

Planted 5/6/09, VT Application 7/17/09



South Central Agricultural Lab near Clay Center, NE

Frogeye Leaf Spot

Frogeye Leaf Spot Management

- Soybean varieties vary in their susceptibility and resistant varieties are available.
- Fungus overwinters in residue and will be more severe in continuous soybean and no-till.
- Fungicides can increase yields if applied at growth stage R3- R5. Products containing a strobilurin fungicide are better for this disease.

The University of Tennessee

UT Extension

West TN Research and Education Center
605 Airways Boulevard
Jackson, TN 38301

Special Alert

An Update for Tennessee

No. 1 *October 20, 2010*

SOYBEAN PATHOGEN FOUND TO BE RESISTANT TO FUNGICIDES

by Melvin A. Newman and Carl A. Bradley*

Frogeye Leaf Spot (FLS) caused by the fungus *Cercospora sojina* has shown resistance to strobilurin fungicides in a commercial field in Lauderdale County, Tennessee this year. Strobilurin fungicides belong to a group of fungicides known as the quinone outside inhibitors (QoI), which is the most widely-used group of foliar fungicides applied to field crops. In petri dish tests conducted by Plant Pathologists at the University of Illinois, spores from isolates of *C. sojina* were found to germinate in the presence of high concentrations of azoxystrobin, pyraclostrobin, and trifloxystrobin, which are active ingredients found in fungicide products

Results of *Cercospora sojina* fungicide sensitivity testing (conidial germination)

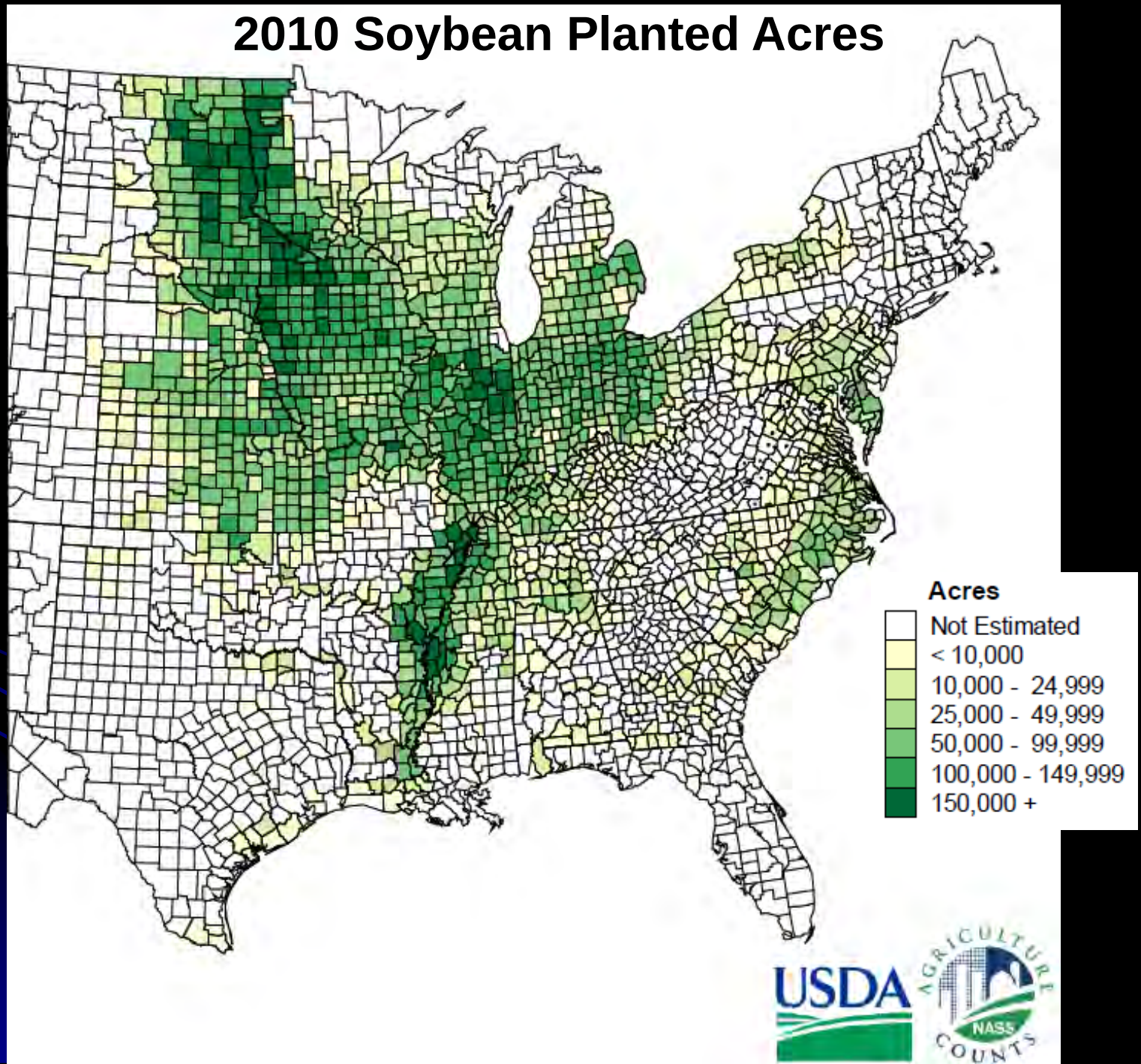
	Baseline isolates (n = 58)		2010 TN isolates (n = 15)	
Fungicide	**EC_{50} range**	**EC_{50} mean**	**EC_{50} range**	**EC_{50} mean**
Azoxystrobin	0.0029 – 0.0323	0.0127	2.7826 – 4.5409	3.1644
Pyraclostrobin	0.00014 – 0.00076	0.00027	0.2818 – 0.6404	0.3297
Trifloxystrobin	0.00018 – 0.00311	0.0012	0.3665 – 2.5119	0.8573

Notes:

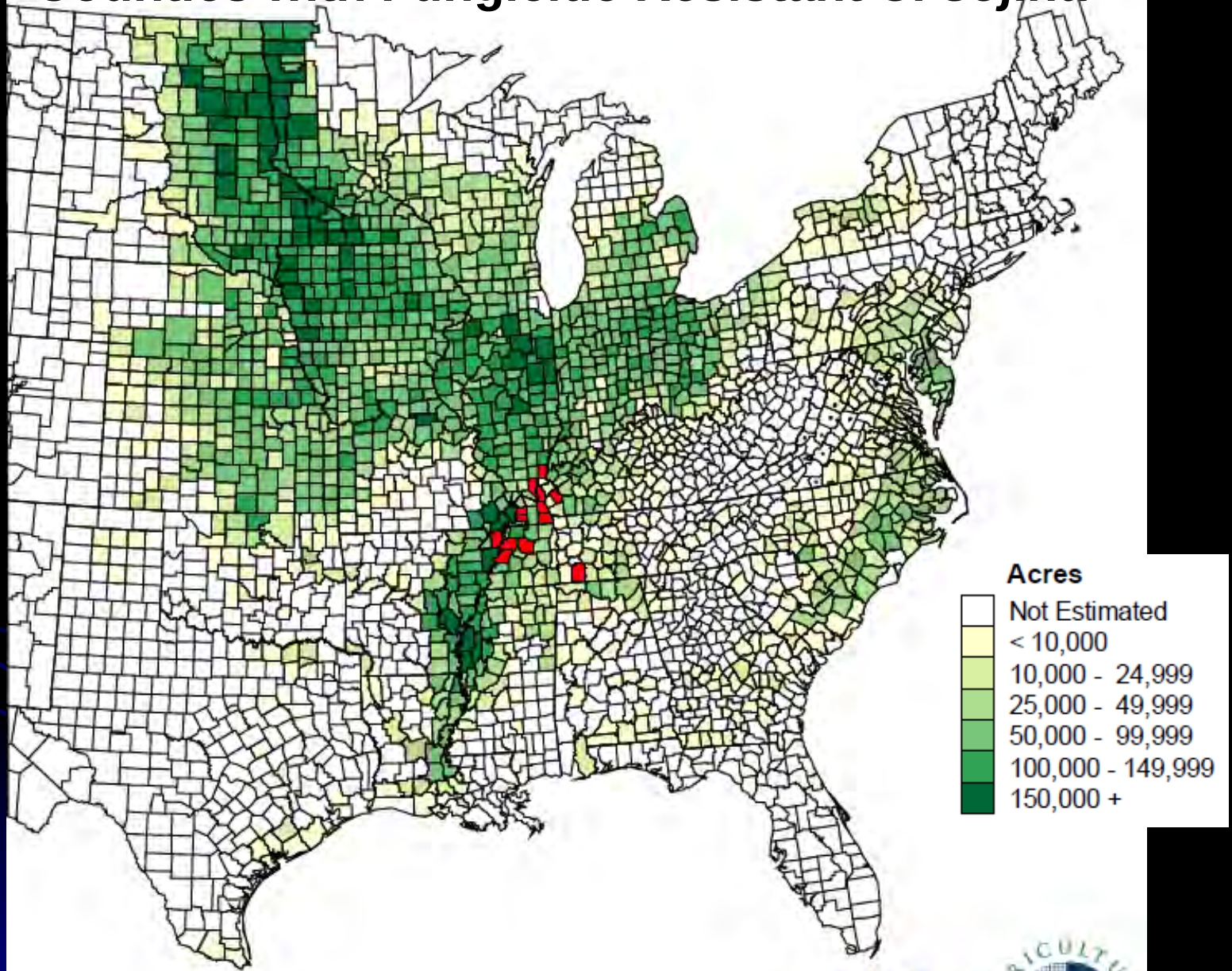
- **EC_{50} = effective concentration that inhibits 50% conidial germination when compared to non-amended (no fungicide) media. Unit is µg/ml.**
- **Bradley (2010): Research funded by the Illinois Soybean Promotion Board**

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

2010 Soybean Planted Acres



Counties with Fungicide Resistant *C. sojina*



USDA AGRICULTURE NASS

Goss's Bacterial Wilt and Blight

Then and Now

- Common in 1970's-80's
- 2005 – western NE, northeast CO, southeast WY
- 2008 – was widespread in NE, CO, SD, KS, IA, IL, etc.
  - First report IN, TX, ND
- Through 2011 - >60 NE counties
  - 12 states
  - Ontario and Manitoba, Canada

Goss's Bacterial Wilt and Blight

Biology

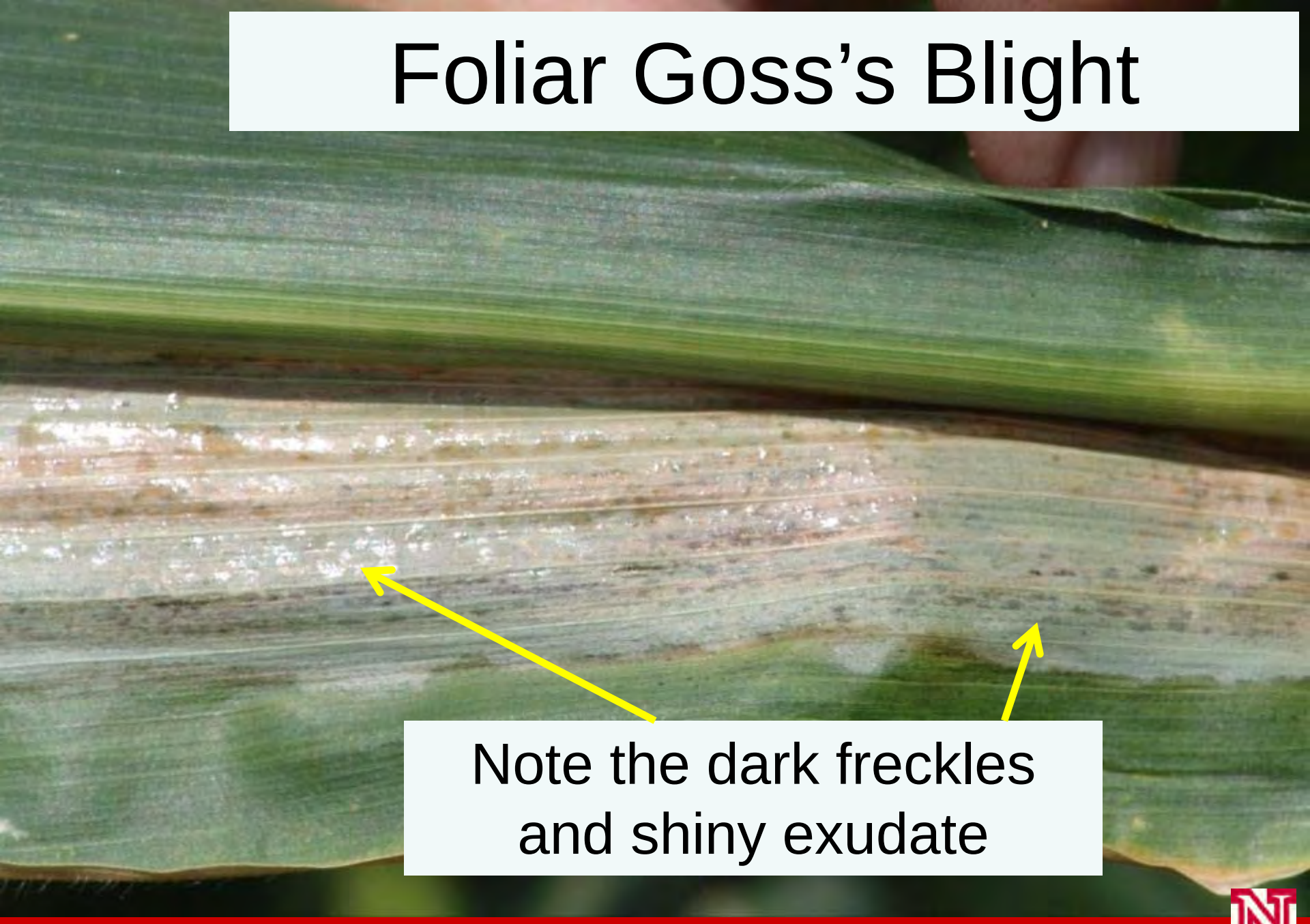
- Caused by bacterium
  - *Clavibacter michiganensis* subsp. *nebraskensis*
  - Gram positive
- Survives in residue
- Wounding
  - Hail, sandblasting, wind
- Temperature
  - Optimum 80 F
  - Range 53 – 104 F

Goss's Bacterial Wilt and Blight

Epidemiology

- 2 Phases of the disease
  - Systemic wilt
    - Esp. injured seedlings
    - Plant mortality
  - Foliar blight
    - Most common
    - Diagnostic symptoms:
    - "Freckles"
    - "Ooze" = bacterial exudate

Foliar Goss's Blight



Goss's Bacterial Wilt and Blight

Management

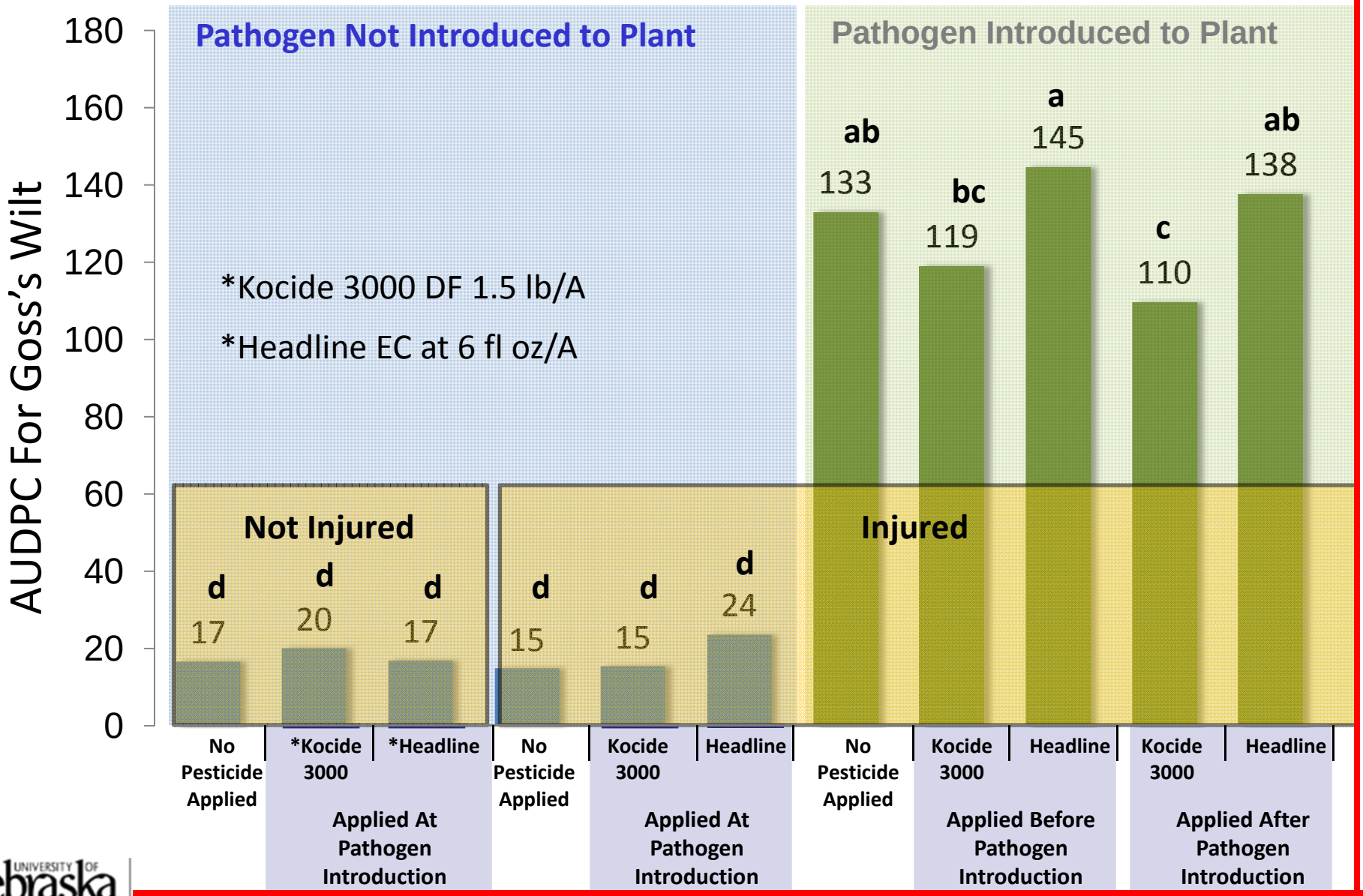
- Fungicides not effective
- Hybrid resistance (not immunity) is available
  - 65% companies rate hybrids (2009)
  - 25% in 2006
  - Multigenic (3-5 genes)
  - Additive effect
  - Not for systemic disease, though
  - Popcorn typically susceptible
- Crop rotation
- Tillage
- Weed control may help
  - Alternate hosts
- Bactericides?

Goss's Wilt Management Trials

- Applications made by CO_2 pressurized backpack sprayer
- 3 application timings
- 6 replications
- 2009
  - 2 hybrids at 105 day RM
  - 2 products
- 2010
  - 4 hybrids – 105 & 110 day RM
  - 5 product/rate combinations
  - Early season flooding = very high variability
    - Results not shown due to poor testing conditions
- Monsanto Water Utilization Center – Gothenburg, NE

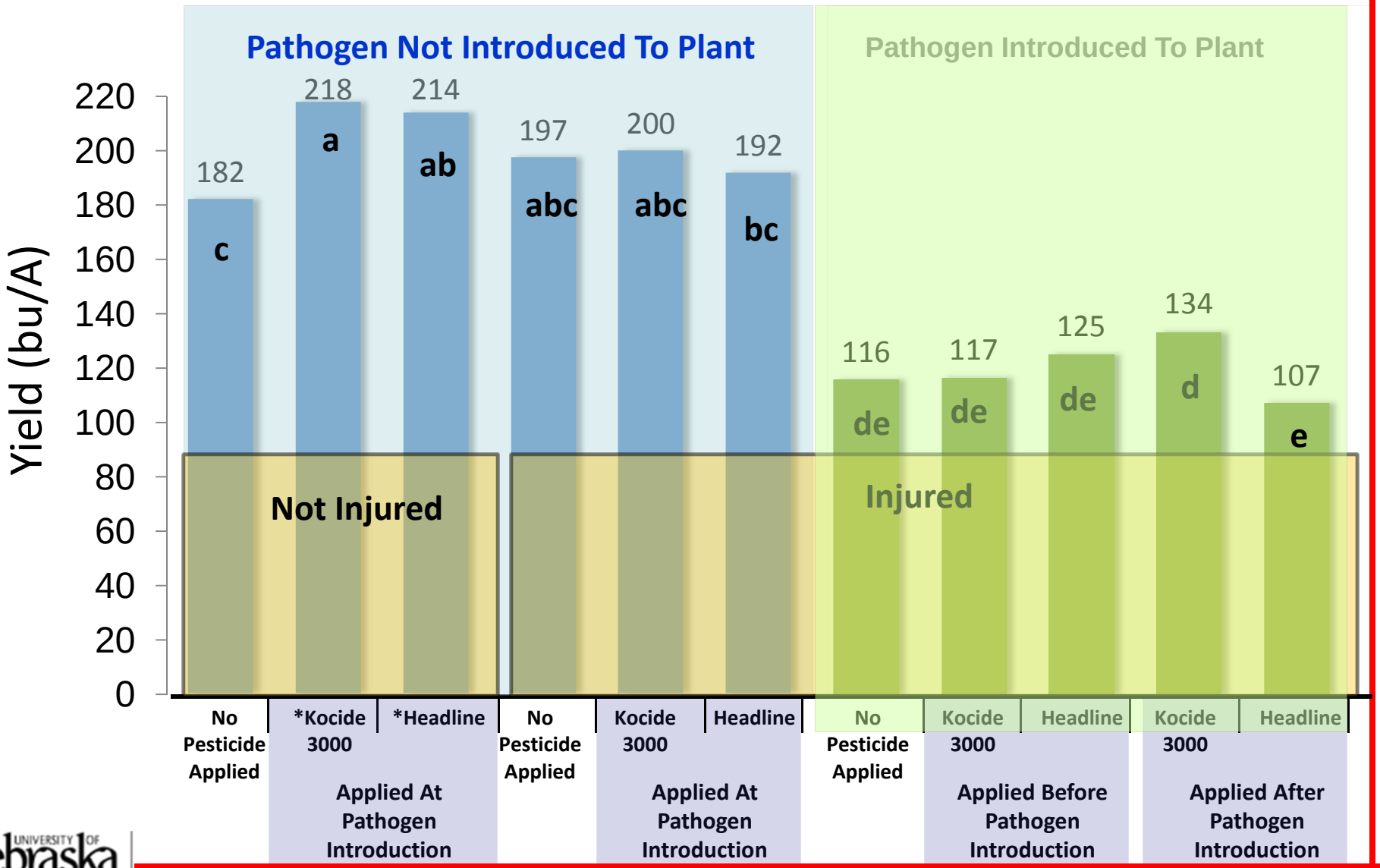
Area Under the Disease Progress Curve (AUDPC)

105RM Susceptible Hybrid (rating = 7/poor)



2009 Corn Goss's Bacterial Wilt and Blight Harvest Yield

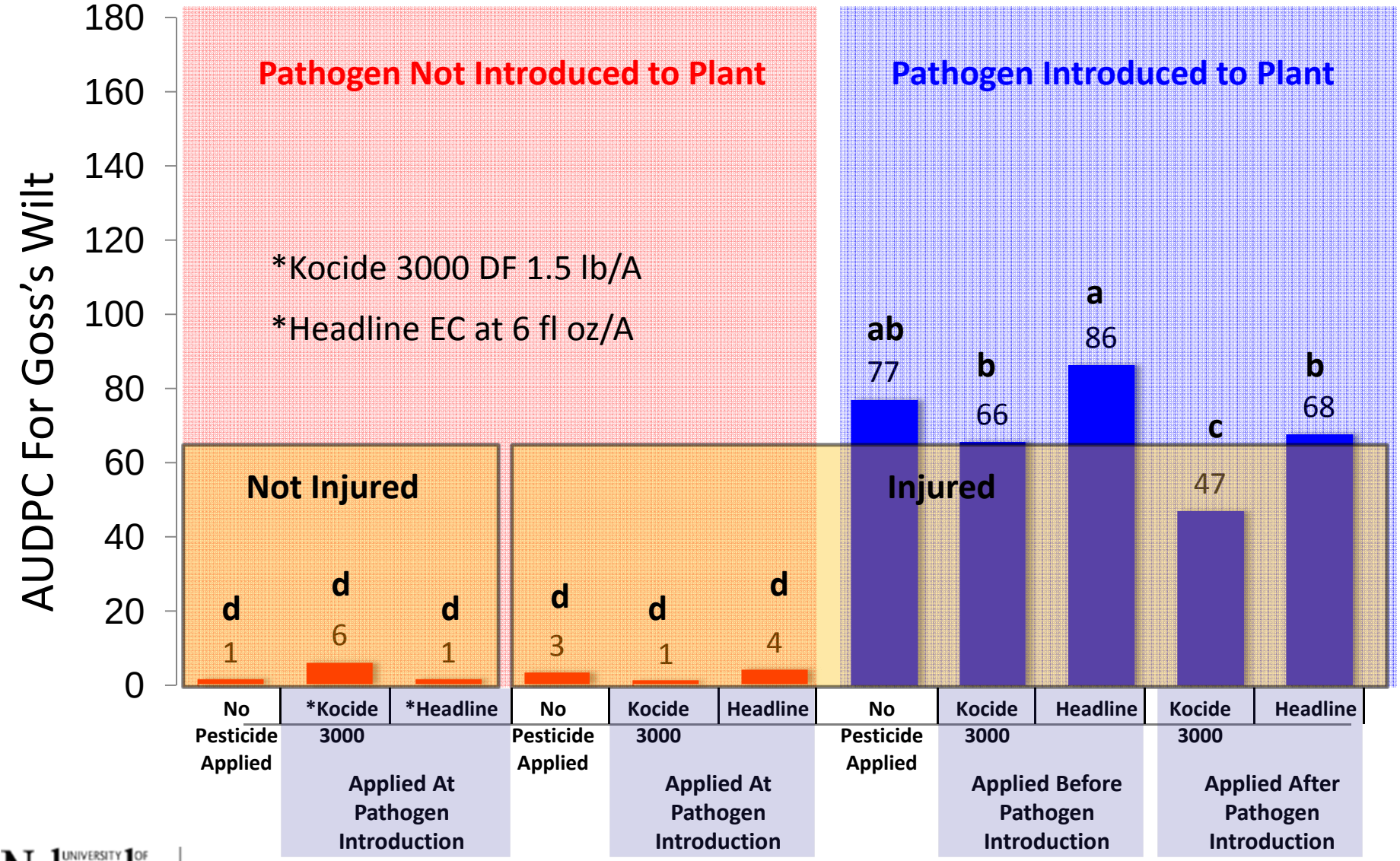
105RM Susceptible Hybrid (rating = 7/poor)



Tamra Jackson, Extension Plant Pathologist

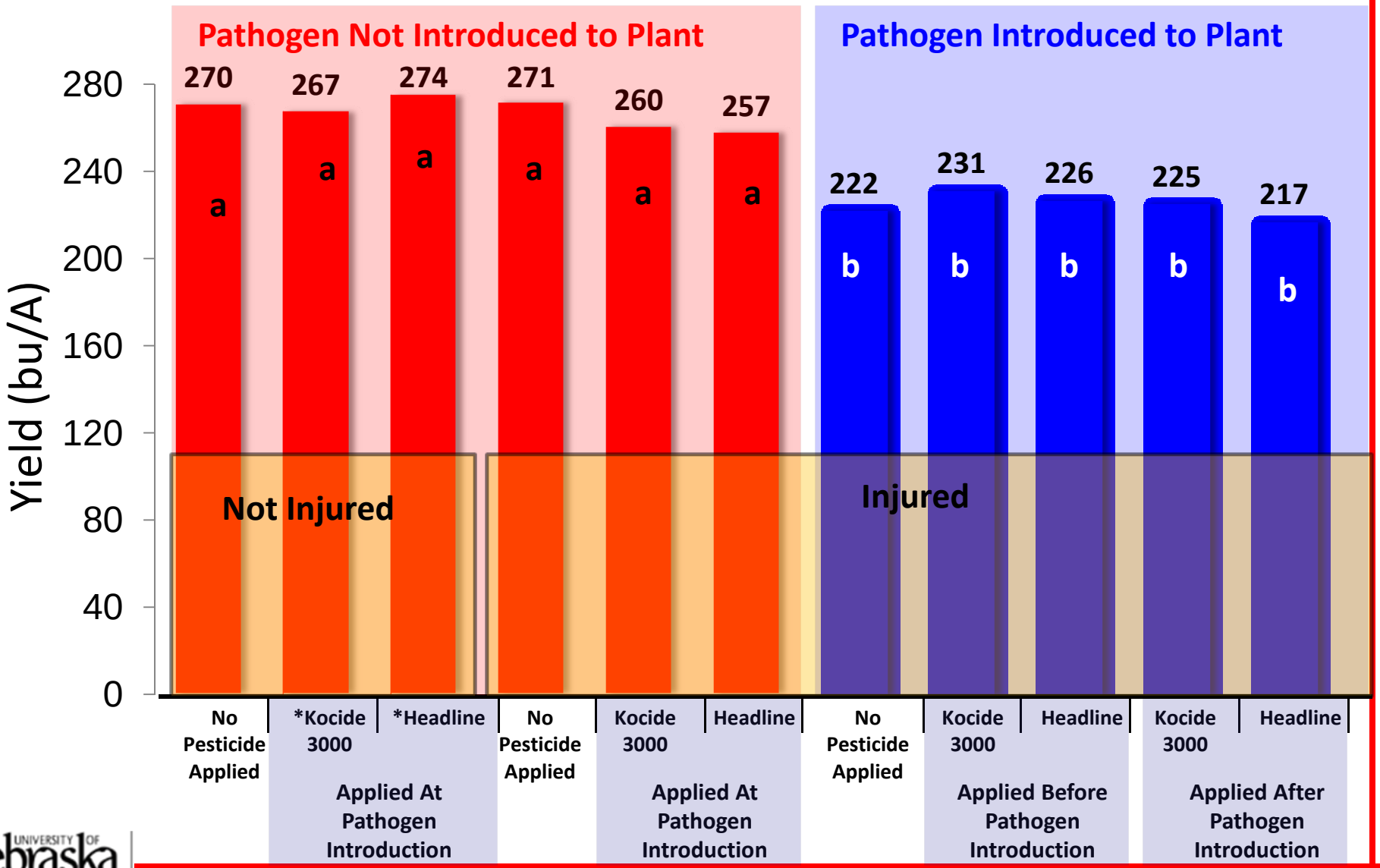
Area Under the Disease Progress Curve (AUDPC)

105RM Resistant Hybrid (rating = 3/very good)



2009 Corn Goss's Bacterial Wilt and Blight Harvest Yield

105RM Resistant Hybrid (rating = 3/very good)



University of Nebraska Lincoln EXTENSION

Tamra Jackson, Extension Plant Pathologist

Help is available at:

Plant & Pest Diagnostic Clinic

448 Plant Sciences Hall

University of Nebraska

Lincoln, NE 68583-0722

(402) 472-2559

UNL P&PDC
Sample Submission form

Plant & Pest Diagnostic Clinic
Specimen Identification Form
448 Plant Science Hall
Lincoln, NE 68583-0722

Nebraska Lincoln EXTENSION

SUBMITTER

CLIENT

Available on-line at:
http://pdc.unl.edu/diagnosticclinics/plantandpest/submissionforms

Tips for Submitting Samples for Diagnosis

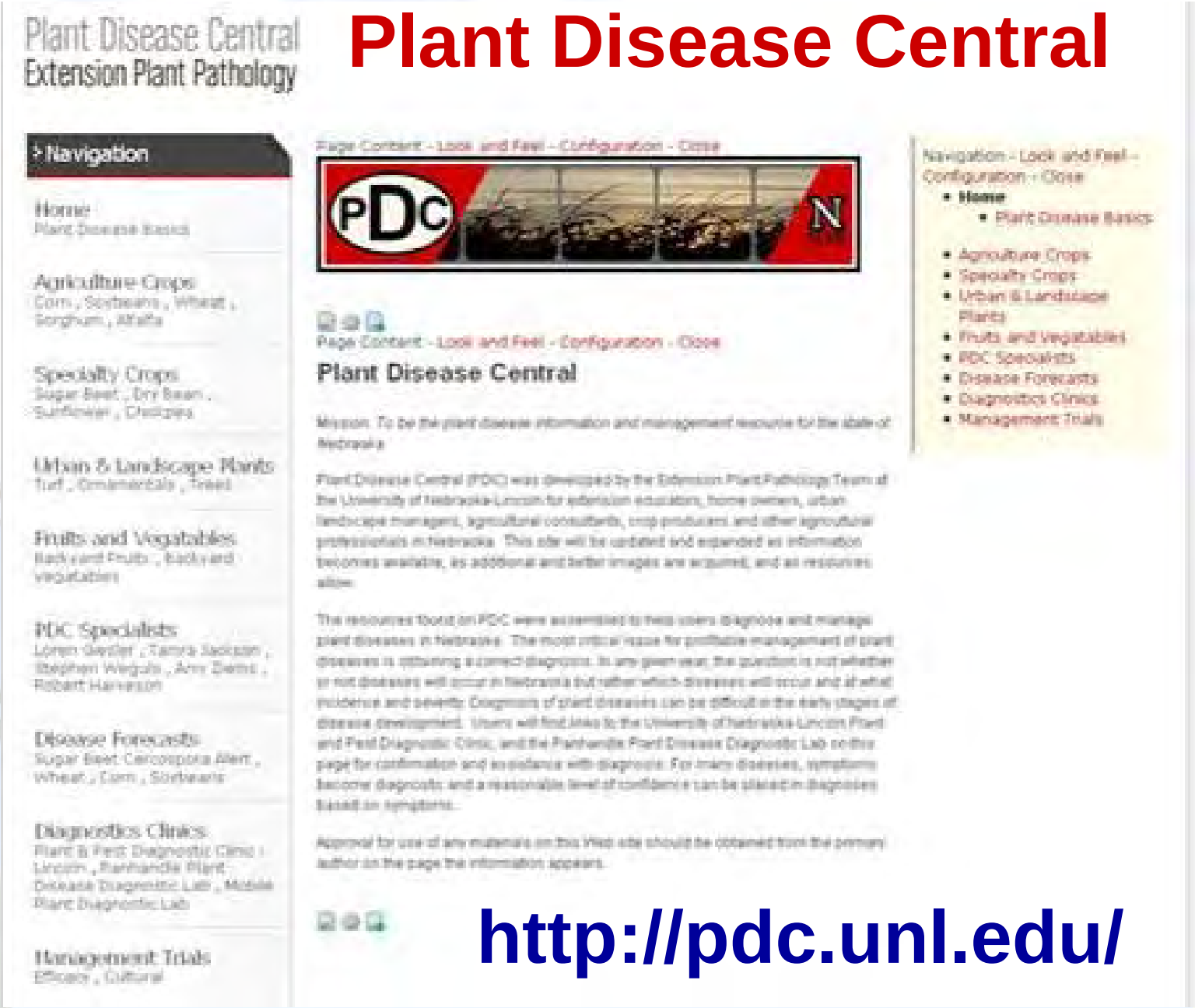
- Send several whole plants, roots and all that represent all stages of the symptoms
- Include “normal” plants
- Enclose the root ball in a plastic bag separate from the leaf material
- Place entire sample into a plastic bag
- Provide as much information as possible
  - Crop Growth Stage
  - Symptoms Distribution
  - Description of the symptom
  - How many plants in area affected?
- Mail sample Monday through Wednesday

When Submitting Samples DO NOT:

- DO NOT Add water
  - If there is excess water with the sample add *dry* paper towels to absorb the moisture
- DO NOT Let samples get too hot/cold
  - Keep samples cool. Store in a refrigerator overnight/weekend if possible
- DO NOT Place samples in paper bags
- DO NOT Mail Thursday or Friday

The reliability of your results depends upon the quality of the sample that the diagnostic lab receives.

Plant Disease Central



http://pdc.unl.edu/