Identification and Management of New and Emerging Diseases

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Advanced Crop Advisors Workshop…Fargo….January 2024

UNIVERSITY OF MINNESOTA EXTENSION

NDSU EXTENSION

opics for this session

New and emerging diseases

- Soybean brown stem rot
- Soybean sudden death syndrome
- Soybean charcoal rot
- Soybean Cyst Nematode
- Corn tar spot
- Canola – verticillium stripe

Brown Stem Rot (BSR)

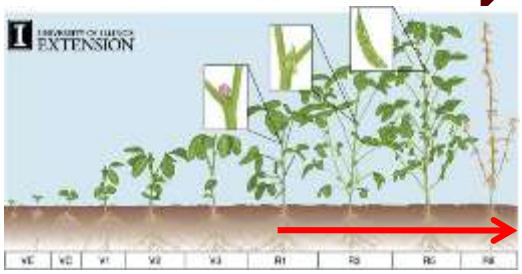
reported to cause yield losses exceeding 30%, but yield losses in the 10 – 20% range appear more common

Disease Cycle Of *C. gregata*

Seedlings infected in spring

?

Latent Infection (asymptomatic) until August



Pathogenic infection (symptomatic)

Infected soybeans harvested

Infected debris may remain on soil surface or in the soil

C. gregata survives on residue

agnosis of BSR

- **Stem Symptoms**

milar: BSR, Stem Canker, Pod and Stem Blig

- **Leaf Symptoms**

Similar: BSR, SDS, sometimes white mold

- **Laboratory**

ymptoms and DNA test or isolation of pathoge

Brown Stem Rot - Symptoms

- ymptoms usually develop after pods form
- ary depending on type of pathogen, environme nd soybean variety
- ecome more severe as plants mature
- remature defoliation and lodging can develop

Internal Stem Symptoms on Soybean

BSR

Stem Canker

Pod and Stem Blight (*Phomopsis longicolla*)

Symptoms
BSR vs Sudden Death Syndrome (SDS)

No browning of pith in stems

Management of BSR - and Related Questions

tate out of soybean – (*host range is poorly understood)*

ant resistant soybean varieties –(*resistance is different for A and*
es and is challenging to characterize)

ry little is known about value of fungicides *(especially the diverse*
atment AI's that are now used)

Sudden Death Syndrome (SDS)

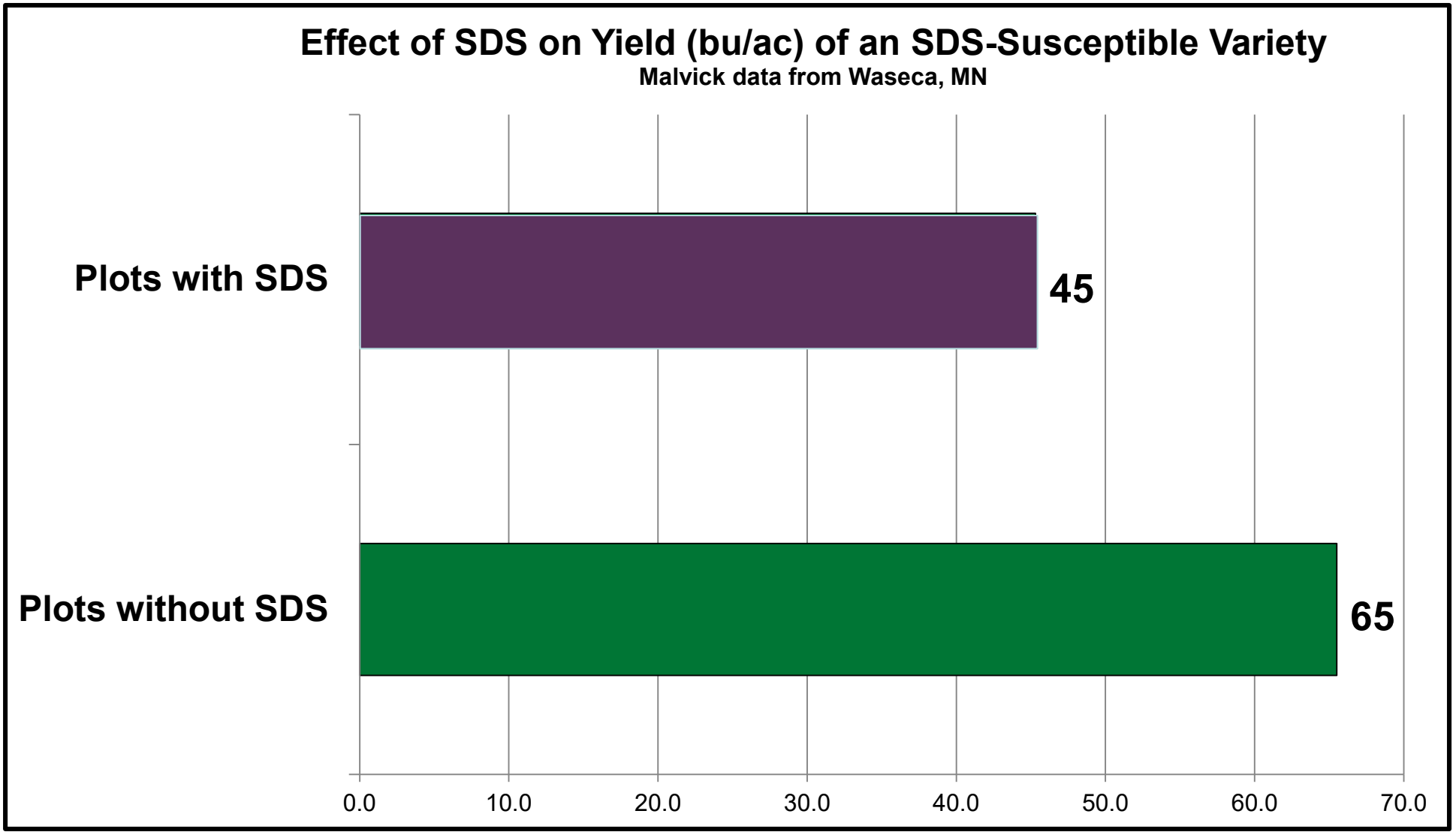
Sudden Death Syndrome (SDS) - Some Facts

ausal Pathogen: soilborne fungus *Fusarium virgulifo*

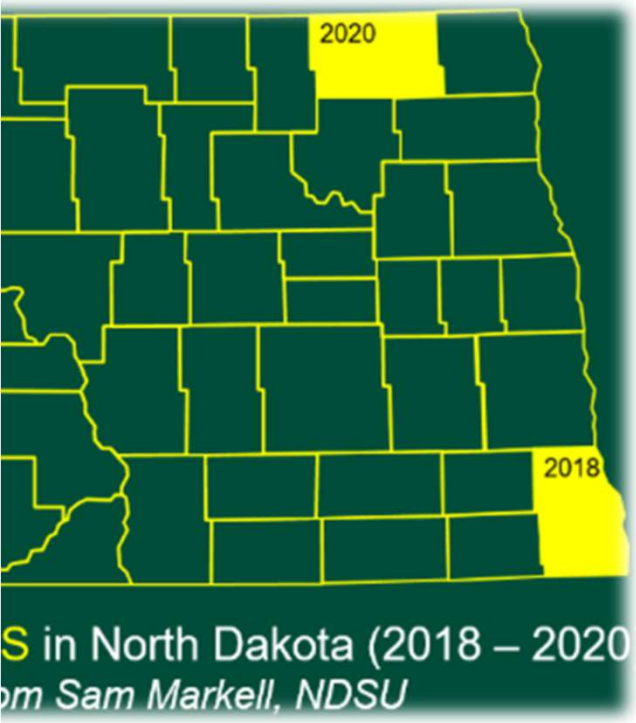
eld loss can be >50%, but usually less over entire fie

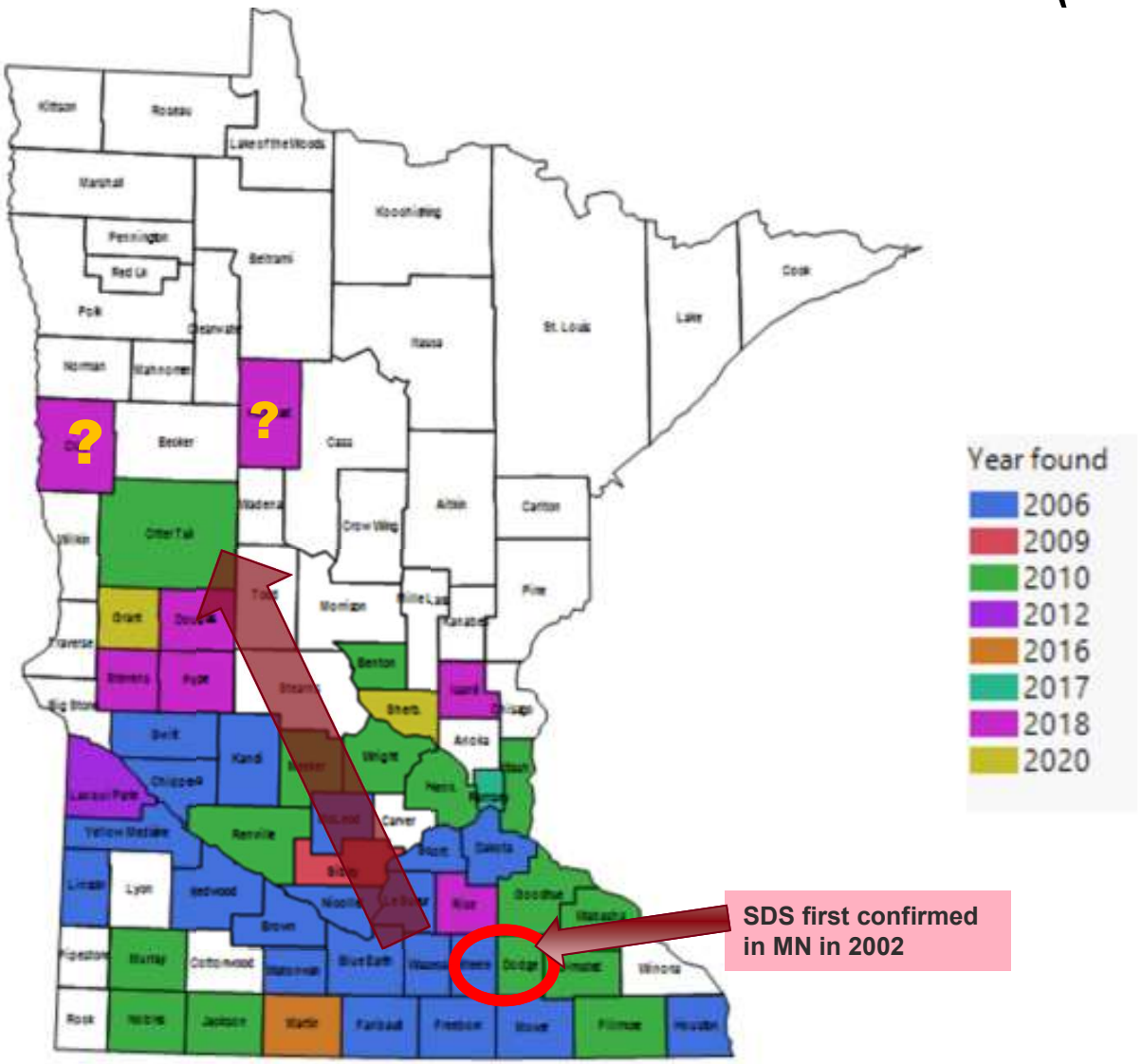
sses depend on when plants are infected, extent of oblem in field, weather, & soybean variety.

Impact of SDS on Yield (In a Field with Low SCN)



Known Distribution of SDS in MN and ND *(Jan 2023)*





SDS Risk Factors

- Field history of SDS
- Compacted soil, poor drainage
- Susceptible soybean varieties
- Wet soil 2-3 weeks after planting
- Moist to wet soil throughout the summer
- High SCN populations

Scouting for SDS

hen:

egin looking in early August

here:

DS often but not always initially appears in low, poo
ained, or compacted areas

hat to look for:

ok for yellow and brown patches between veins on l

S Symptoms at Different Stages of Developm

ner Diseases That Can be Confused with S

- Brown stem rot
- Root rots caused by other *Fusarium* pathogens (*Fusarium solani*)
- Others that cause leaf discoloration

Symptoms

lden Death Syndrome (SDS) *vs*. Brown Stem Rot (BS

Managing SDS

- Know fields of greatest risk – scout in August
- Use resistant varieties
- Use specific seed treatments labeled for SDS
  - Fungicides: ILeVO® (BASF) and Saltro® (Syngen
  - Biological: Heads-Up® (Plant Protectants Inc.)

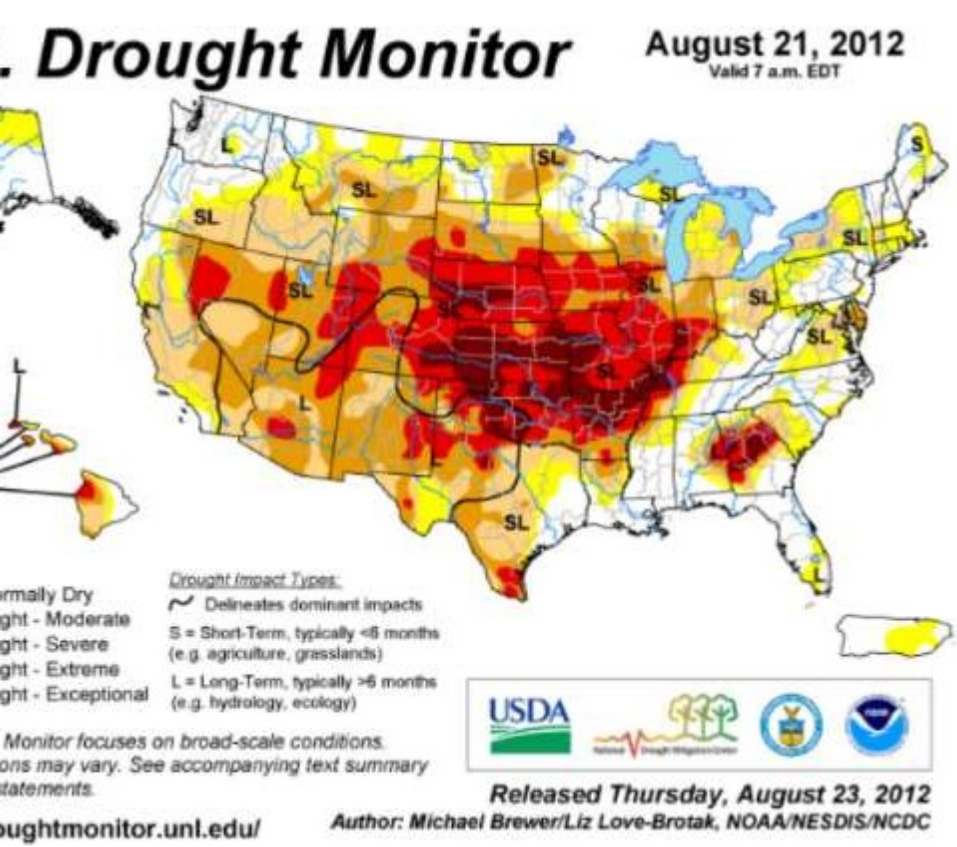
: fungicide sprays are not effective for SDS

Charcoal Rot

Charcoal Rot

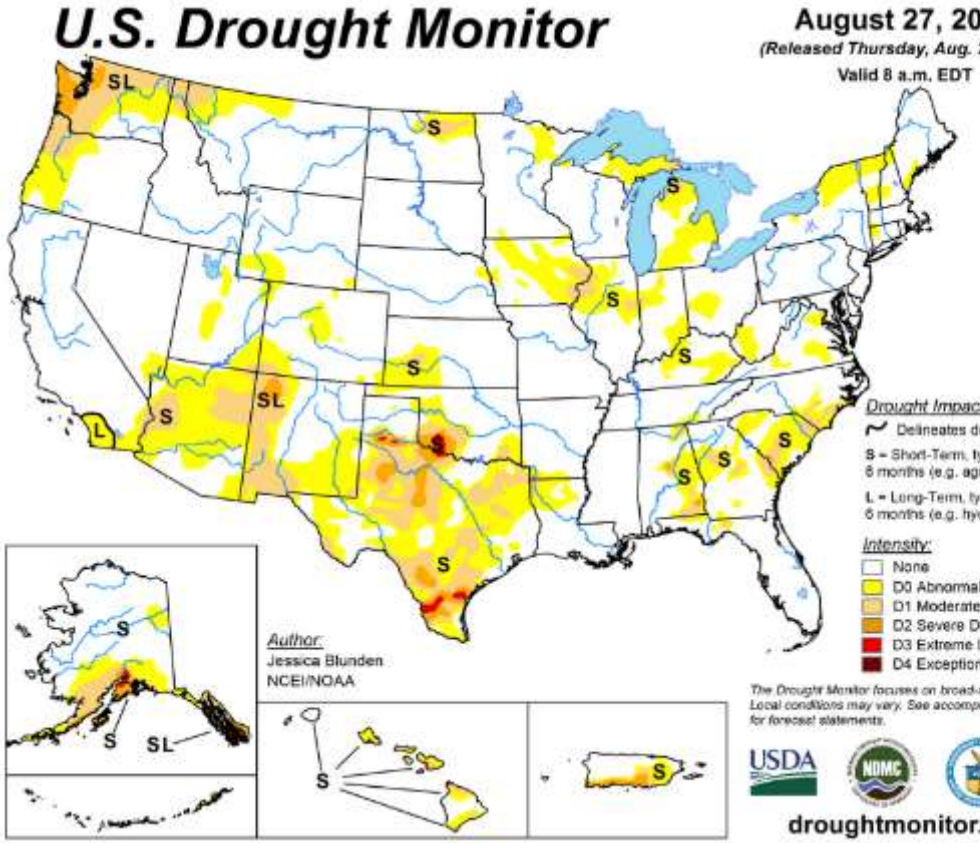
- Widespread throughout North Dakota 2023, but highest severity in Southeast
- Driven by HOT and DRY, which is what most of us saw early in 2023
- Persists in the soil as microsclerotia for up to 5 years
- Other hosts for Charcoal Rot include Corn and Sunflowers

2012



% loss (60M bu - $858M)

2019



0.05% loss (1.7M bu - $15


Photo: Berlin Nelson


Photo: Berlin Nelson

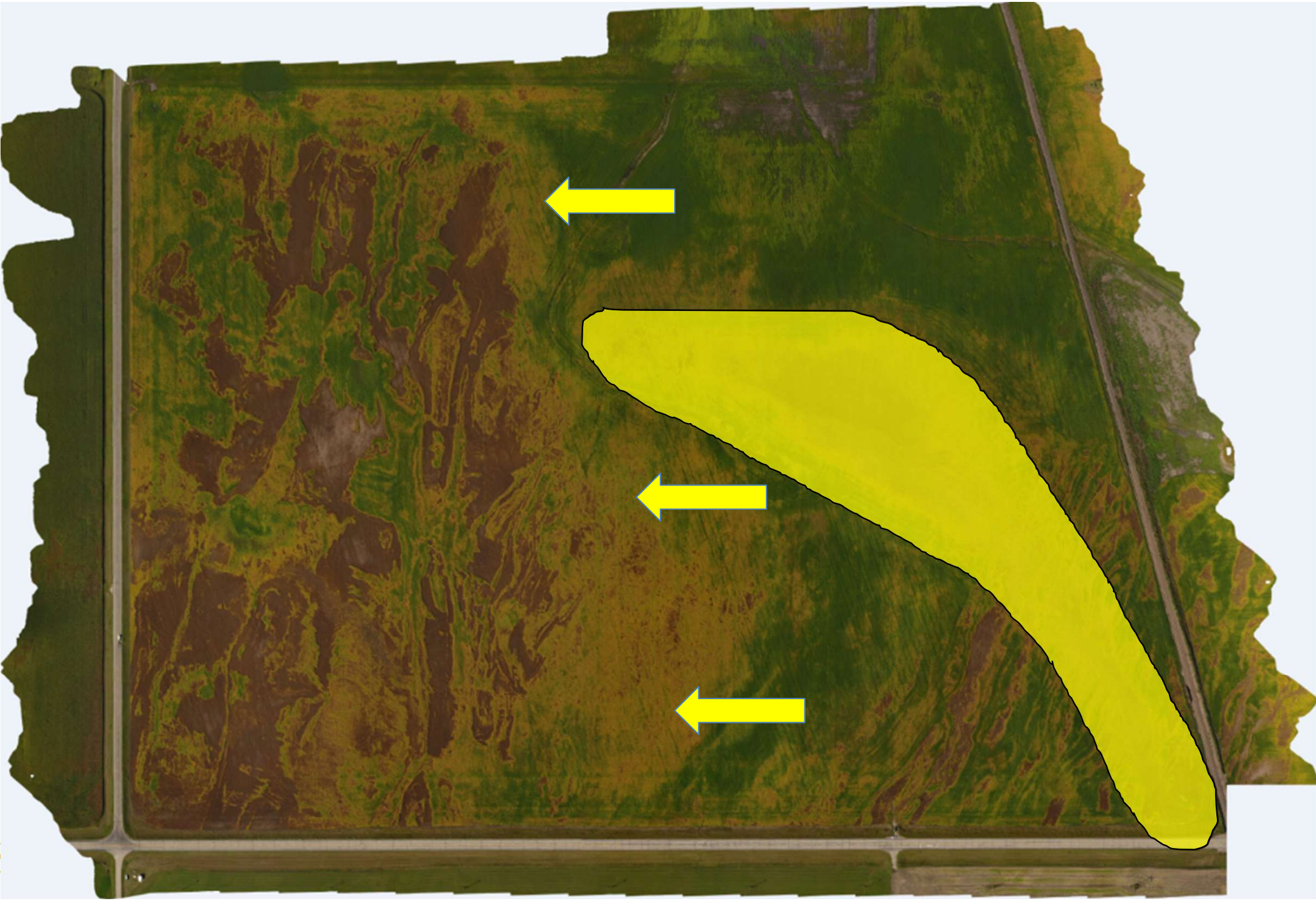



Photo: Berlin Nelson

Management of Charcoal Rot

- Pathogen is probably present across the area but just needs one very dry year
- Scout fields to understand problematic areas
- Crop Rotation (small grains especially)
- Look for varieties with less susceptibility

FROGEYE LEAF SPOT

Spots on leaves, brown/tan & surrounded by a brown/purplis
Black specks may develop in lesions
Spots may grow together and kill large areas of leaves

Photo fby D.Malvick

Frogeye leaf spot

Yield loss up to 30% reported in southern U.S.

Favored by warm and humid weather

Pathogen overwinters in infested soybean residue

Manage with : crop rotation, tillage, fungicides

Management is complicated by **QoI (strobilurin) resistance** in the FLS fungal pathogen

ybean Cyst ematode (SCN)

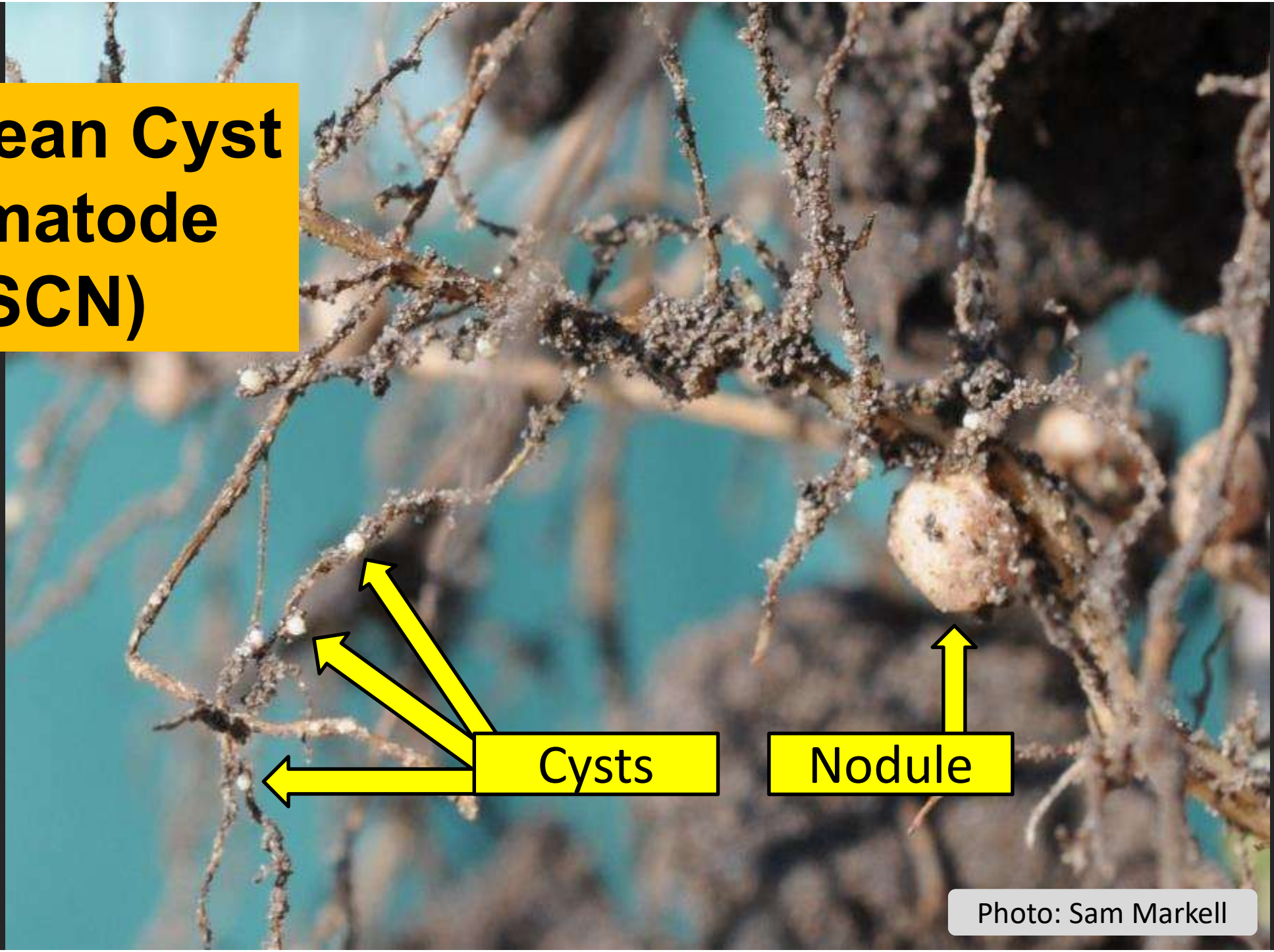
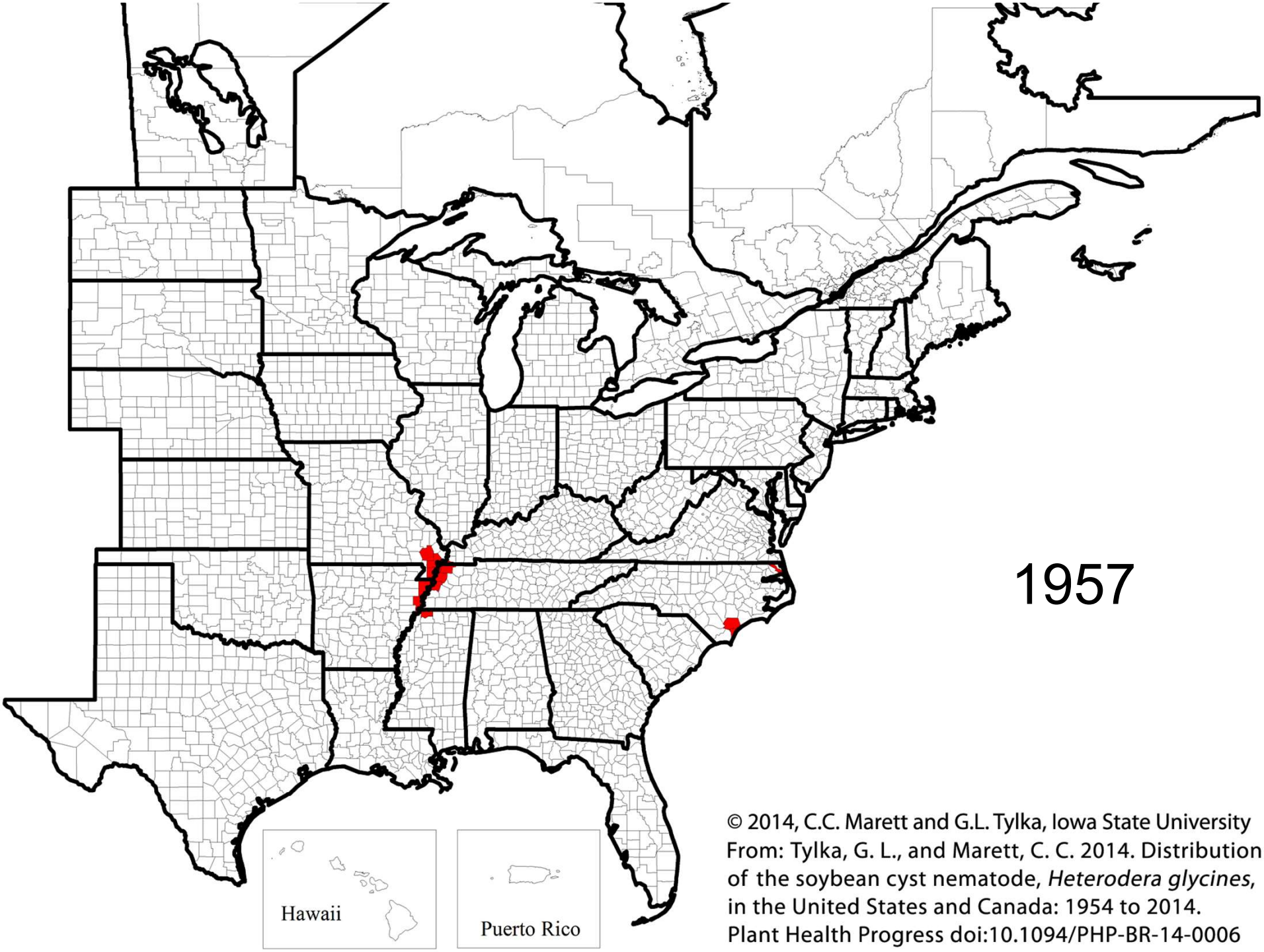
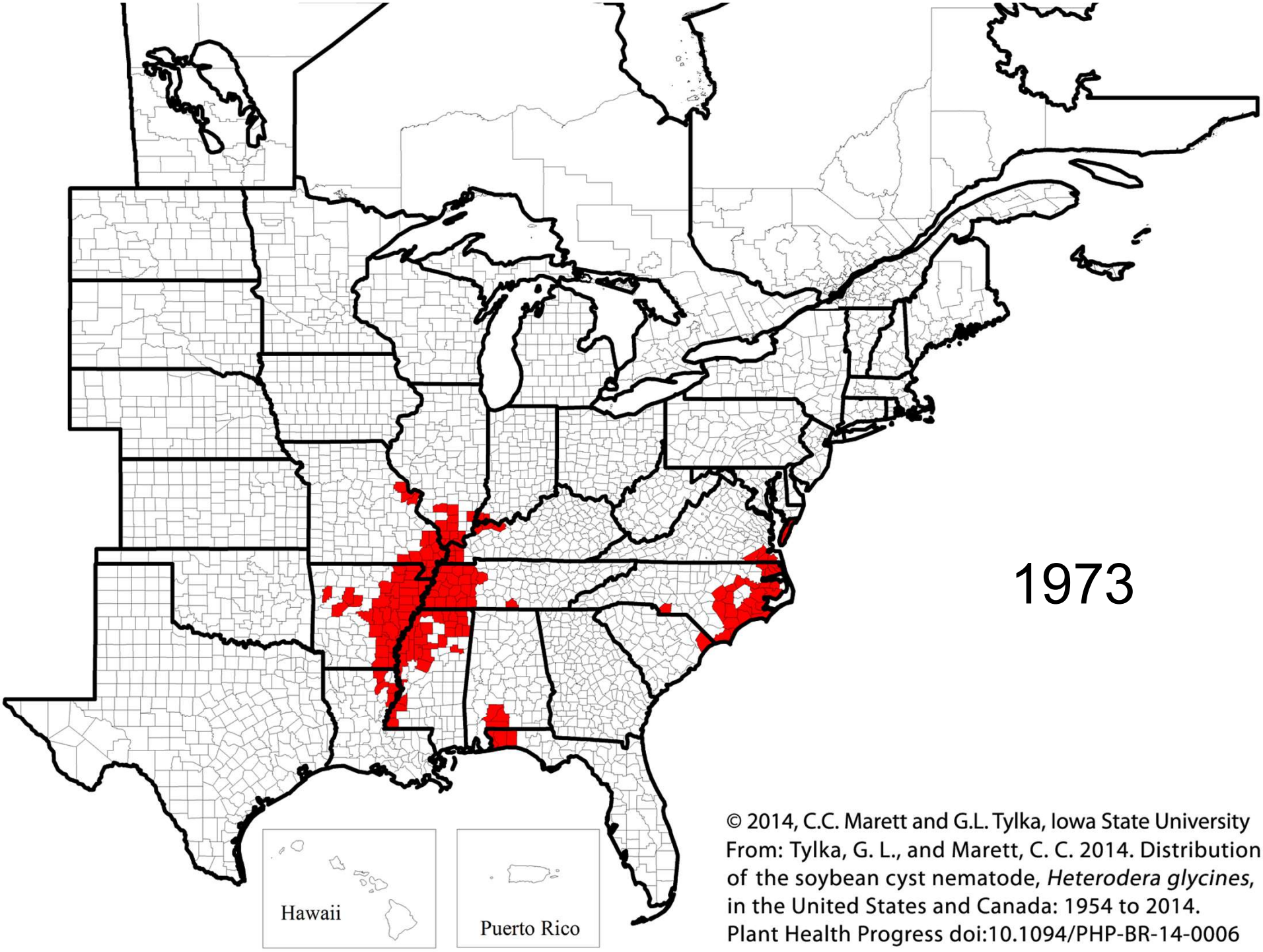


TABLE 6
e 10 most yield reducing diseases based on estimates of loss and associated estimated soybean yield losses (bushels isands) by disease or disease type from 13 soybean producing states in the northern United States[a] and Ontario, Can from 2015 to 2019

2015		2016		2017		2018		2019	
Disease	Loss	Disease	Loss	Disease	Loss	Disease	Loss	Disease	L
Soybean cyst nematode	100,679	Soybean cyst nematode	87,963	Soybean cyst nematode	102,453	Soybean cyst nematode	108,899	Soybean cyst nematode	6
Seedling diseases[b]	56,690	Seedling diseases	47,460	Sclerotinia stem rot (white mold)	61,086	Diaporthe (Phomopsis) seed decay[c]	63,457	Sclerotinia stem rot (white mold)	
Sclerotinia stem rot (white mold)	45,360	Sudden death syndrome	45,448	Seedling diseases	45,778	Frogeye leaf spot	47,187	Seedling diseases	2
Sudden death syndrome	44,243	Sclerotinia stem rot (white mold)	39,551	Sudden death syndrome	29,004	Sudden death syndrome	36,944	Sudden death syndrome	
Phytophthora root and stem rot	25,148	Phytophthora root and stem rot	26,959	Charcoal rot	23,612	Seedling diseases	32,612	Phytophthora root and stem rot	
Septoria brown spot	24,267	Brown stem rot	14,510	Phytophthora root and stem rot	20,949	Phytophthora root and stem rot	26,565	Frogeye leaf spot	
Brown stem rot	19,451	Septoria brown spot	14,416	Brown stem rot	13,534	Pod and stem blight[d]	25,967	Pod and stem blight	
Stem canker	11,434	Pod and stem blight	9,445	Stem canker	11,585	Sclerotinia stem rot (white mold)	24,172	Brown stem rot	
Charcoal rot	11,382	Frogeye leaf spot	8,378	Septoria brown spot	9,733	Charcoal rot	19,244	Septoria brown spot	
Pod and stem blight	9,444	Stem canker	8,159	Pod and stem blight	9,212	Stem canker	16,872	Other nematodes[e]	



From: Tylka, G. L., and Marett, C. C. 2014. Distribution of the soybean cyst nematode, *Heterodera glycines*, in the United States and Canada: 1954 to 2014. Plant Health Progress doi:10.1094/PHP-BR-14-0006



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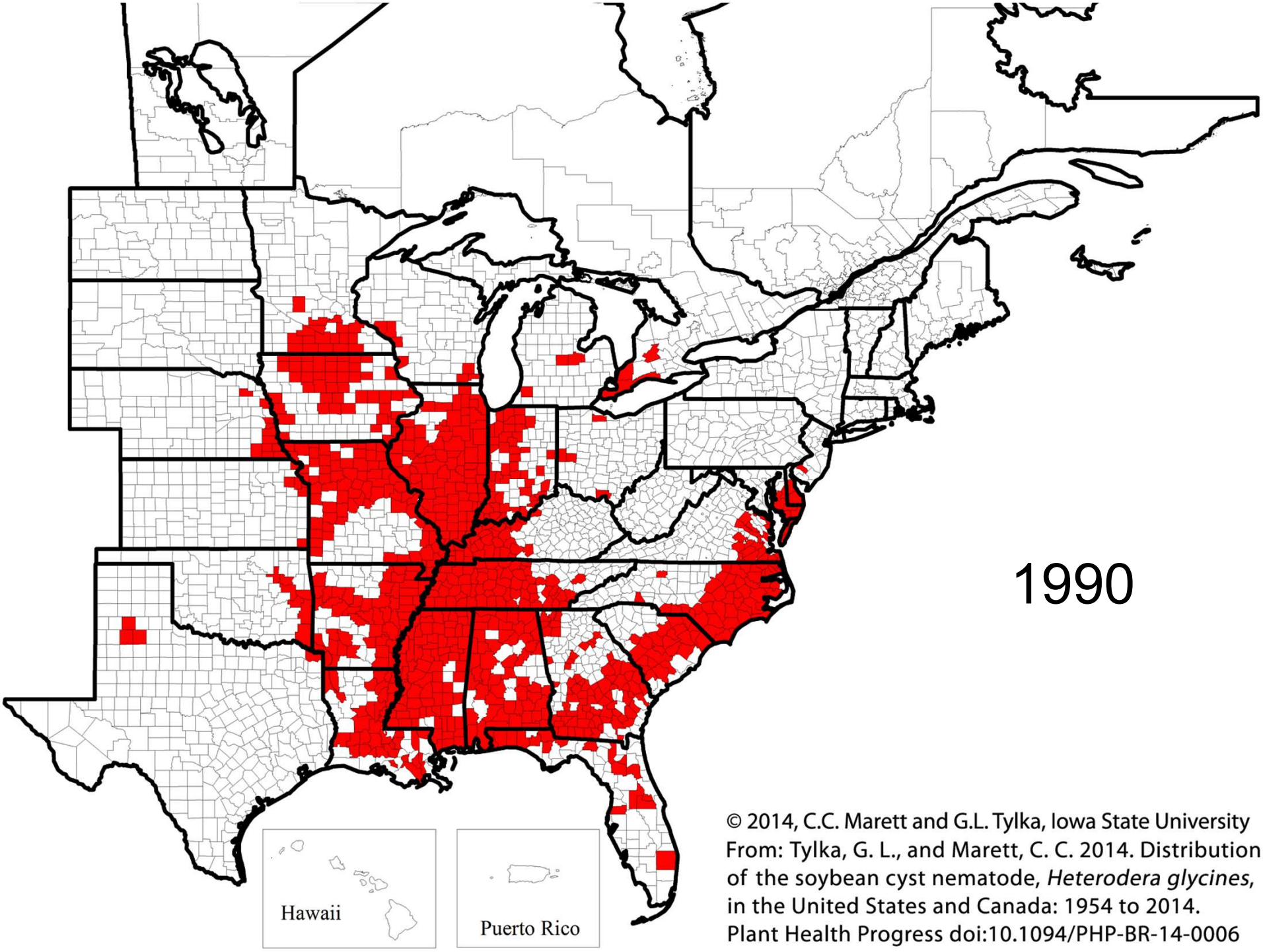

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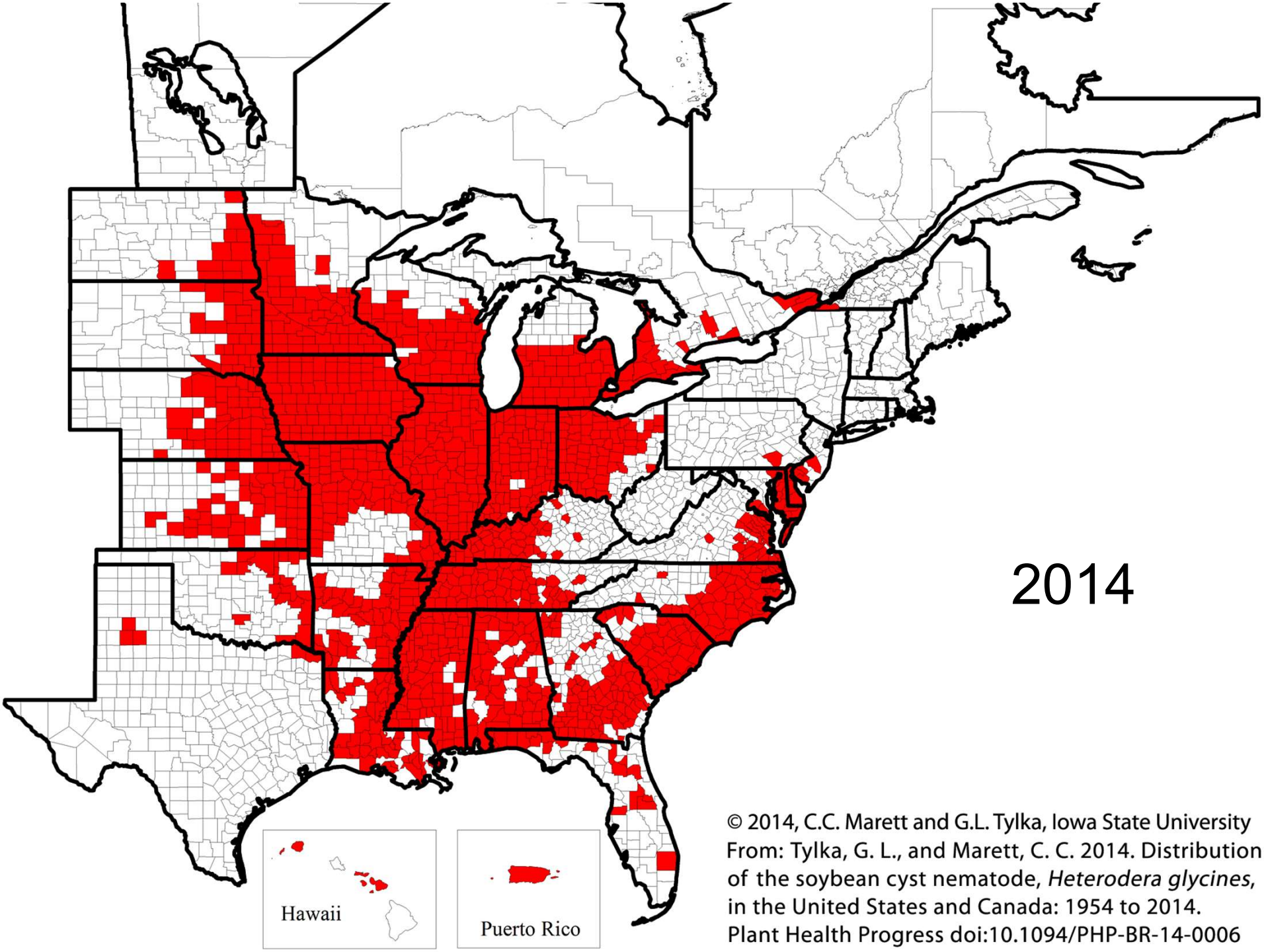

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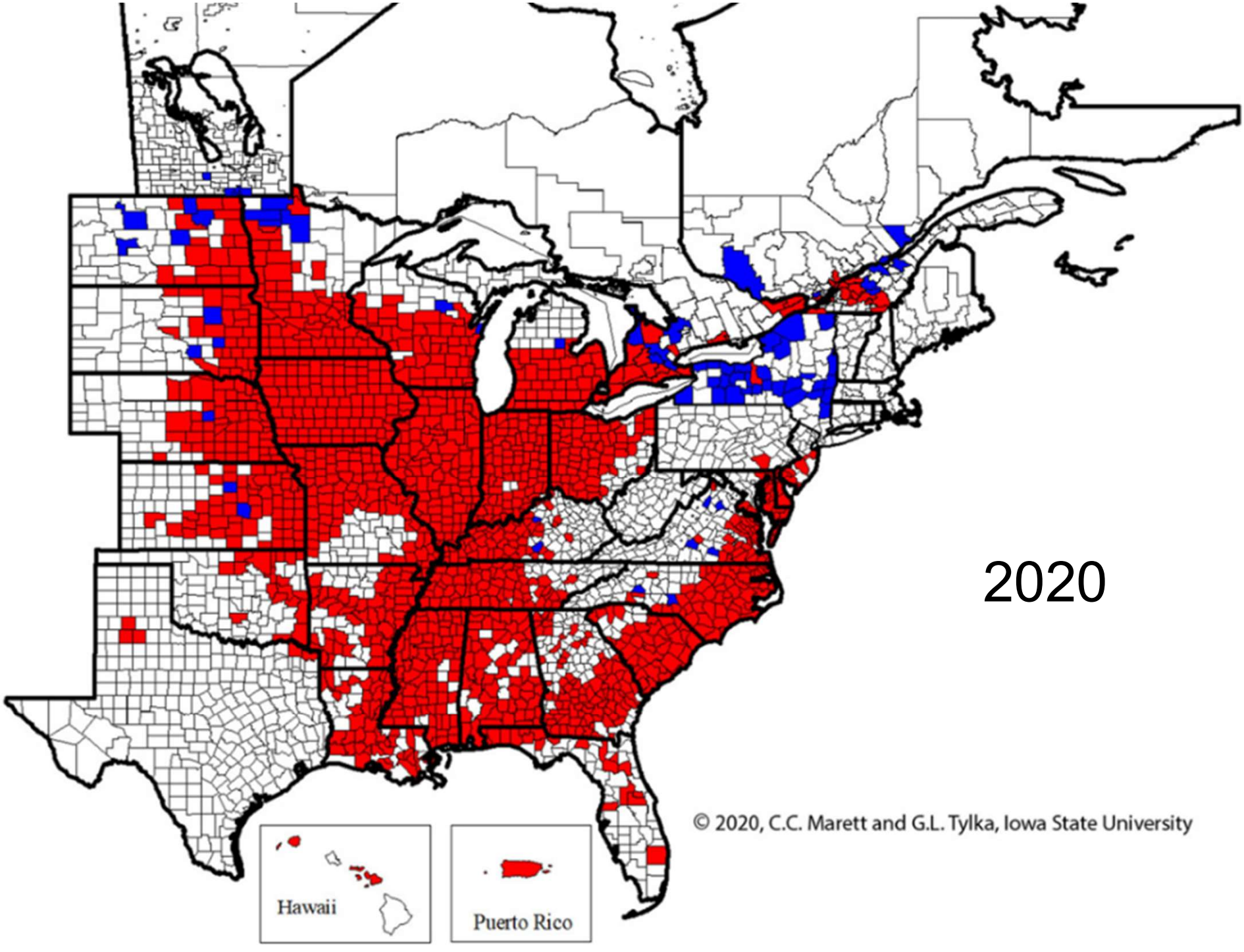
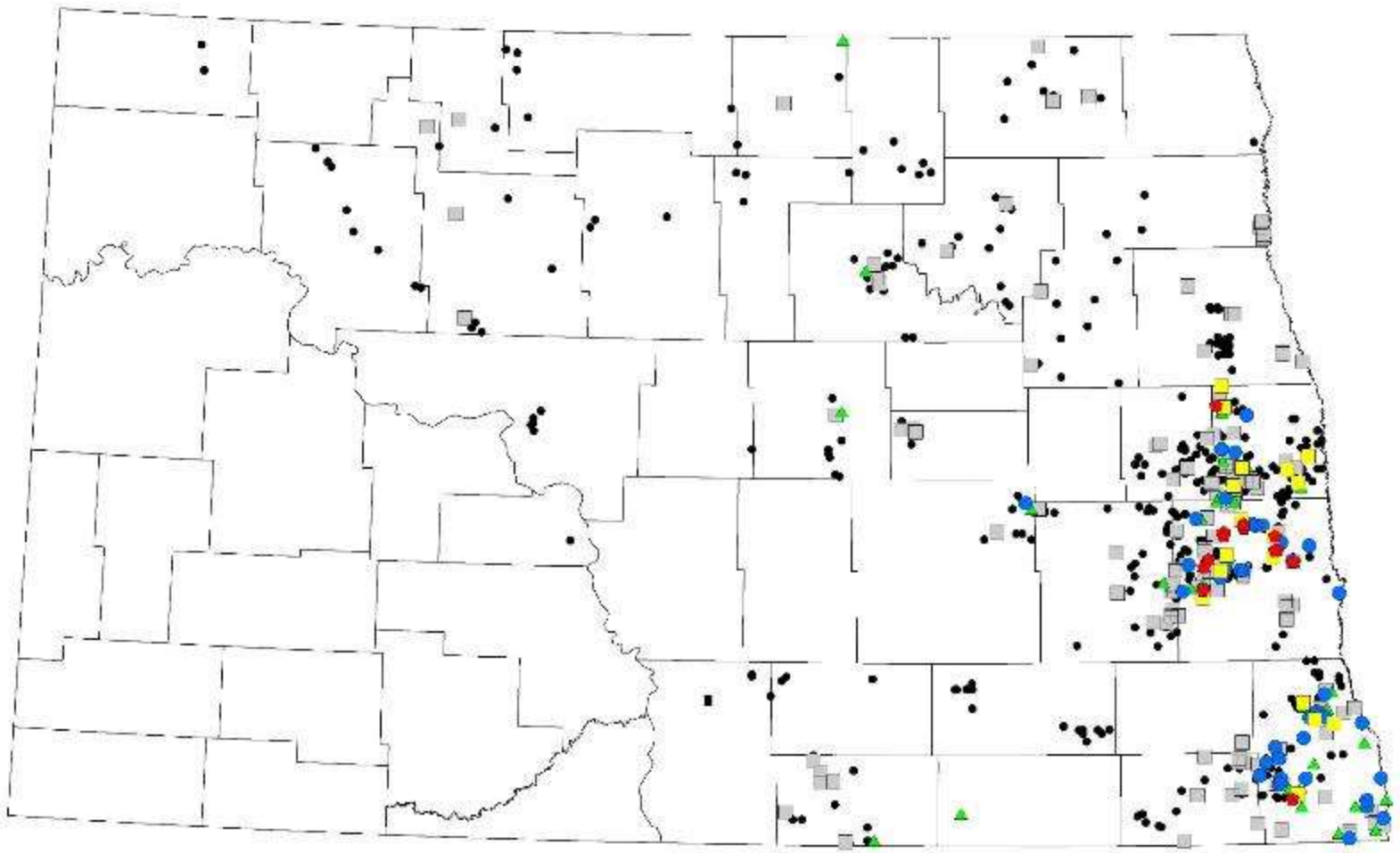

2020
Hawaii
Puerto Rico
© 2020, C.C. Marett and G.L. Tylka, Iowa State University

orth Dakota SCN Sampling Program (2013-202

- Funding = North Dakota Soybean Council
- Pick up sample bags at County Extension Office (Mi
  August or later)
- Soil Sample – Send in sample
- Data mailed to you
- Reported in eggs/100cc

SCN Survey 2013-2014

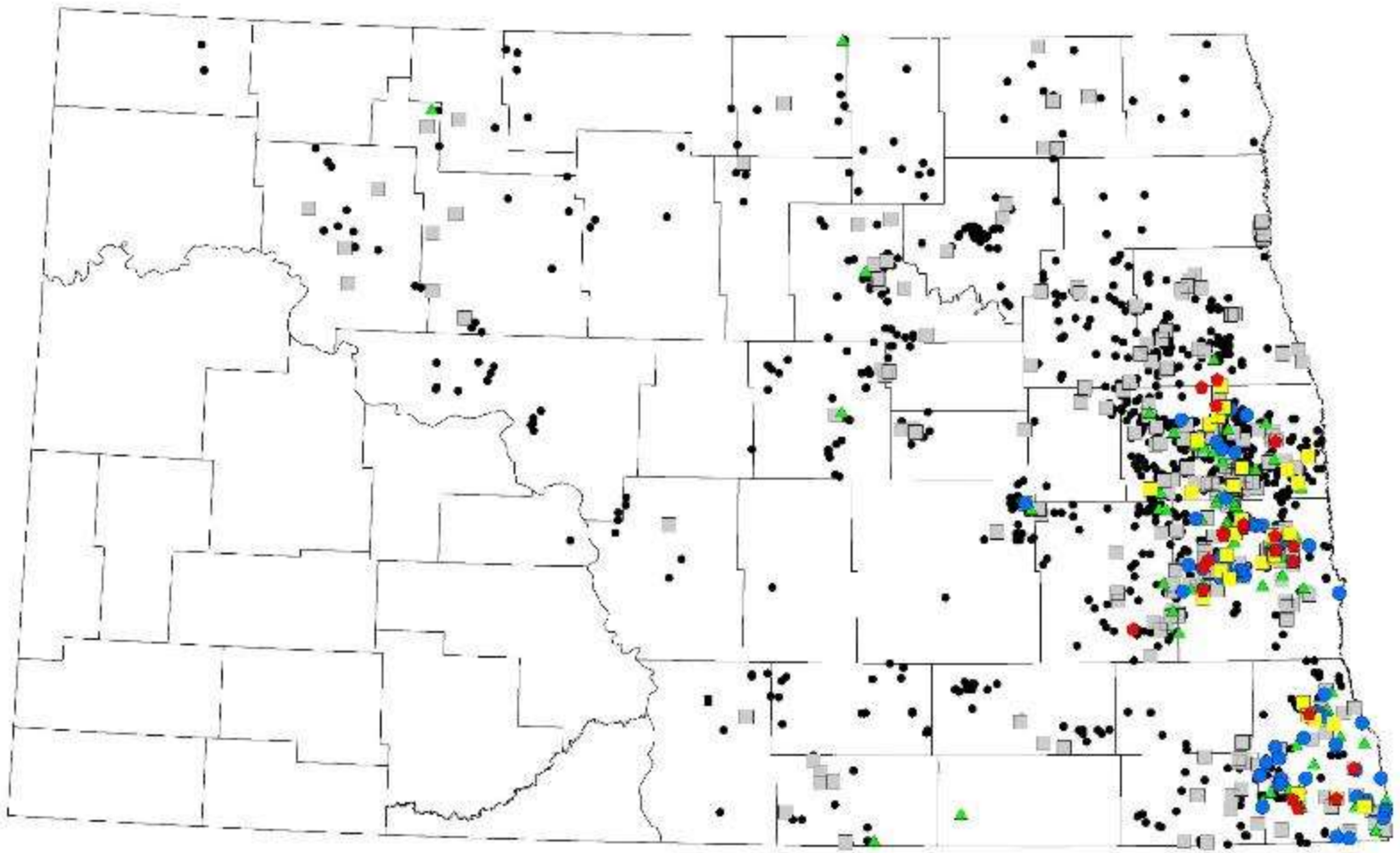


Eggs/100cc

0 12.5 25 50 Miles

0 | 50 - 200 | 201 - 2000 | 2001 - 10000 | 10001 - 20000 | 20000 +

SCN Survey 2013-2015

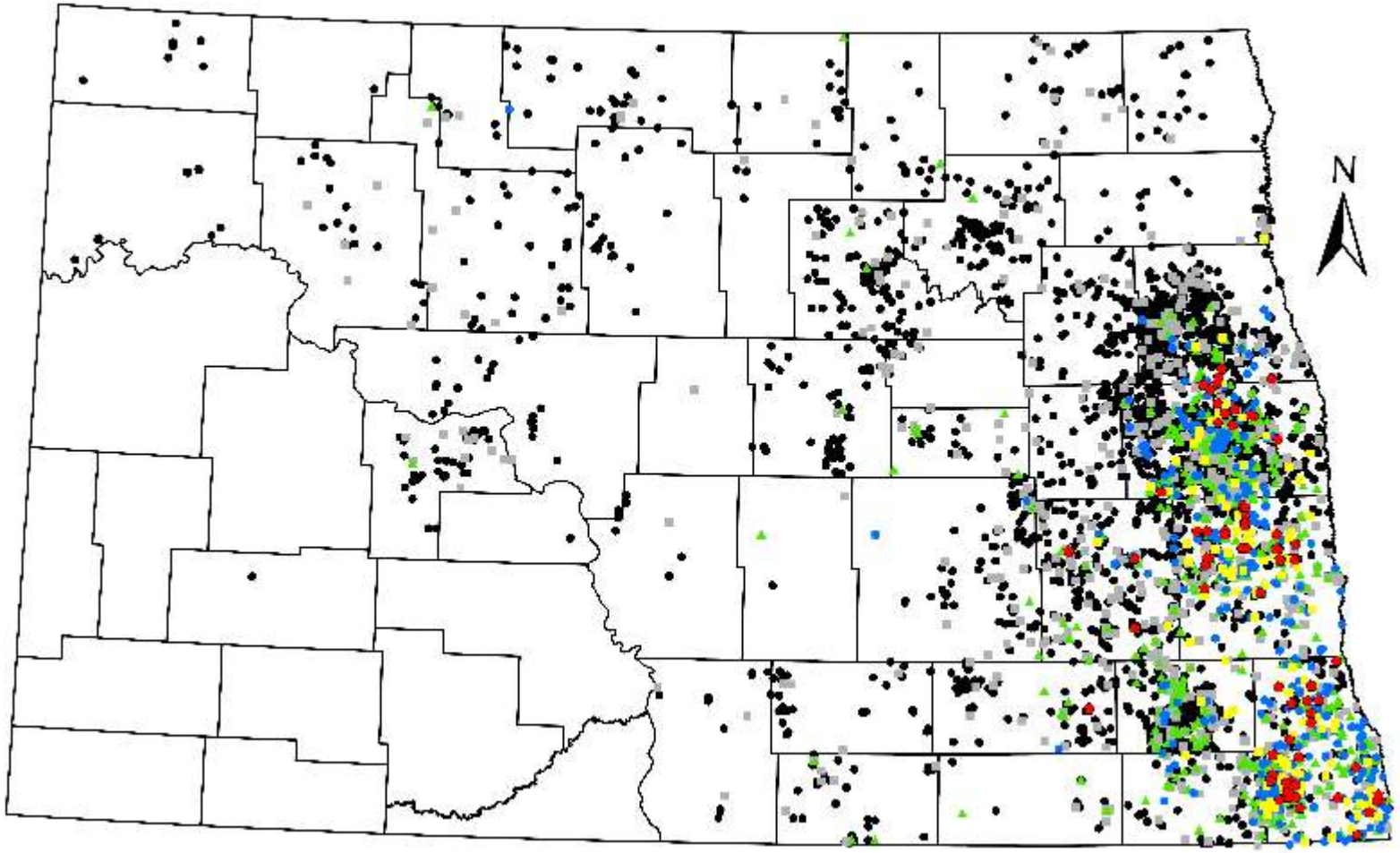


Eggs/100cc

0 12.5 25 50 Miles

0 | 50 - 200 | 201 - 2000 | 2001 - 10000 | 10001 - 20000 | 20000 +

SCN Survey 2013-2023



EFFECT OF SCN ON GROWTH OF DRY BEAN (Courtesy Berlin Nelson)

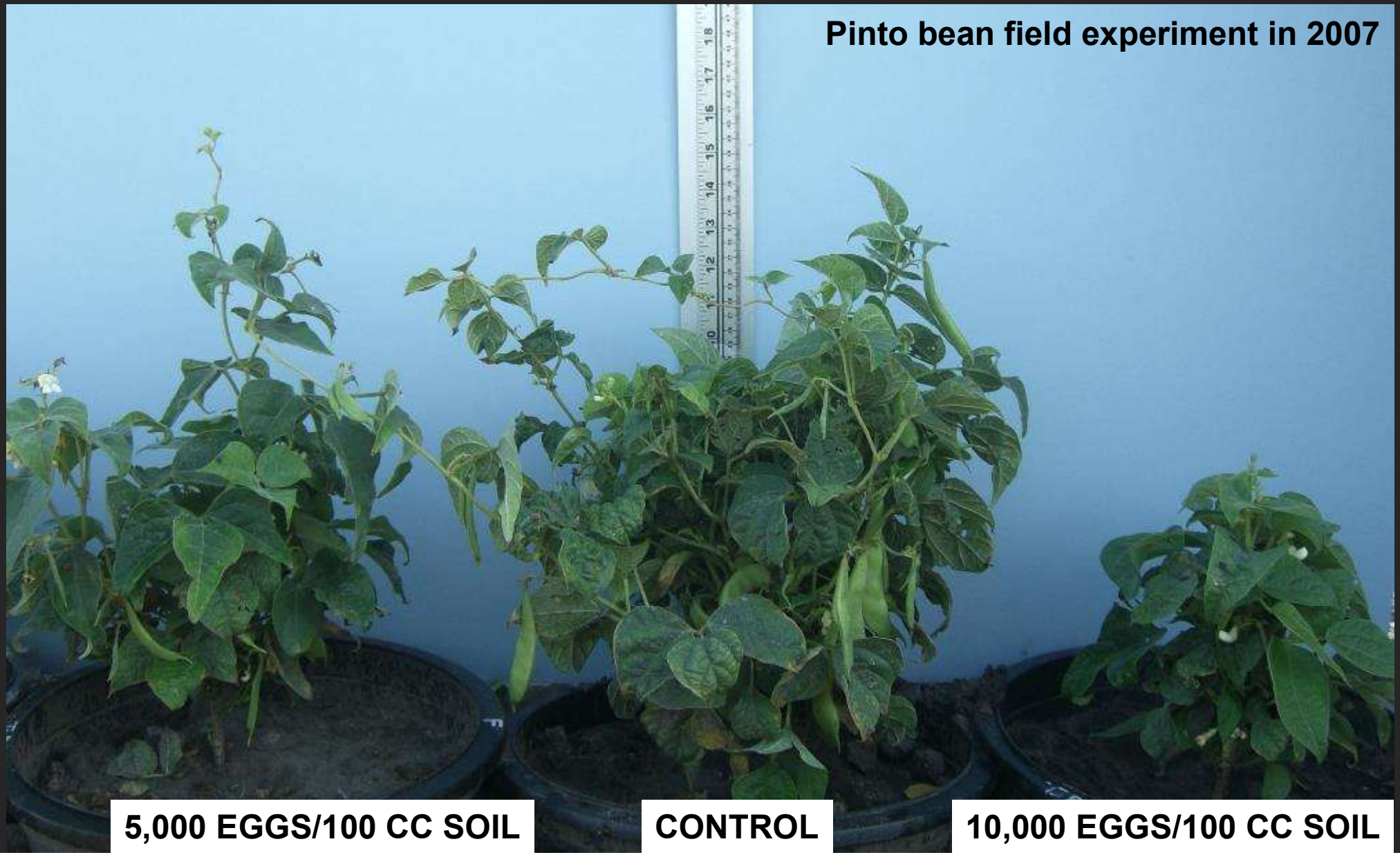



Photo: Sam Markell

SCN Management

Soil Sampling!

Maintain Control of Egg Levels

- **Resistance**
- **Crop Rotation**
- **Seed Treatments**

What's your number?

Take the test. Beat the pest.

The **SCN** Coalition™

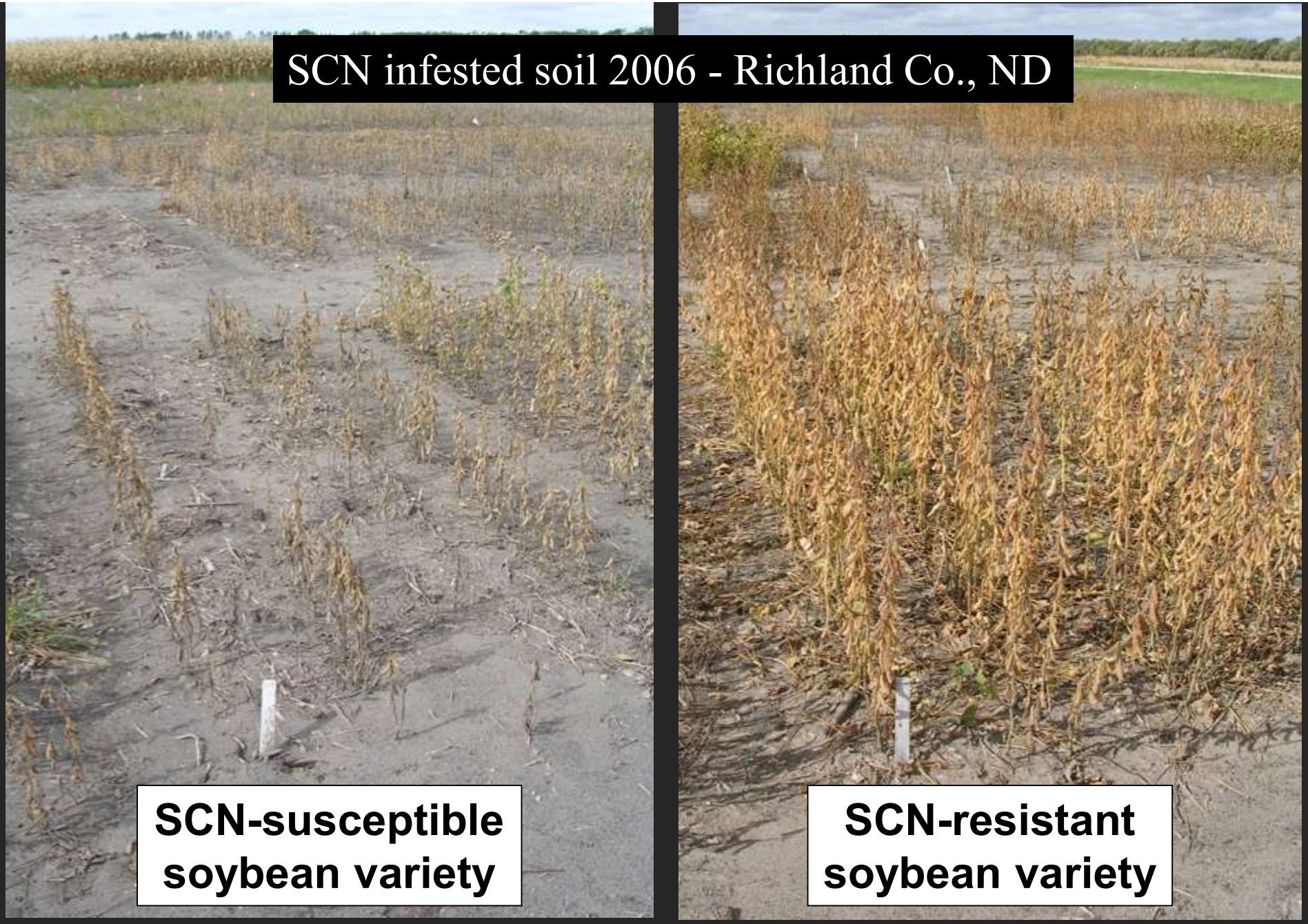
Funded by the soybean checkoff

SCN Management

Soil Sampling!

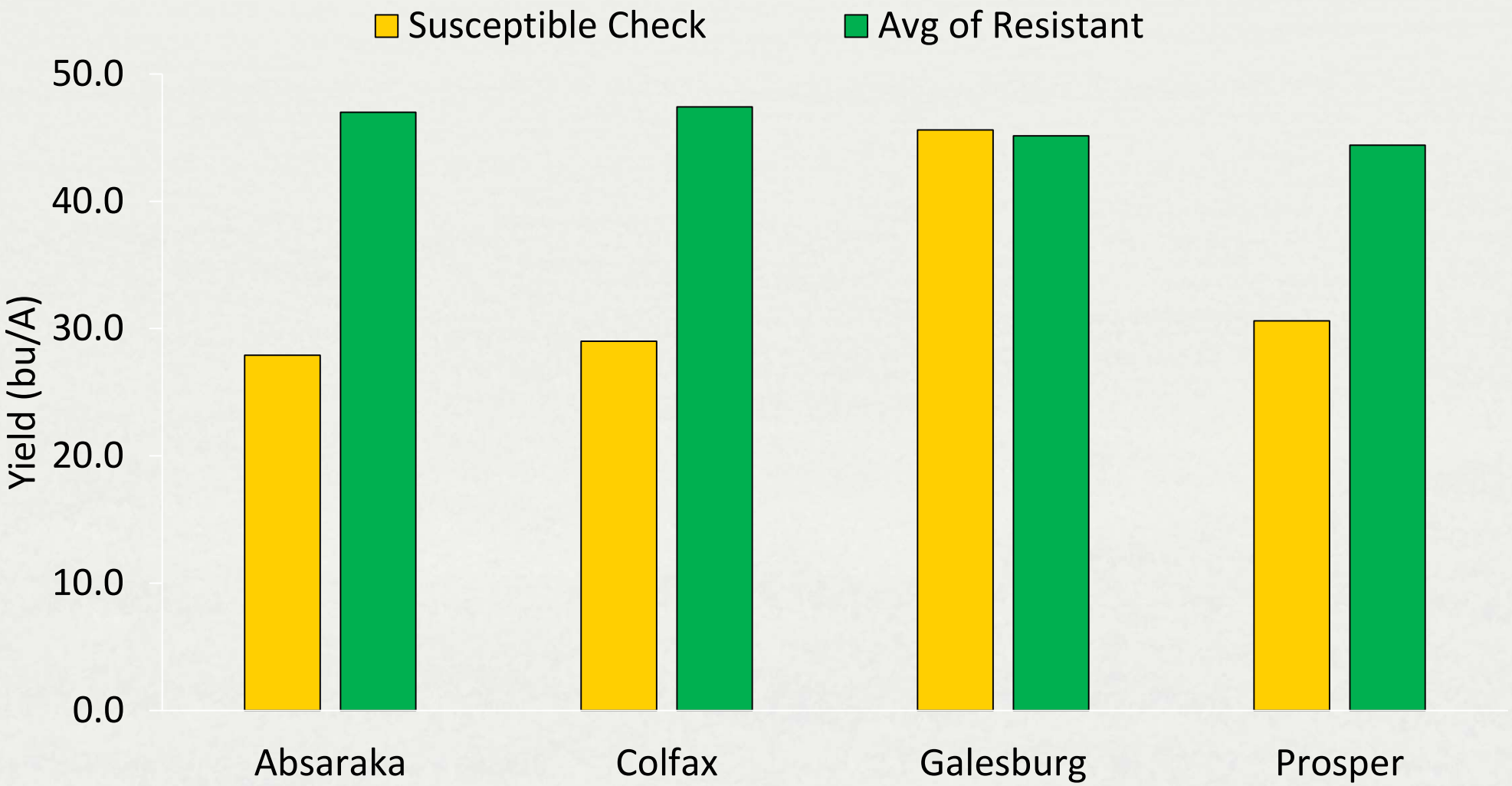
Maintain Control of Egg Levels

- **Resistance**
  - **Resistance Pays Twice**
    - **Protects Yield**
    - **Keeps Egg Levels Low**
- Crop Rotation
- Seed Treatments



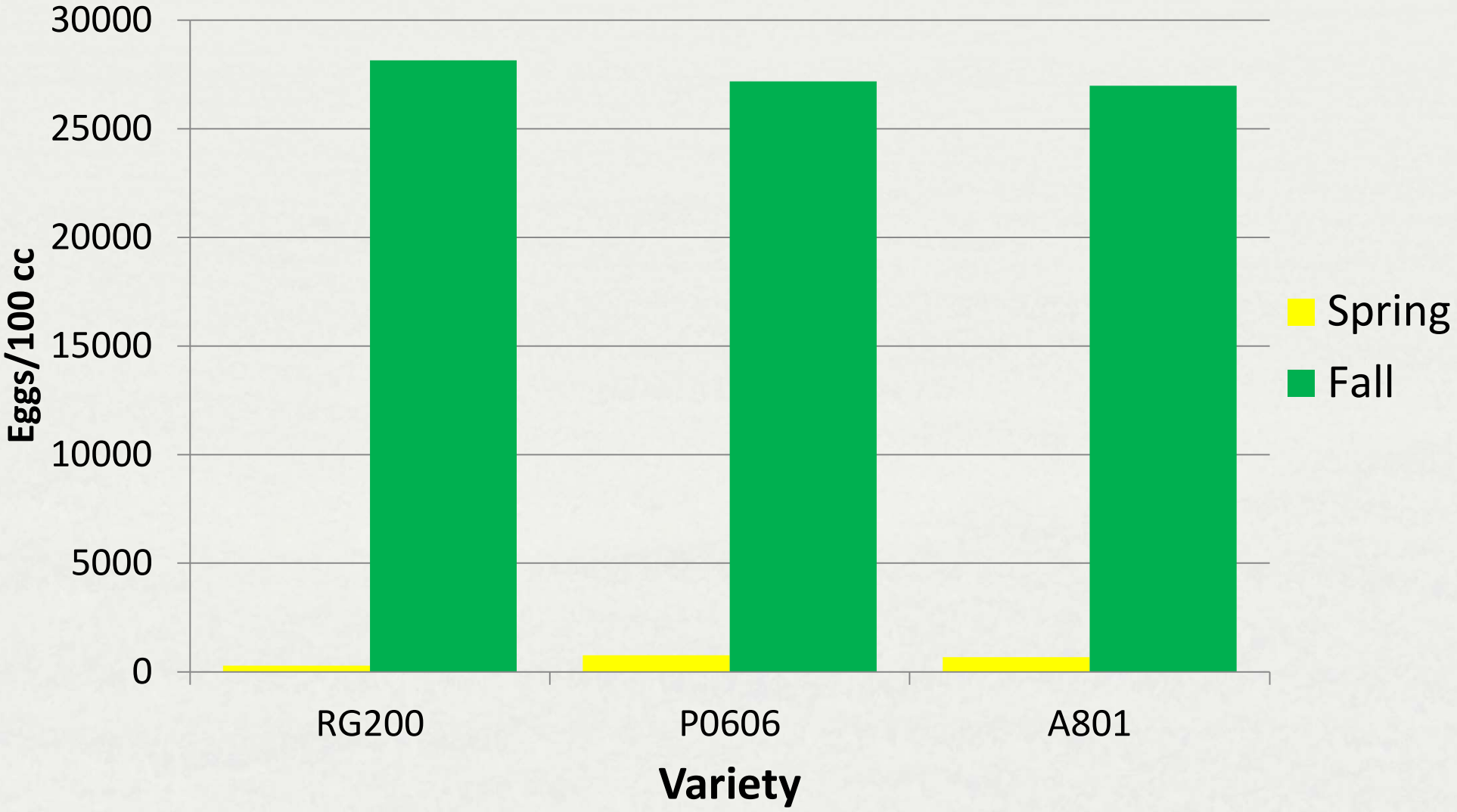
Source: B.D. Nelson, North Dakota State University

2017 SCN Yield Trial



Adapted from Te

How Fast Can SCN Increase?



Adapted from Te

That's why the SCN Coalition recommends that you work with your advisors to develop a plan to manage SCN:

1. Test your fields to know your numbers

2. Rotate resistant varieties

3. Rotate to non-host crops

4. Consider using a nematode-protectant seed treatment

VIEW ADDITIONAL RESOURCES

THE TEST. Know your numbers.

g soybean cyst nematode (SCN) involves more than just planting an SCN-resistant
You need to know your numbers. Here's why:

early all SCN-resistant varieties have the same source of resistance: PI 88788.
N Populations are adapting and reproducing on PI 88788 — they're becoming
sistant to the resistance.
SCN reproduction increases, yield decreases.

TAR SPOT OF CORN

Photos of tar spot in MN by D. Malvick

Corn Tar Spot: Basics

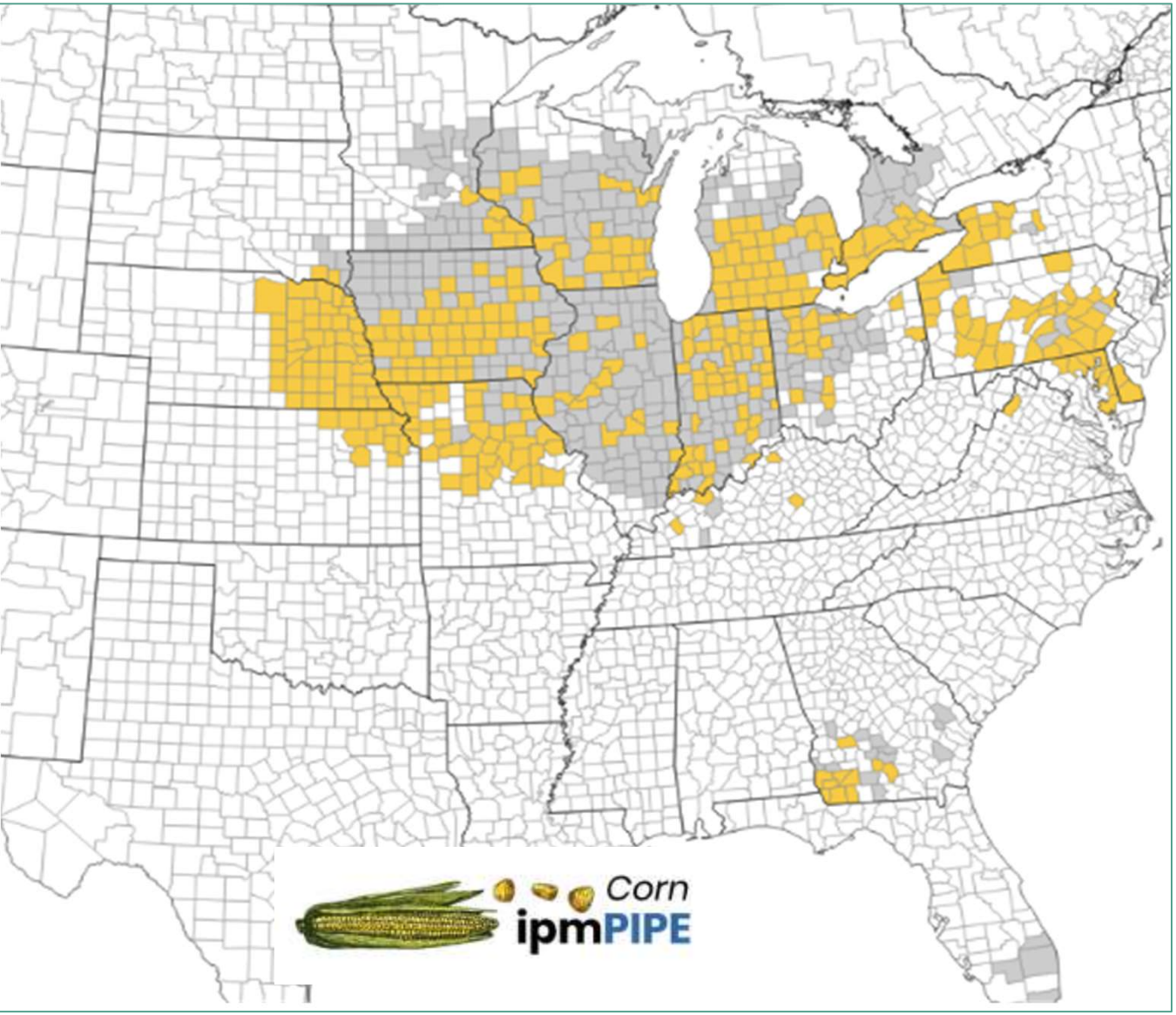
- Caused by the fungus *Phyllachora maydis*

Produces small, raised black spots on leaves and husks

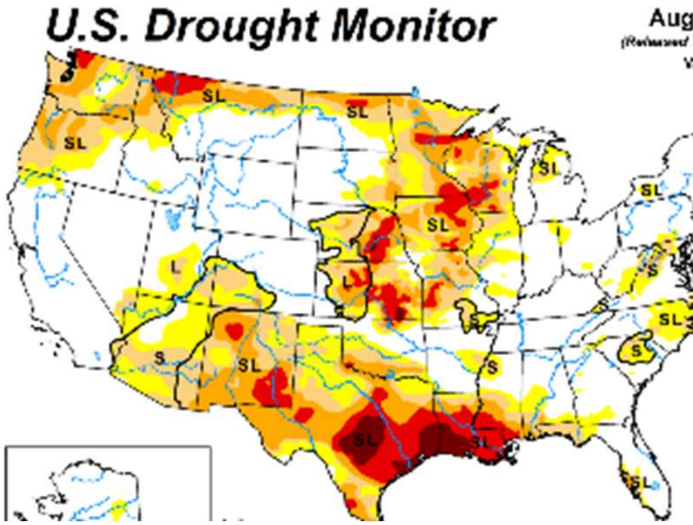
Tar spot is spreading and causing significant yield loss

- Favored by moderate temperatures

Corn Tar Spot Distribution Map - October 2023

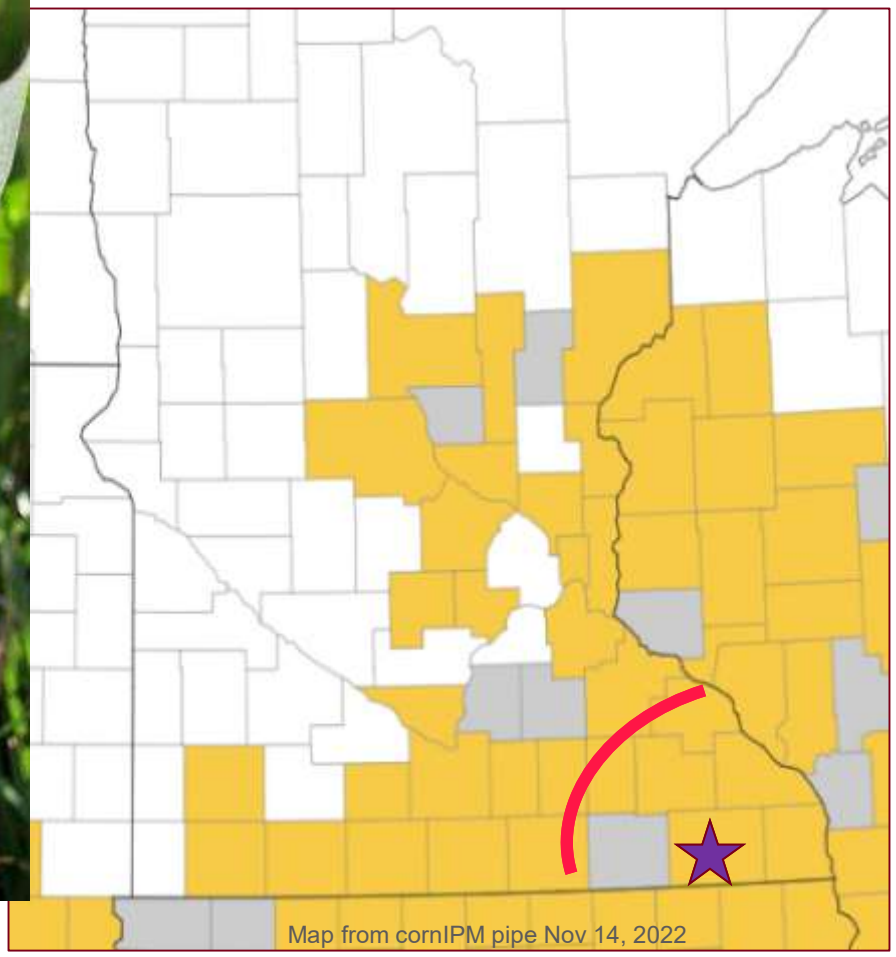


Note: gray counties show where tar spot has
found, and the gold counties show the more
distribution of where tar spot was detected ir



rn Tar Spot Has Been Spreading in Minnes

Has been at very low levels outside of SE MN



ich conditions favor tar spot in the U.S

y Risk factors

derate temperature (@60-74˚F)

erage RH >70% and <90%

~~erage of 7h/night of leaf wetness~~

~~nthly rainfall total > @6 inches~~

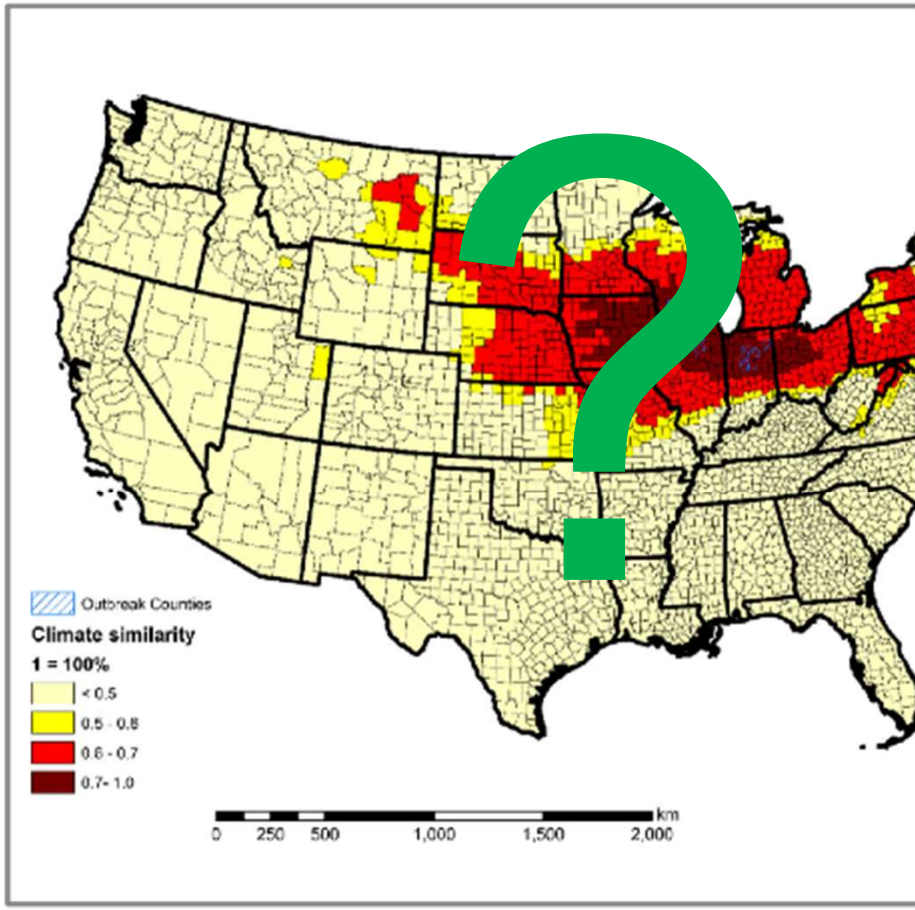


Fig. 4 Maize-producing counties vulnerable to tar spot complex (TSC) calculated based indices using historic climatic data from the counties where TSC has been detected. Source:

CIMMYT - International Maize and Wheat Improvement Center

Figure From Mottaleb et al., 2018

Managing Tar Spot

oid the most susceptible hybrids

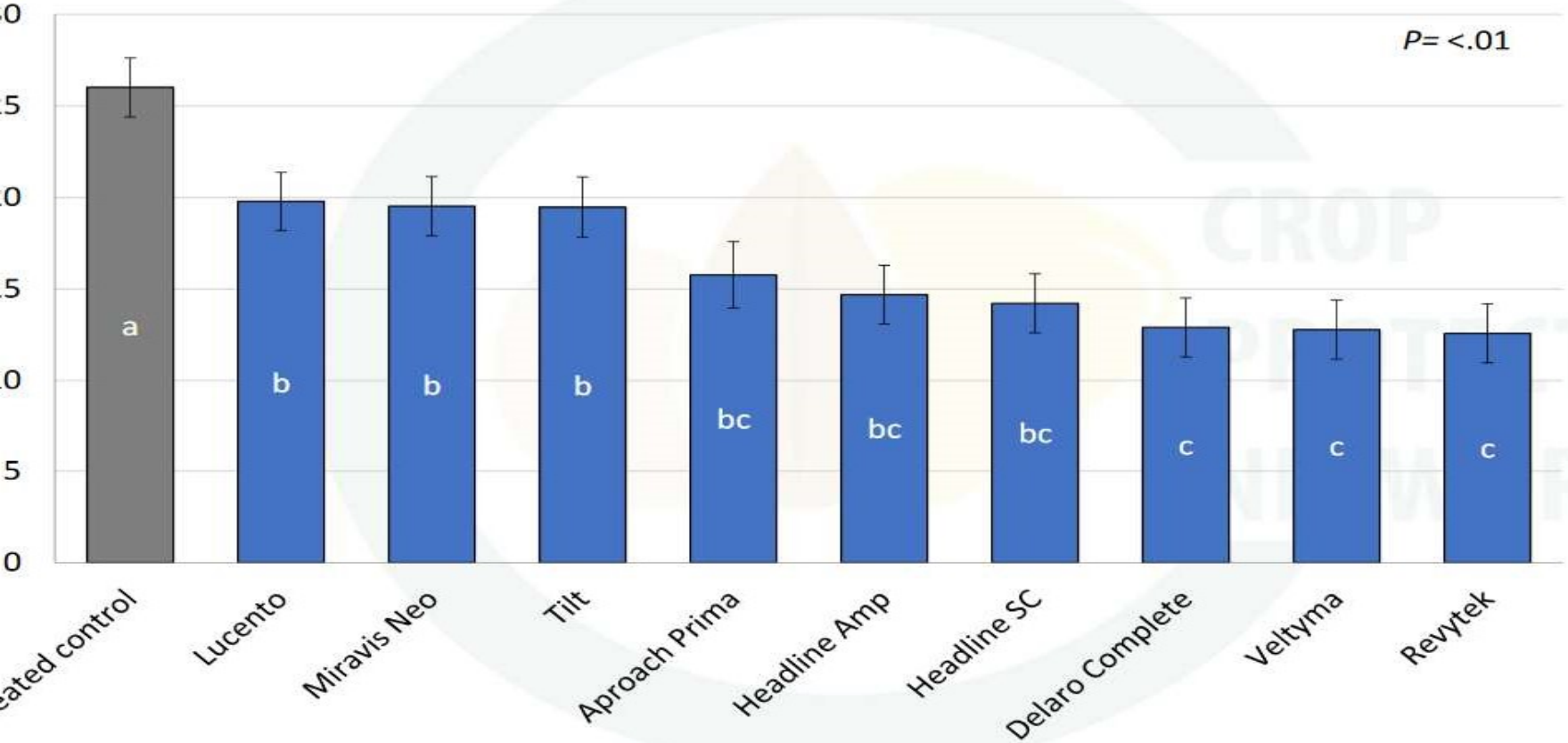
out fields starting mid-July to assess risk and distrib

ngicides can be effective & profitable when >5% seve

Application needed when epidemic starts

Timing VT- R3

form Fungicide Trial on Tar Spot – Disease Severity 2021



2021 trials conduct
Illinois, Indiana, Mi
Wisconsin, and On
(5 environments)

severity was rated by visually assessing the percentage of the symptomatic leaf area on the ear leaf at the dent growth stage (R5).
e least squares means. Values with different letters are significantly different based on least square means test (α=0.05).

enko, Ames, Chilvers, Smith, and Tenuta (2021). Tar spot uniform fungicide trails 2021.

Fungicide Efficacy for Corn Leaf Diseases

Fungicide Efficacy for Control of Corn Diseases Table (05/2023)

	Active ingredient (%)	Product/Trade name	Rate/A (fl oz)	Anthracnose leaf blight	Common rust	Eyespot	Gray leaf spot	Northern corn leaf blight	Southern rust	Tar spot[1]	Harvest restriction[2]
11	Azoxystrobin 22.9%	Quadris 2.08 SC, multiple generics	6.0 – 15.5	VG	E	VG	E	G	VG	NL	7 days
11	Pyraclostrobin 23.6%	Headline 2.09 EC/SC	6.0 – 12.0	VG	E	E	E	VG	VG	NL	7 days
11	Picoxystrobin 22.5%	Aproach 2.08 SC	3.0 – 12.0	VG	VG-E	VG	F-VG	VG	G	G[3]	7 days
3	Flutriafol 20.9% Flutriafol 26.4%	Xyway LFR 1.92 SC Xyway 3D 2.5 SC	LFR: 5.8 – 15.2 3D: 5.8 – 11.8	NL	U	NL	G	VG	NL	NL	N/A
3	Propiconazole 41.8%	Tilt 3.6 EC, multiple generics	2.0 – 4.0	NL	VG	E	G	G	F	NL	30 days
3	Prothioconazole 41.0%	Proline 480 SC	5.7	U	VG	E	U	VG	G	NL	14 days
3	Tebuconazole 38.7%	Folicur 3.6 F, multiple generics	4.0 – 6.0	NL	U	NL	U	VG	F	NL	36 days
3	Tetraconazole 20.5%	Domark 230 ME	4.0 – 6.0	U	U	U	E	VG	G	G[3]	R3 (milk)
11 3	Azoxystrobin 13.5% Propiconazole 11.7%	Quilt Xcel 2.2 SE, multiple generics	10.5 – 14.0	VG	VG-E	VG-E	E	VG	VG	NL	30 days
7 11 3	Benzovindiflupyr 2.9% Azoxystrobin 10.5% Propiconazole 11.9%	Trivapro 2.21 SE	13.7	U	U	U	E	VG	E	G-VG	30 days
3 11	Cyproconazole 7.17% Picoxystrobin 17.94%	Aproach Prima 2.34 SC	3.4 – 6.8	U	U	U	E	VG	G	G-VG[3]	30 days
3 11	Flutriafol 19.3% Fluoxastrobin 14.84%	Fortix 3.22 SC Preemptor 3.22 SC	4.0 – 6.0	U	U	U	E	VG	VG	G-VG[3]	30 days
3 7	Flutriafol 26.47% Bixafen 15.55%	Lucento	3.0 – 5.5	U	U	U	VG-E	VG	VG	G[3]	30 days
3 11	Flutriafol 18.63% Azoxystrobin 25.30%	TopGuard EQ	5.0 – 7.0	U	F	U	VG	G-VG	G-VG	G-VG[3]	45 days
3 11	Mefentrifluconazole 17.56% Pyraclostrobin 17.56%	Veltyma	7.0 – 10.0	U	U	U	VG-E	VG-E	VG	VG	21 days
3 7 11	Mefentrifluconazole 11.61% Fluxapyroxad 7.74% Pyraclostrobin 15.49%	Revytek	8.0 – 15.0	U	U	U	VG-E	VG-E	VG	VG	21 days
3 11	Prothioconazole 16.0% Trifloxystrobin 13.7%	Delaro325 SC	8.0 – 12.0	VG	E	VG	E	VG	G-VG	G-VG	14 days
3 7 11	Prothioconazole 14.9% Fluopyram 10.9% Trifloxystrobin 13.1%	Delaro Complete 3.83 SC	4.0 – 12.0	U	U	U	E	VG	G-VG	VG	14 days
7 11 3	Pydiflumetofen 7.0% Azoxystrobin 9.3% Propiconazole 11.6%	Miravis Neo 2.5 SE	13.7	U	U	U	E	VG-E	VG	G-VG	30 days
11 7	Pyraclostrobin 28.58% Fluxapyroxad 14.33%	Priaxor 4.17 SC	4.0 – 8.0	U	VG	U	VG	VG-E	VG	NL	21 days
11 3	Pyraclostrobin 13.64% Metconazole 5.14%	Headline AMP 1.68 SC	10.0 – 14.4	U	E	E	E	VG	G	G-VG	20 days
11 3	Trifloxystrobin 32.3% Prothioconazole 10.8%	Stratego YLD 4.18 SC	2.0 – 5.0	VG	E	VG	E	VG	G	NL	14 days
3 11	Tetraconazole 7.48% Azoxystrobin 9.35%	Affiance 1.5 SC	10.0 – 14.0	U	G-VG	U	G-VG	G-VG	G	G[3]	7 days

University of Minnesota Extension

Verticillium Stripe of Canola

Verticillium Stripe of Canola

- First identified in Manitoba in 2014
- Common throughout Europe
- Was identified in Northern North Dakota but at low incidence (< 5%)
- Commonly misidentified as Black Leg and Sclerotinia Stem Rot

Photo: Canola Council of

Verticillium Stripe - Identification

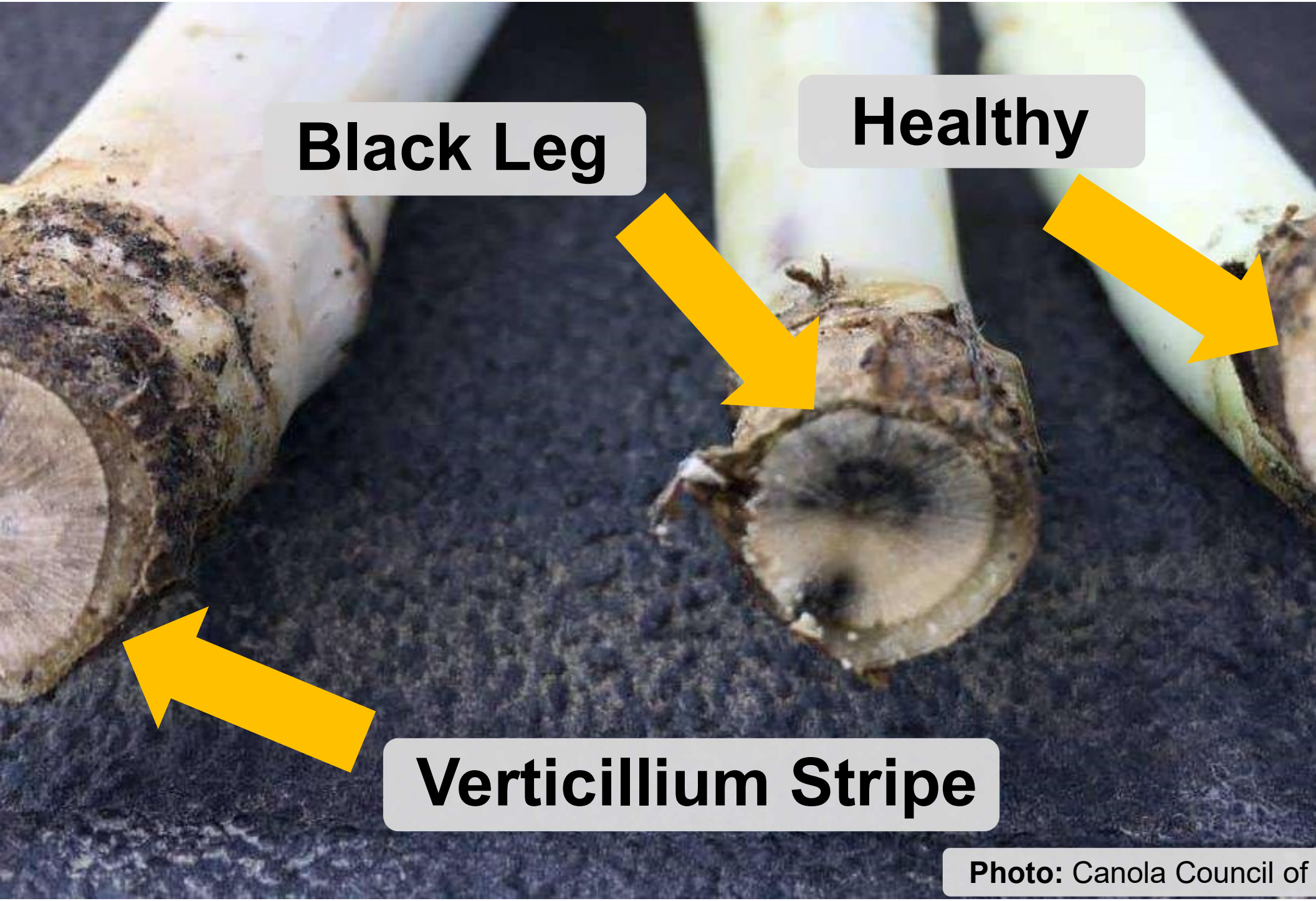
Photo: Canola Council of

Verticillium ntification

Photo: Canola Council of

Verticillium Stripe - Identification

Photo: Canola Council of


Black Leg
Healthy
Verticillium Stripe
Photo: Canola Council of

Black Leg

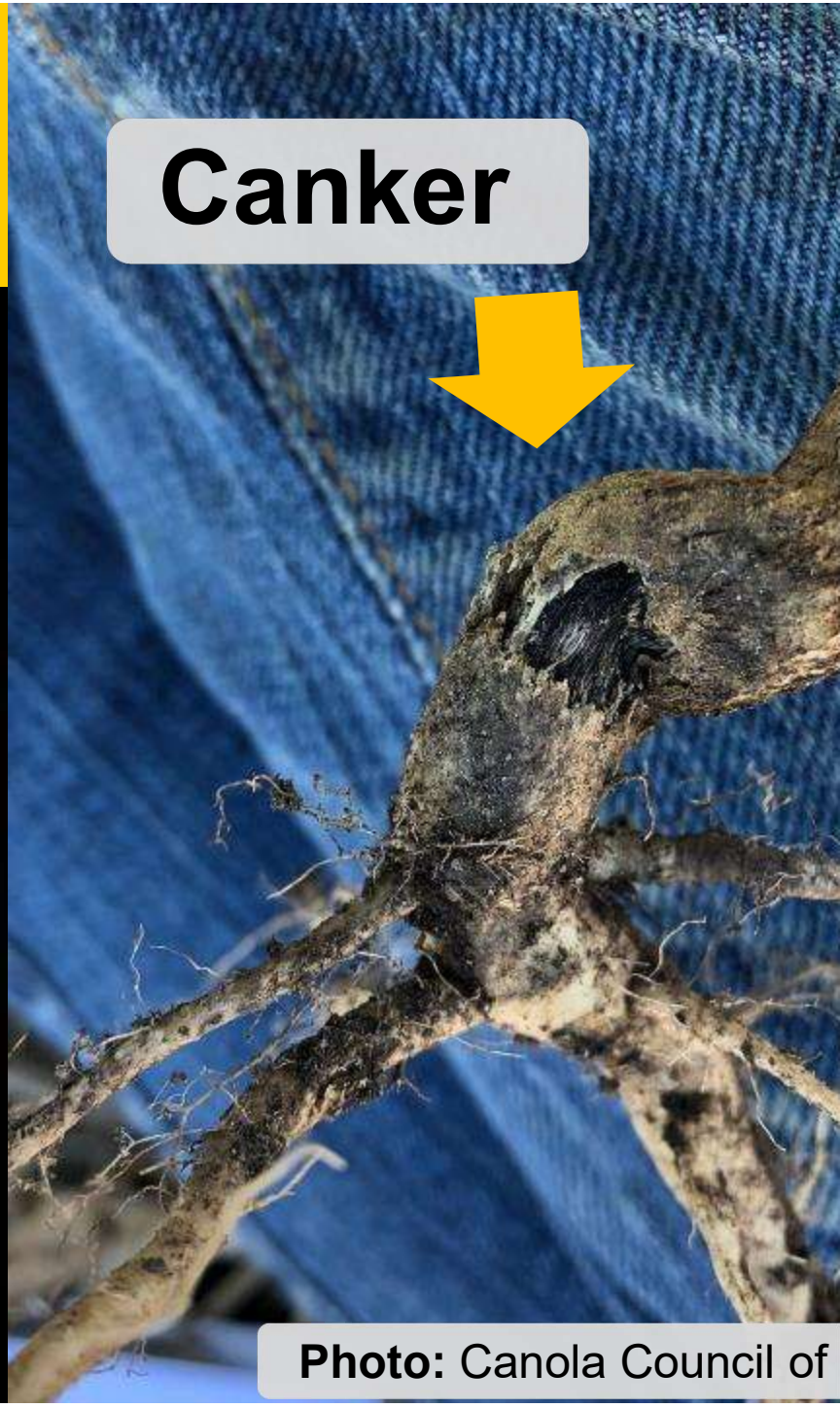


Photo: Canola Council of

Sclerotinia Stem Rot

Photo: Canola Council of

Verticillium Stripe - Management

No fungicides are available for control

No resistance is available

Rotating out of Canola for more than 3 years, but this may not be enough

Summary: New and Emerging diseases

- Soybean brown stem rot
- Soybean sudden death syndrome
- Soybean charcoal rot
- Frogeye Leaf Spot
- Soybean Cyst Nematode
- Corn tar spot
- Canola – verticillium stripe

Questions or Comments

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Minnesota Soybean Research and Promotion Council

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