An Overview of Challenges and Changes in Potato Production and Potato Diseases in the United States and Canada

Amy Charkowski
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University of Wisconsin-Madison

eapr
EUROPEAN ASSOCIATION FOR POTATO RESEARCH

THE UNIVERSITY of WISCONSIN MADISON

COLLEGE OF AGRICULTURAL & LIFE SCIENCES

Plant Pathology

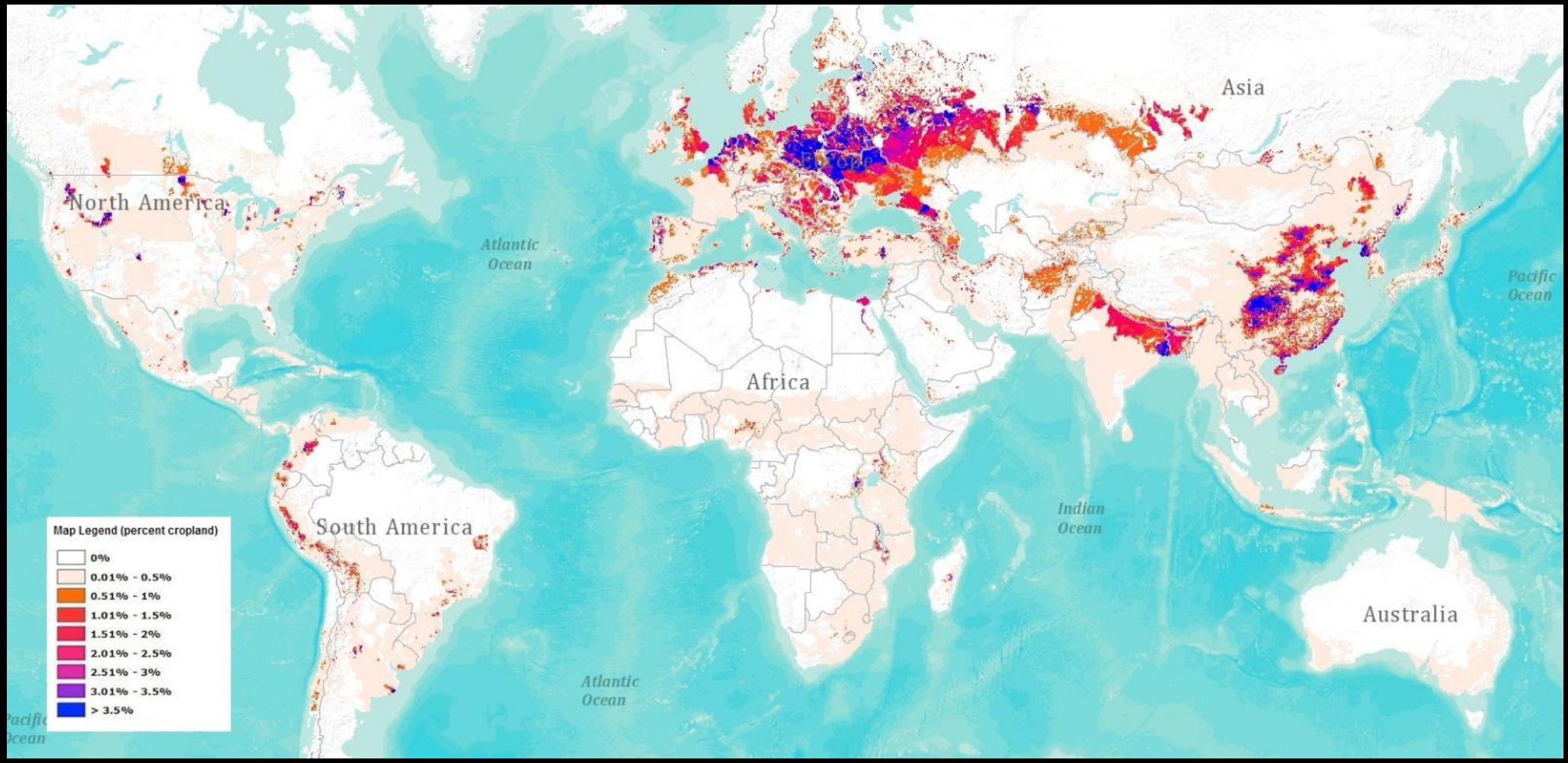
at the University of Wisconsin - Madison

Wisconsin Seed Potato Certification Program

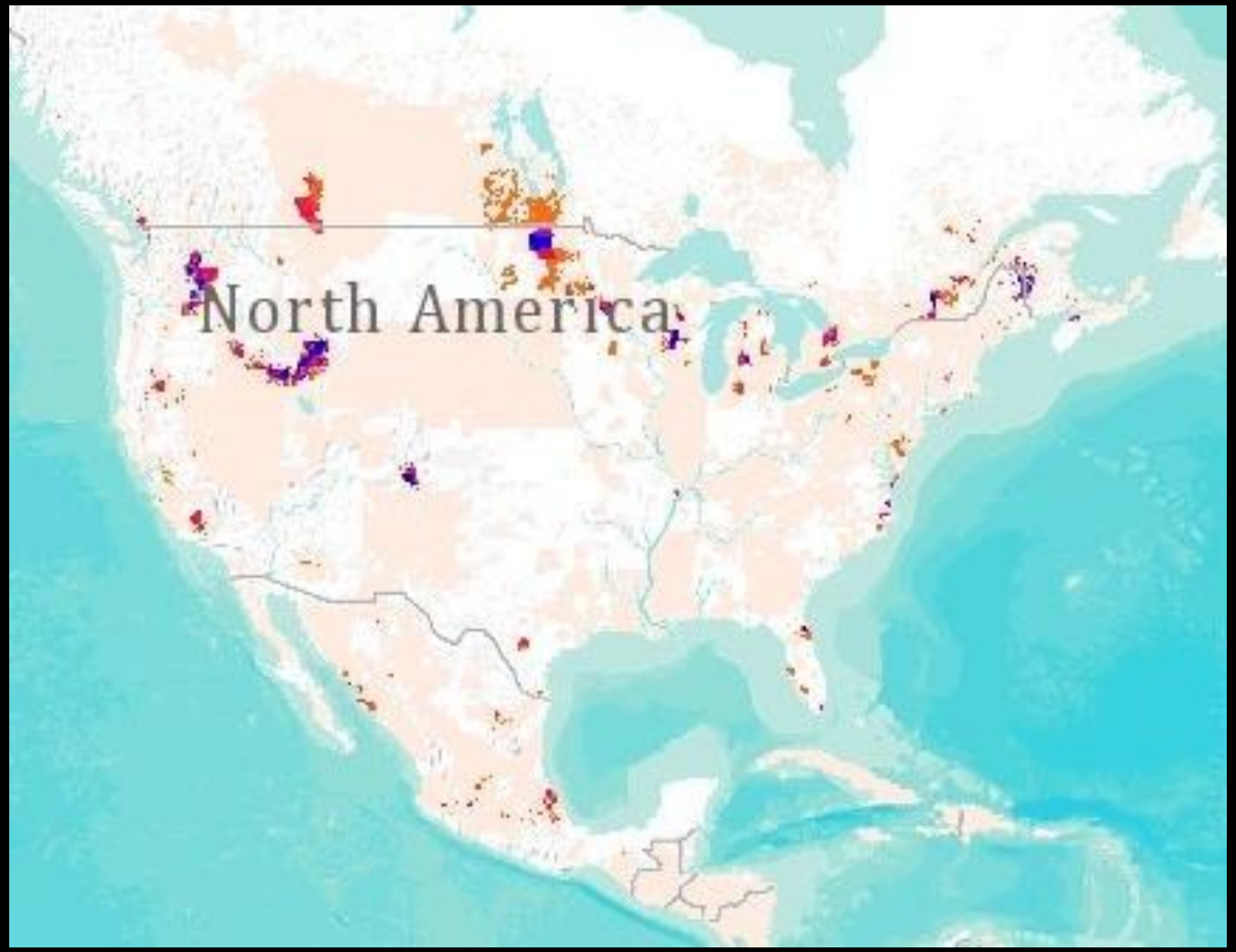
~5% of US potatoes originate at the University of Wisconsin seed potato farm

Wisconsin
Certified
Seed Potatoes

World Potato Production



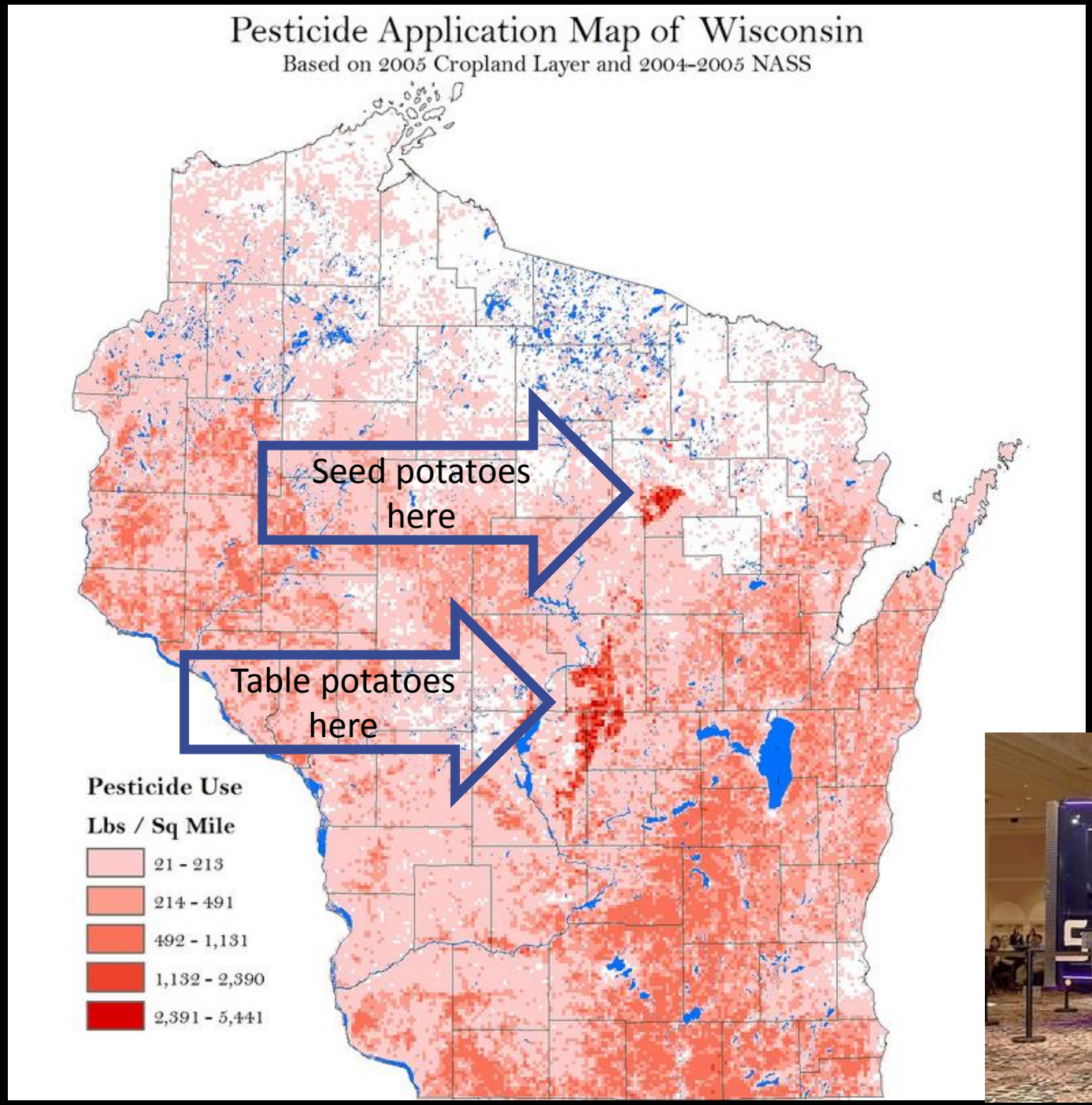
http://www.potatopro.com/world/potato-statistics



Processing and fresh potatoes are produced year round in North America.

Majority of seed potatoes produced across Northern US and Southern Canada.

Seed production also occurs in the San Luis Valley of Colorado


Pesticide Application Map of Wisconsin
Based on 2005 Cropland Layer and 2004-2005 NASS
Seed potatoes here
Table potatoes here
Pesticide Use
Lbs / Sq Mile
21 - 213
214 - 491
492 - 1,131
1,132 - 2,390
2,391 - 5,441


WISCONSIN HEALTHY GROWN
RUSSET POTATOES


POTATOES RAISE THE BAR ON SCHOOL NUTRITION
POTATO POWER!
THE FARMERS' MARKET
PotatoesRaiseTheBar.com


GLOBALLY INSPIRED POTATO CUISINE

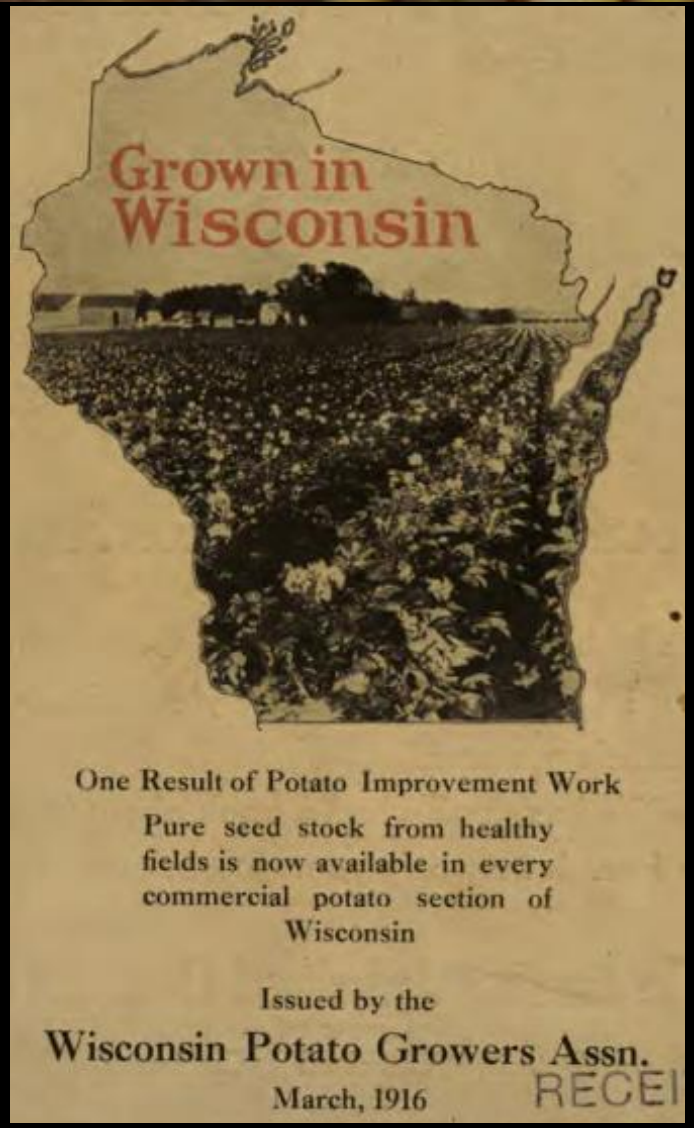
1912 Plant Quarantine Act and Potato Wart

THE PLANT QUARANTINE ACT, AUGUST 20, 1912, AS AMENDED MARCH 4, 1913, AND MARCH 4, 1917.

AN ACT To regulate the importation of nursery stock and other plants and plant products; to enable the Secretary of Agriculture to establish and maintain quarantine districts for plant diseases and insect pests; to permit and regulate the movement of fruits, plants, and vegetables therefrom, and for other purposes.

hearing any interested party may appear and be heard, either in person or by attorney: *Provided further*, That the quarantine provisions of this section, as applying to the white-pine blister rust, potato wart, and the Mediterranean fruit fly, shall become and be effective upon the passage of this act: *Provided further*, That hereafter any class of nursery stock or of any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products of which the importation may be forbidden from any country or locality under the provisions of section seven of the Plant Quarantine Act approved August twentieth, nineteen hundred and twelve (Thirty-seventh Statutes, page three hundred and fifteen), may be imported for experimental or scientific purposes by the Department of Agriculture upon such conditions and under such regulations as the said Secretary of Agriculture may prescribe.

1905-1913 Farmer-UW partnership led to Wisconsin seed potato program



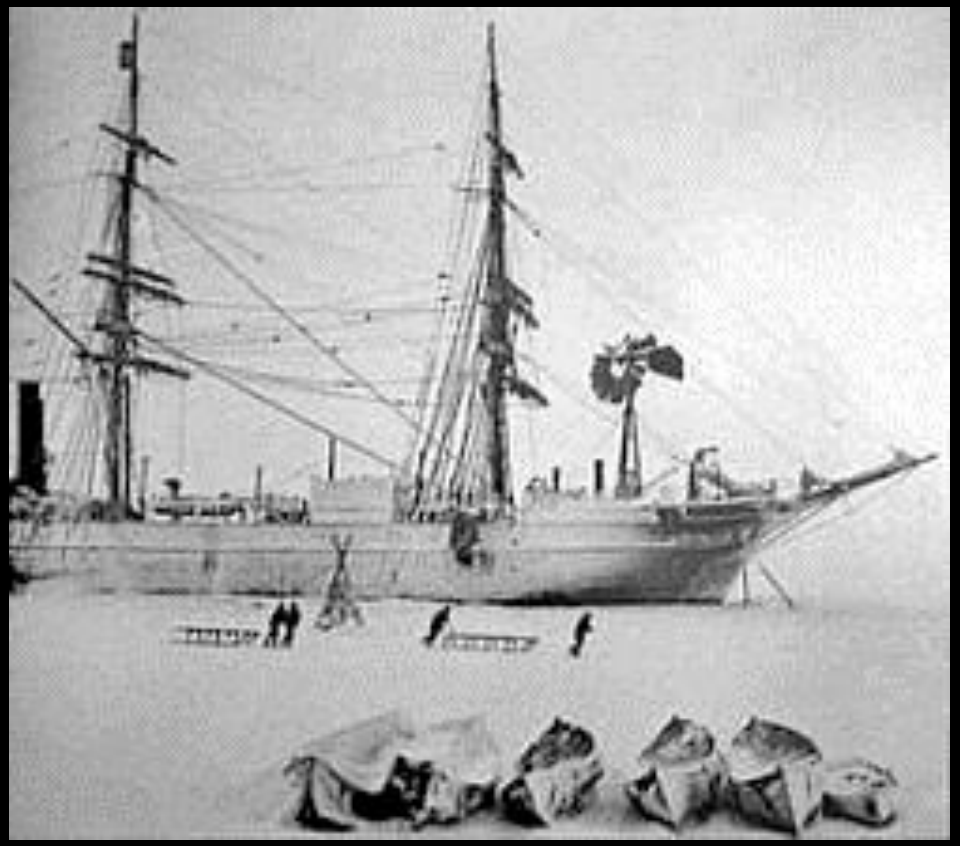
The two essentials are, A. Variety purity. B. Freedom from disease.

Wisconsin seed stock is apparently free from those dangers which menace the potato industry in many commercial centers.

This advantage must be maintained by a careful system of inspection in co-operation with this Association.

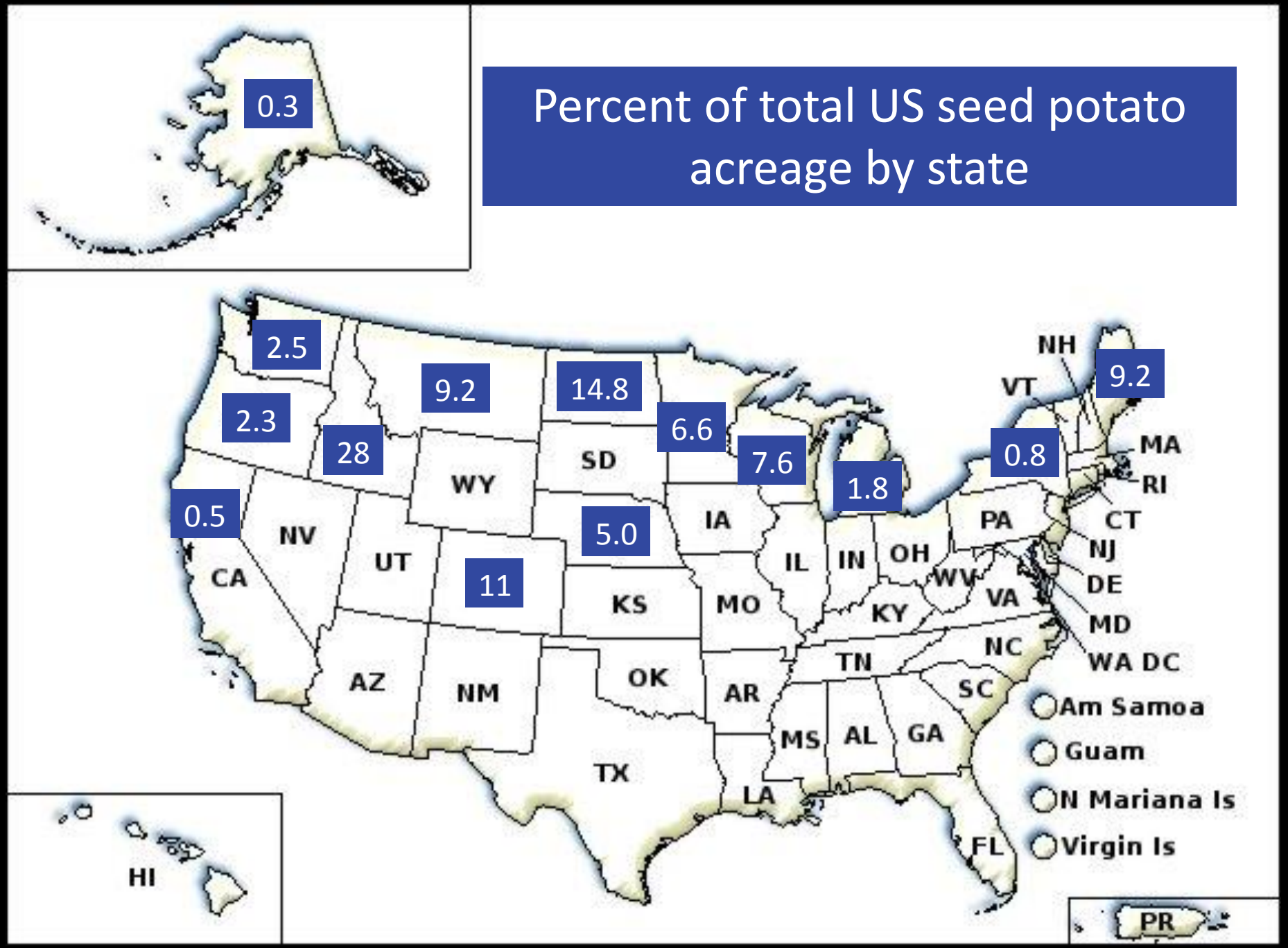
J. W. HICKS
President Wisconsin Potato Growers' Assn.

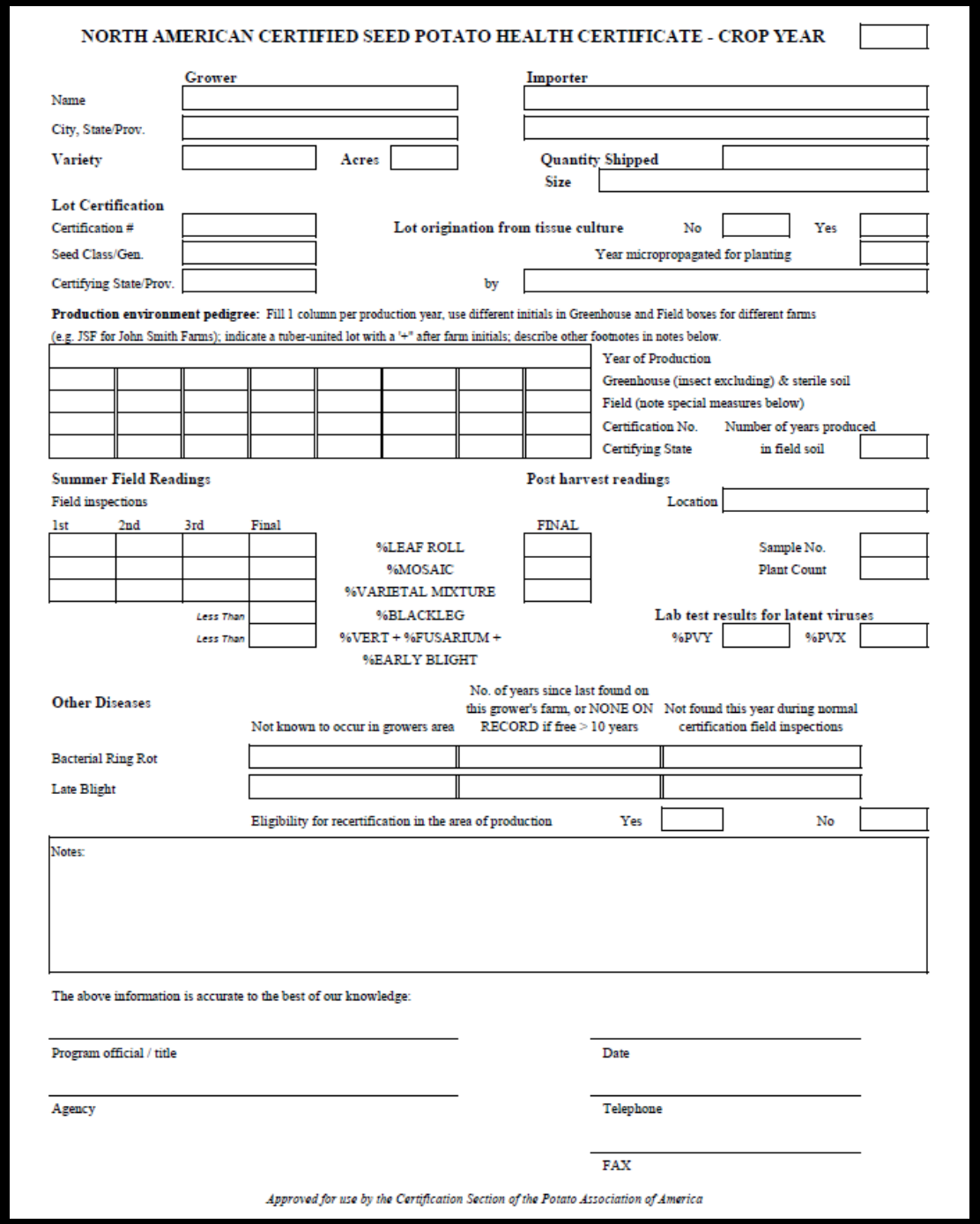
PROFESSOR J. G. MOORE
Wisconsin Experiment Station



Potatoes are propagated with stem cuttings

Percent of total US seed potato acreage by state





NORTH AMERICAN CERTIFIED SEED POTATO HEALTH CERTIFICATE - CROP YEAR

Grower

Name

City, State/Prov.

Variety

Acres

Importer

Quantity Shipped

Size

Lot Certification

Certification #

Seed Class/Gen.

Certifying State/Prov.

Lot origination from tissue culture No Yes

Year micropropagated for planting

by

Production environment pedigree: Fill 1 column per production year, use different initials in Greenhouse and Field boxes for different farms (e.g. JSF for John Smith Farms); indicate a tuber-united lot with a '+' after farm initials; describe other footnotes in notes below.

Year of Production

Greenhouse (insect excluding) & sterile soil

Field (note special measures below)

Certification No.

Certifying State

Number of years produced in field soil

Summer Field Readings

Field inspections

1st 2nd 3rd Final

Less Than

Less Than

%LEAF ROLL

%MOSAIC

%VARIETAL MIXTURE

%BLACKLEG

%VERT + %FUSARIUM + %EARLY BLIGHT

Post harvest readings

FINAL

Location

Sample No.

Plant Count

Lab test results for latent viruses

%PVY %PVX

Other Diseases

	Not known to occur in growers area	No. of years since last found on this grower's farm, or NONE ON RECORD if free > 10 years	Not found this year during normal certification field inspections
Bacterial Ring Rot			
Late Blight			

Eligibility for recertification in the area of production Yes No

Notes:

The above information is accurate to the best of our knowledge:

Program official / title

Date

Agency

Telephone

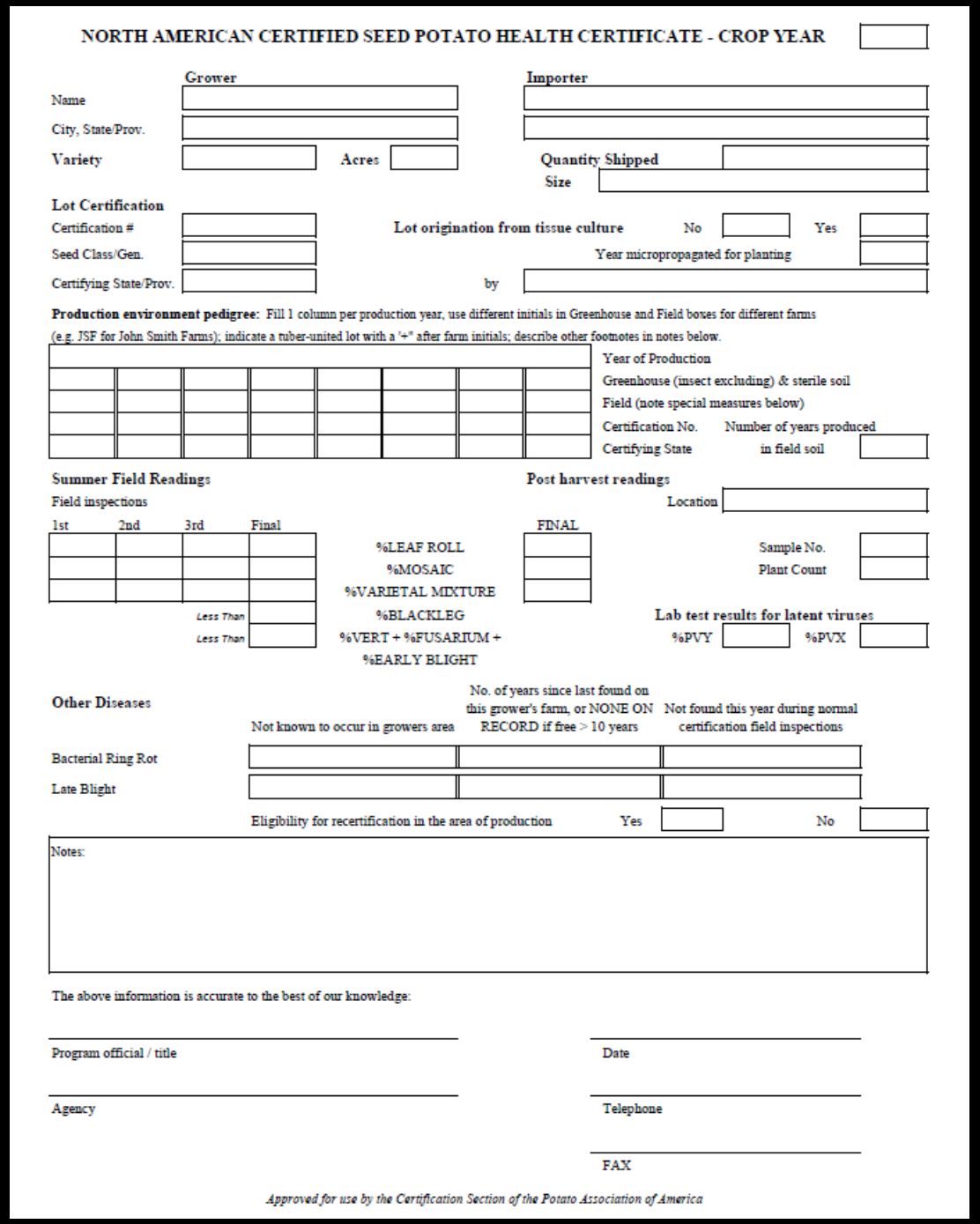
FAX

Approved for use by the Certification Section of the Potato Association of America

North American Certified Seed Potato Health Certificate

Seed potato certification provides a valuable and rare dataset that can be used for decisions on:

- Production
- Trade
- Regulations
- Research priorities



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Integrated Control of Potato Pathogens Through Seed Potato Certification and Provision of Clean Seed Potatoes

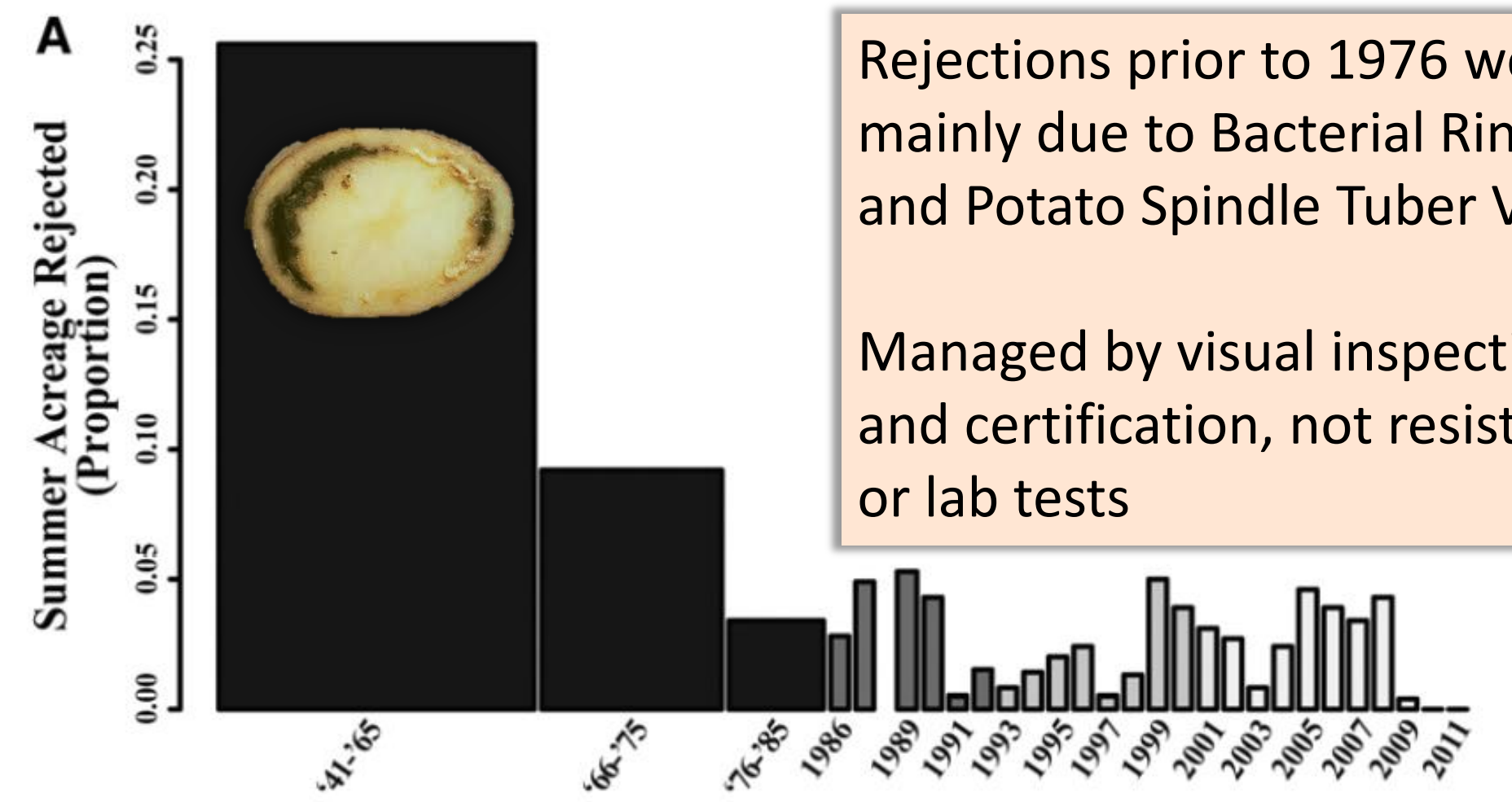
Kenneth E. Frost
Department of Plant Pathology, University of Wisconsin, Madison

Russell L. Groves
Department of Entomology, University of Wisconsin, Madison

Amy O. Charkowski
Department of Plant Pathology, University of Wisconsin, Madison

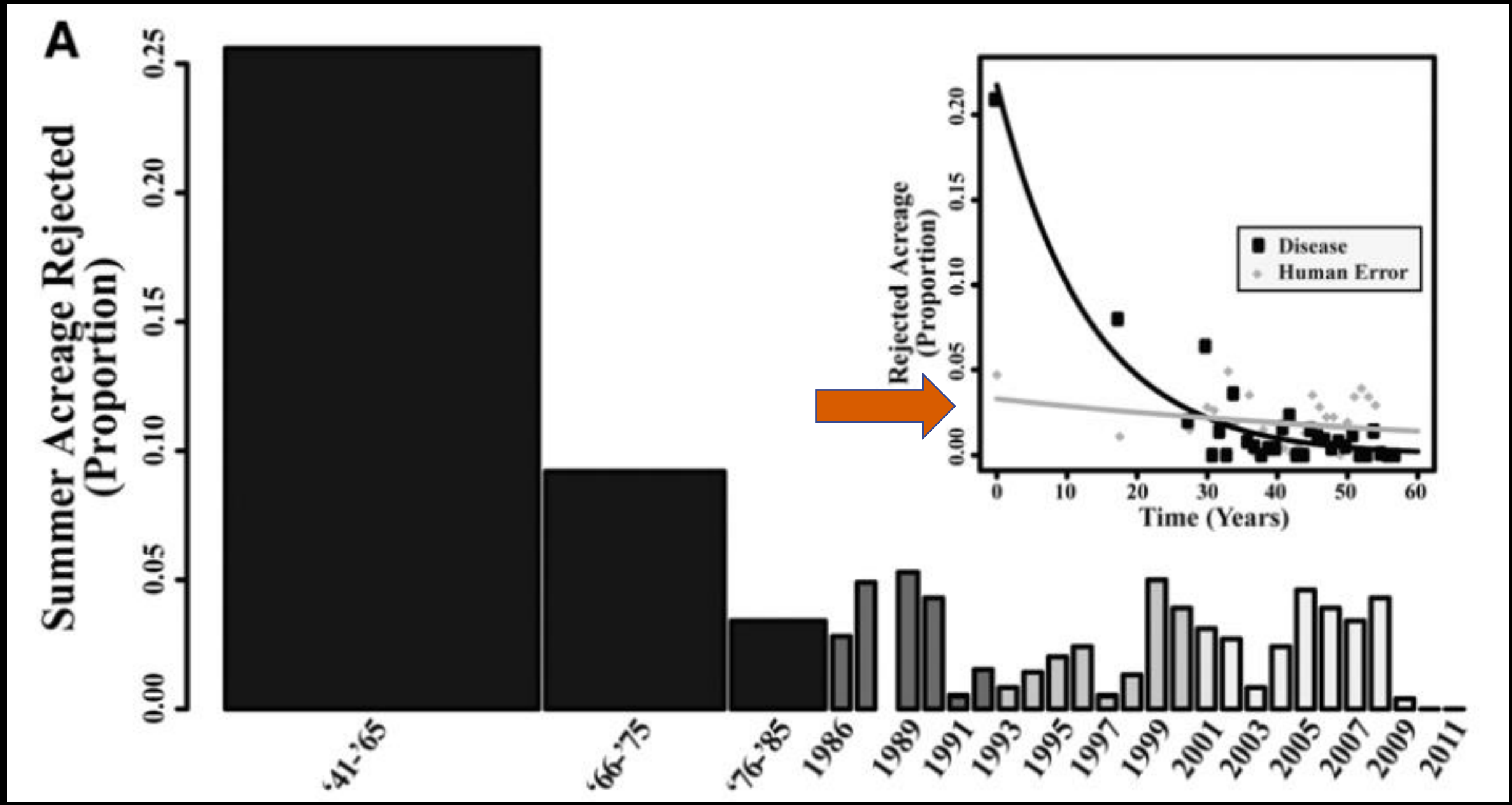
Plant Disease / Vol. 97 No. 10

Seed Certification & Disease Management

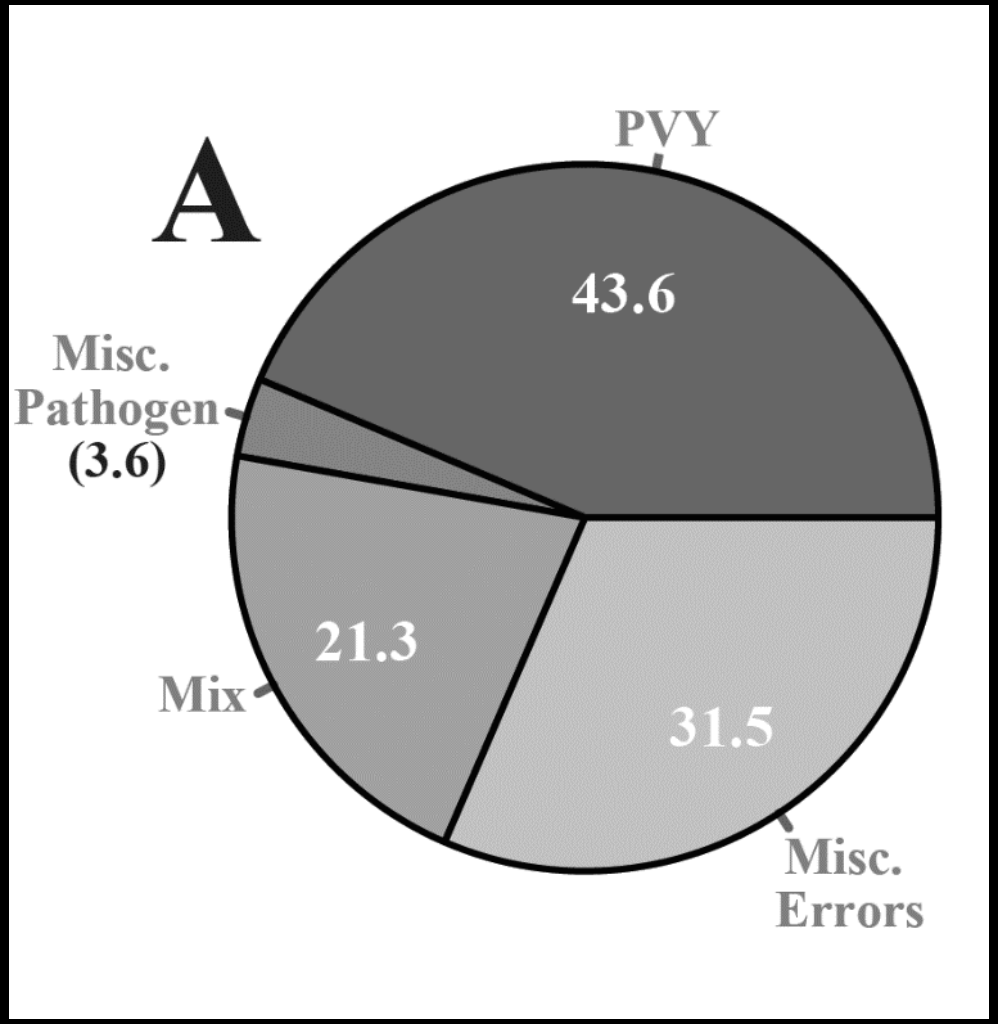


Rejections prior to 1976 were mainly due to Bacterial Ring Rot and Potato Spindle Tuber Viroid.

Managed by visual inspection and certification, not resistance or lab tests


A
Summer Acreage Rejected (Proportion)
0.00
0.05
0.10
0.15
0.20
0.25
'41-'65
'66-'75
'76-'85
1986
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
Rejected Acreage (Proportion)
0.00
0.05
0.10
0.15
0.20
0
10
20
30
40
50
60
Time (Years)
Disease
Human Error

Potato virus Y is now the main reason for seed potato rejection in North America



Novel PVY strains complicate visual inspections for seed potato certification

PVY^{O}

PVY$^{N:O}$

Yukon Gold

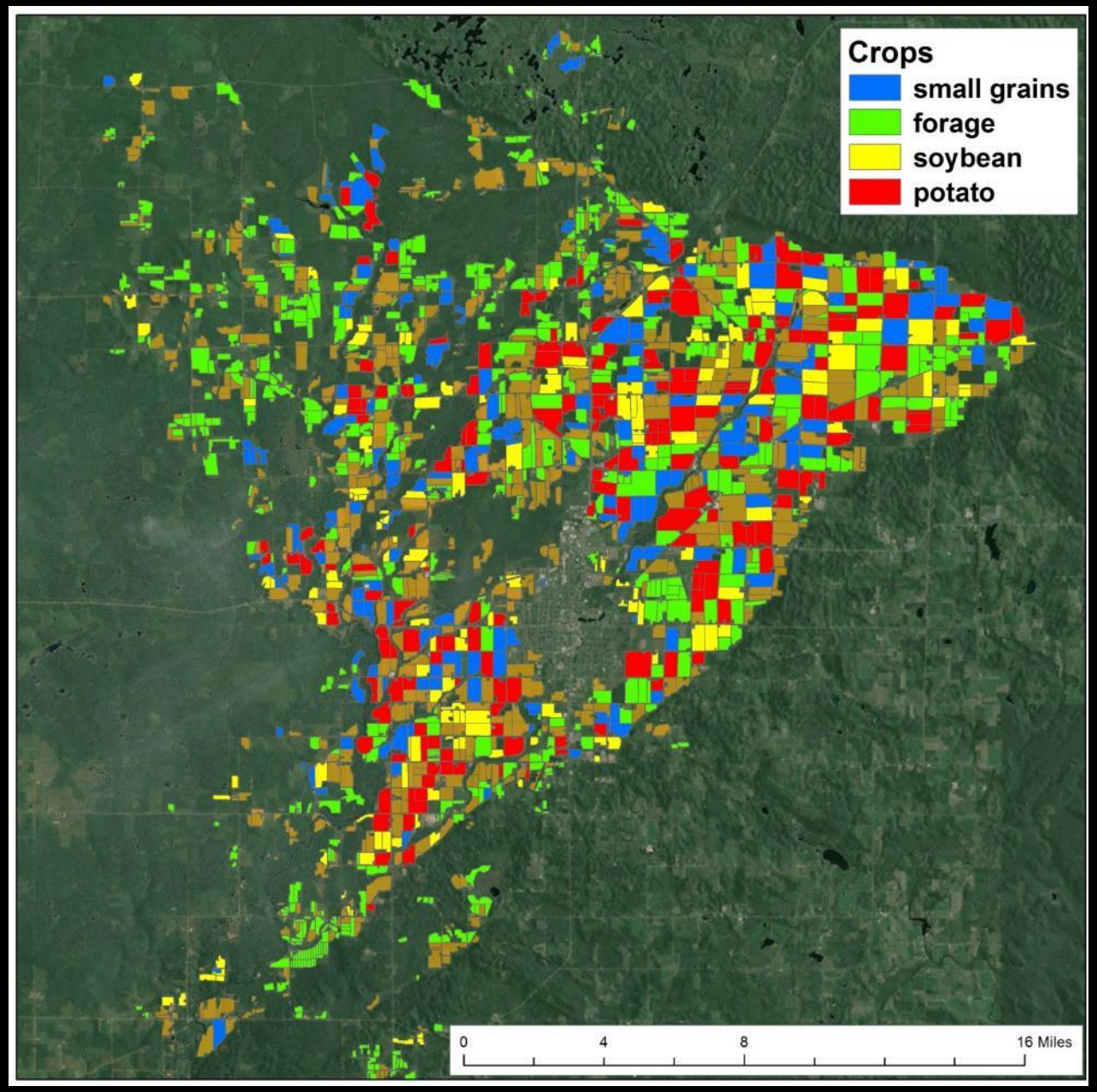
Landscape Management of Potato Pests and Pathogens

University of Wisconsin -
Wisconsin Potato and Vegetable Grower's Association

February 5, 2015

Russell L. Groves, Ken E. Frost, Amy O. Charkowski,
Emily J. Duerr, Alex B. Crockford and Anders S. Huseth

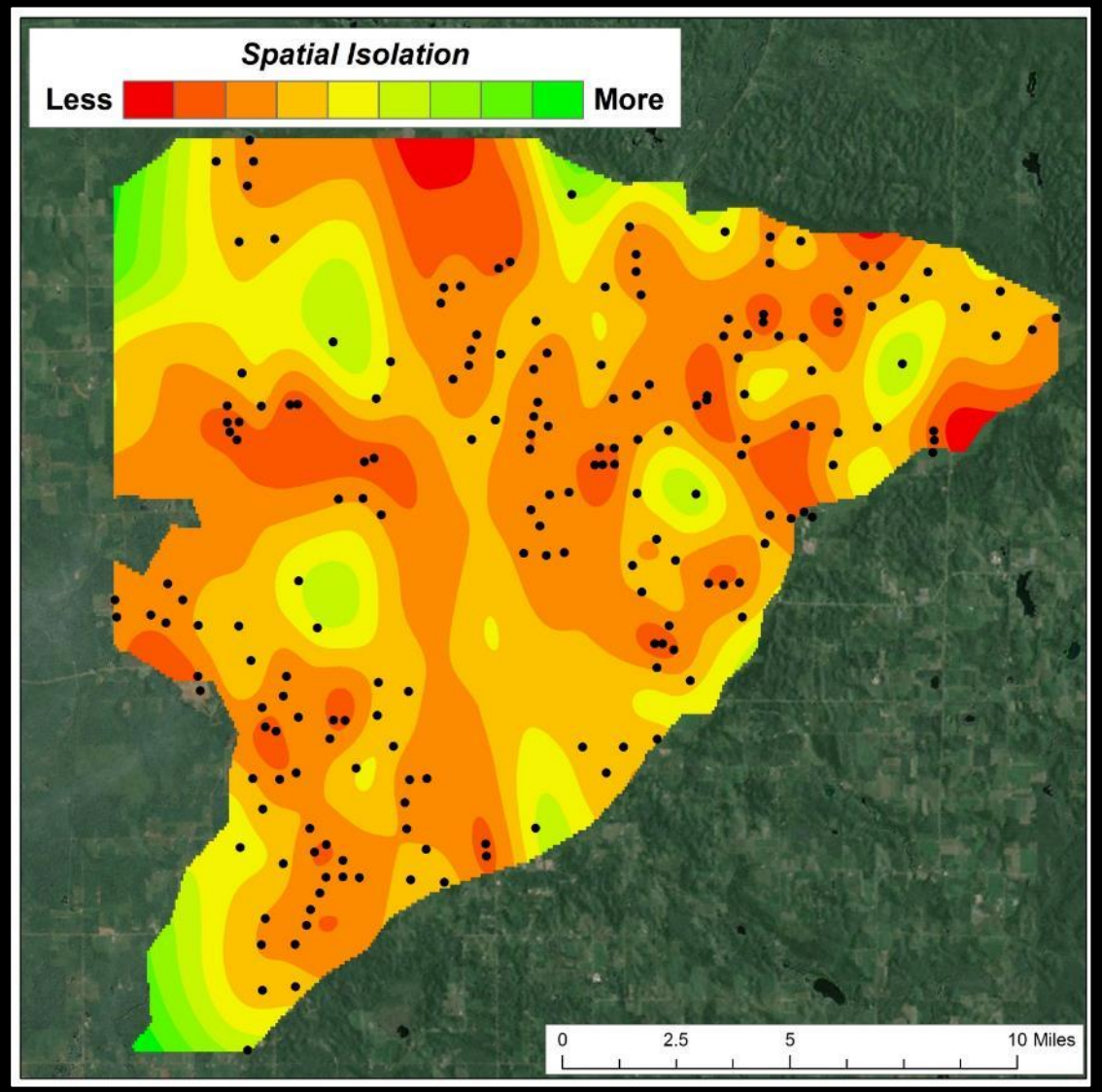
2015 Grower Education Conference
Stevens Point, WI



Groves –

Combined seed potato certification data with USDA Cropland database

Asked which landscape factors impact PVY incidence in seed potato crops



Russ Groves, UW-Madison Entomology

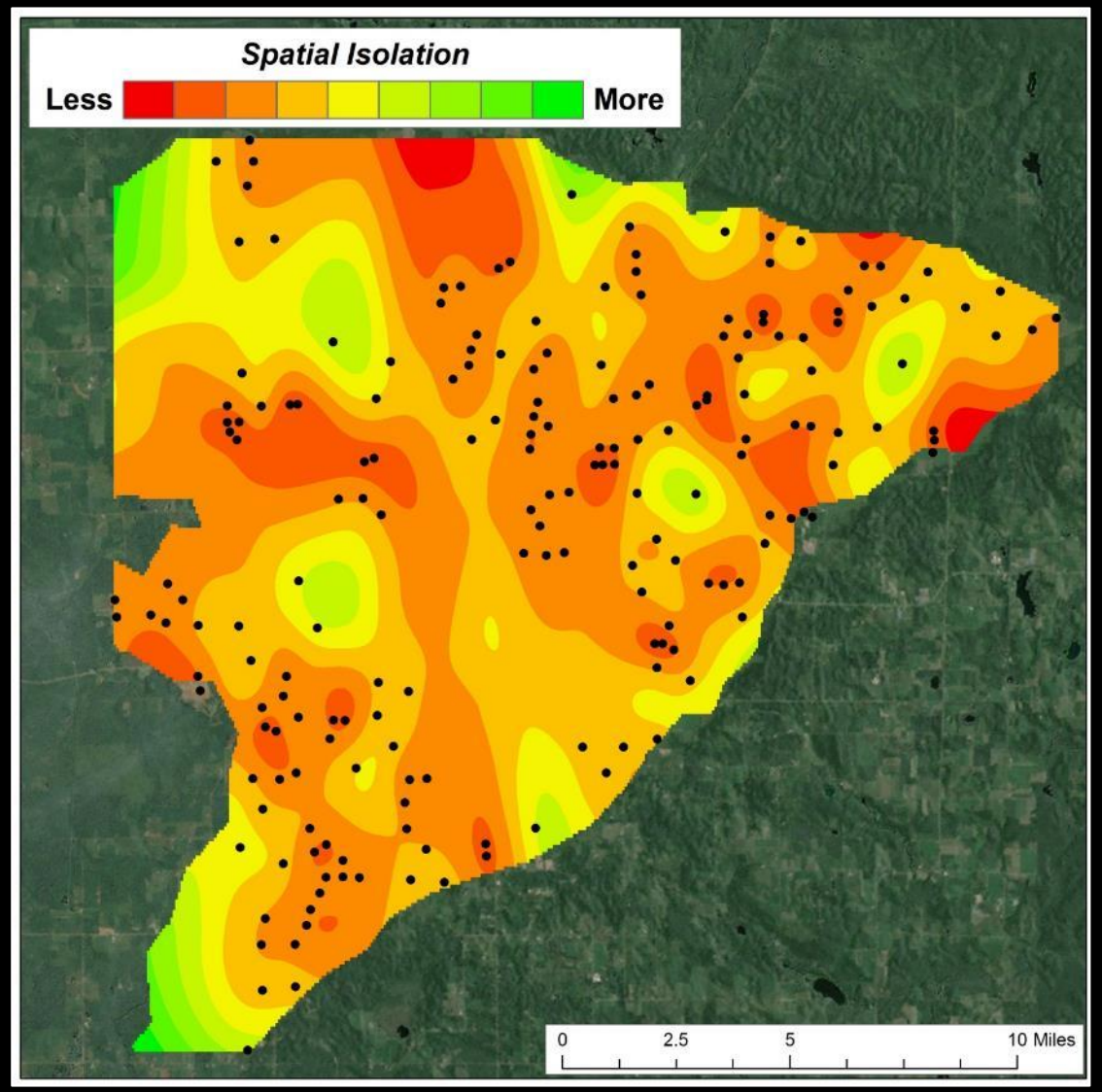
Combined seed potato certification data with USDA cropland database

Asked which landscape factors impact PVY incidence in seed potato crops

Only significant correlation with PVY incidence was distance to nearest potato field.

Y_{ij} ~ Poisson(incidence (*mean potato dist*$_{ij}$)) – Cross Correlation

(R = 0.18, P = 0.081)



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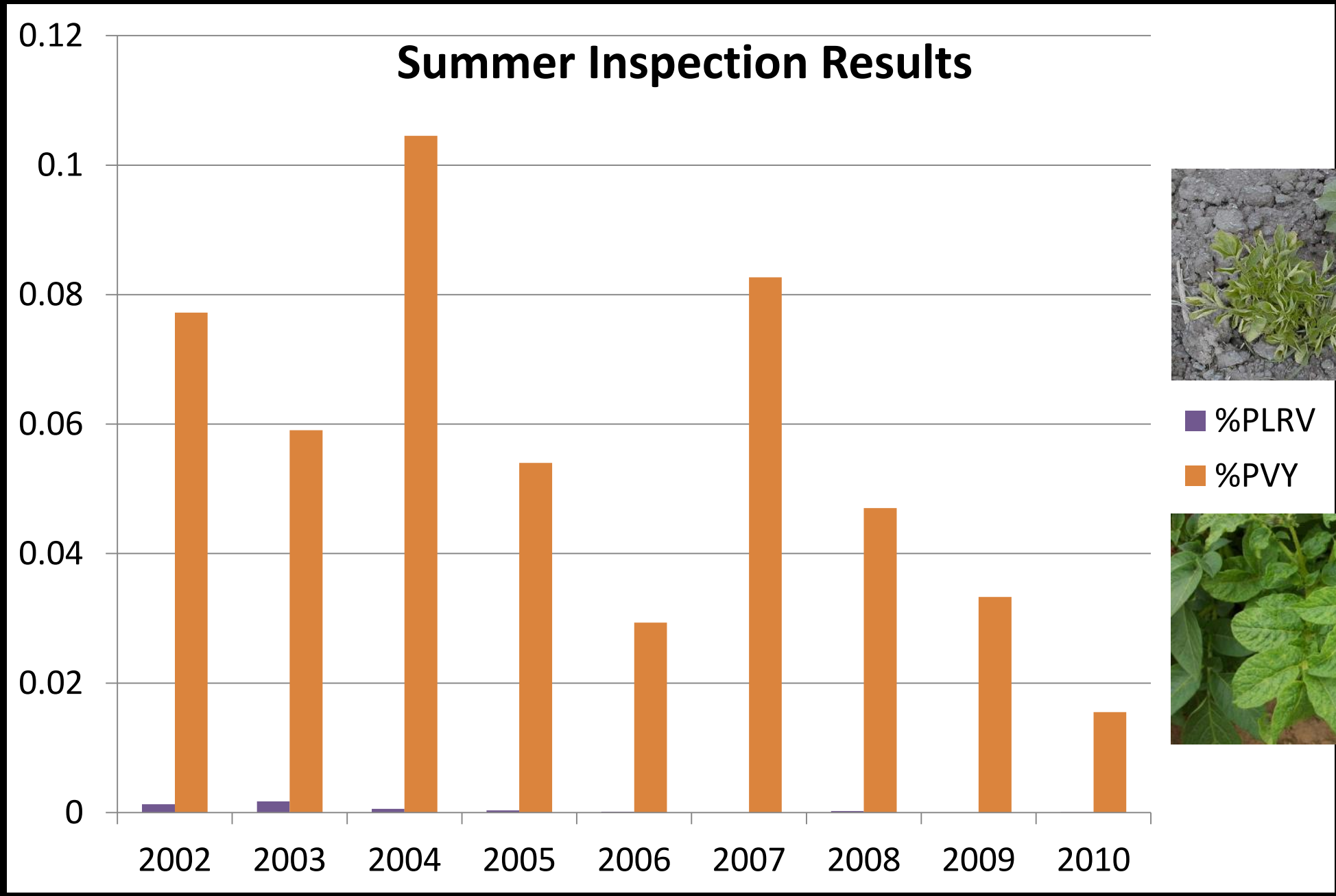

Summer Inspection Results
Percent of plants infected
0.12
0.1
0.08
0.06
0.04
0.02
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
%PLRV
%PVY

NA Certification designed for tuber-borne pathogens

All major new potato disease issues in Canada and the US are soil-borne or water-borne.

Current seed potato certification protocols are not sufficient for reducing disease spread.

All new seed potato diseases are soil-borne or water borne

Viruses: Tobacco rattle virus
Potato moptop virus

Prokaryotes: *Ralstonia solanacearum* Race 3 Bv. 2
Dickeya species

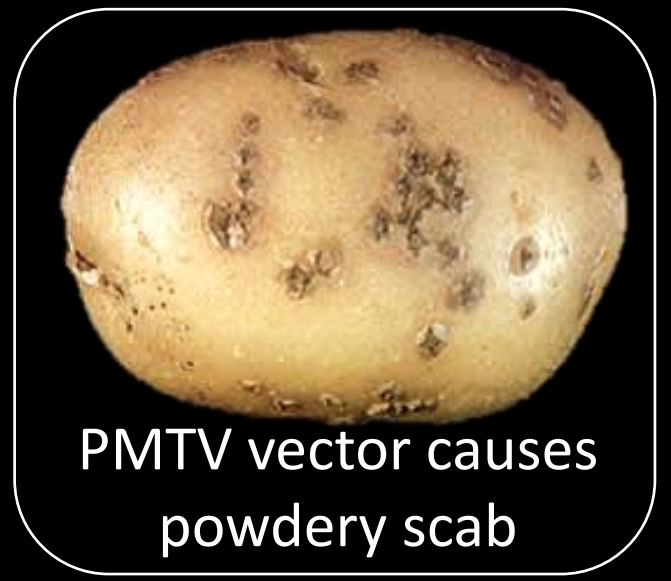
Eukaryotes: Potato wart
Potato cyst nematode

Potato MopTop is Spreading in North America

HOST
Potato

ENVIRONMENT
+ VECTOR

PATHOGEN Virus



PMTV vector causes
powdery scab

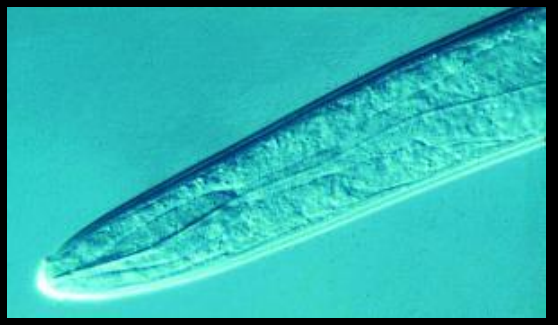
Maine, North Dakota,
Idaho, Washington, and
multiple Canadian provinces

Tobacco Rattle is Spreading in North America

HOST
Potato

ENVIRONMENT
+ VECTOR

PATHOGEN Virus



Stubby root nematode vectors TRV

SCRI grant with 30+ co-PIs funded in 2015 to work on necrotic potato virus management

All new seed potato diseases are soil-borne or water borne

Viruses: Tobacco rattle virus
Potato moptop virus

Prokaryotes: *Ralstonia solanacearum* Race 3 Bv. 2
Dickeya dianthicola

Eukaryotes: Potato wart
Potato cyst nematode

1995
On imported geranium in Connecticut.
Source – Guatemala

1999, 2000
Imported geranium in 7 states
Source – Guatemala

2003
Throughout US (127 nurseries in 27 states)
Source – Kenya
Certification program implemented in late 2003

2004
Throughout US (453 nurseries in 41 states)
Source – Guatemala

Recovery Plan

for

Ralstonia solanacearum Race 3 Biovar 2

Causing Brown Rot of Potato, Bacterial Wilt of Tomato, and Southern Wilt of Geranium

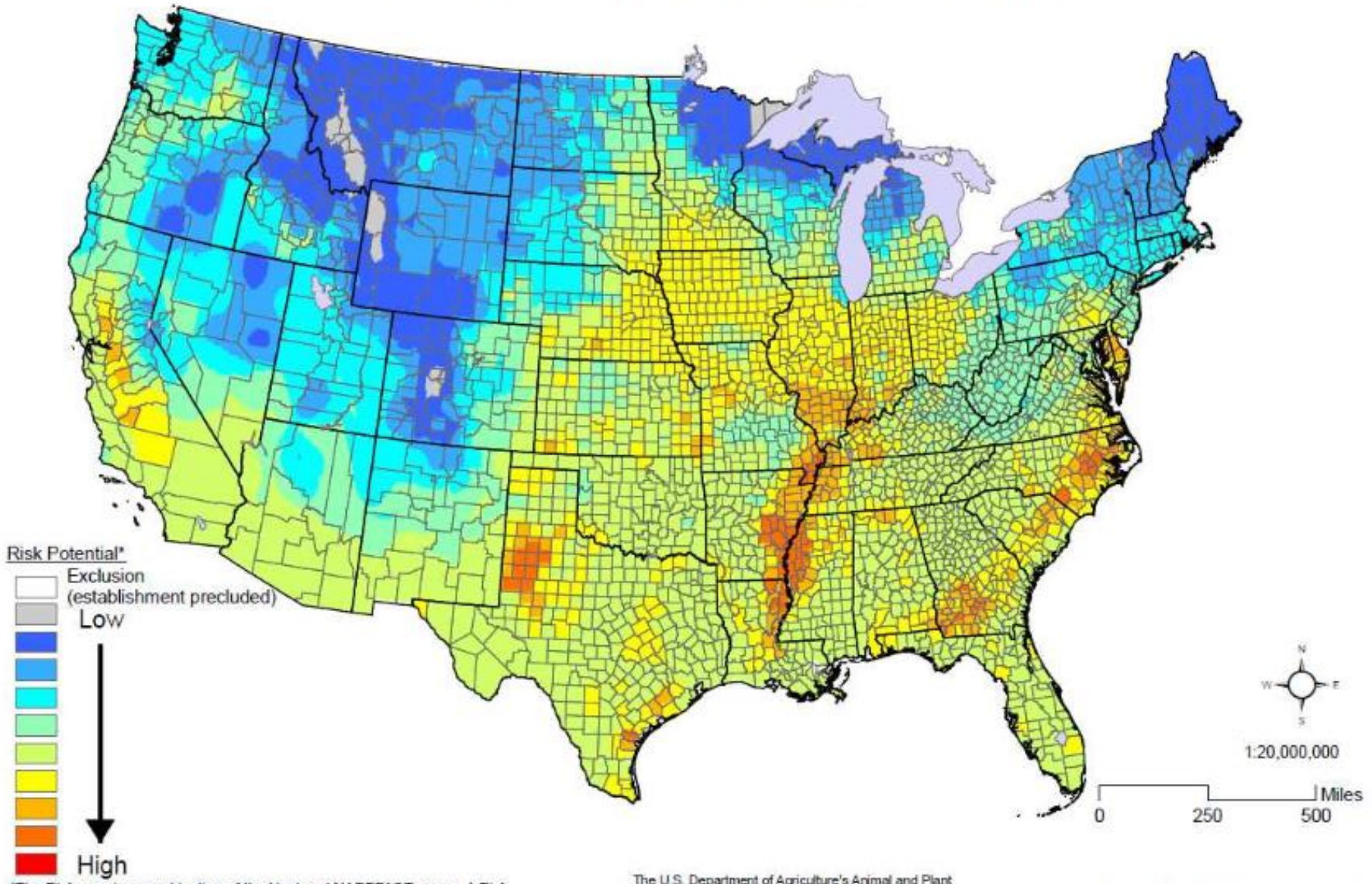
May 20, 2010

Contents

Figure 1. Symptoms of brown rot caused by *R. solanacearum* race 3 biovar 2 on potato. Photo credits: (A) D. Thurston, Cornell University (A) and P. Champoiseau, University of Florida -IFAS (B).

Figure 5. Sign of *R. solanacearum* (race 3 biovar 2) on potato: Bacterial ooze from vascular tissues. Photo credit: P. Champoiseau, University of Florida-IFAS.

Risk Map
Ralstonia solanacearum Race 3 Biovar 2, Bacterial Wilt

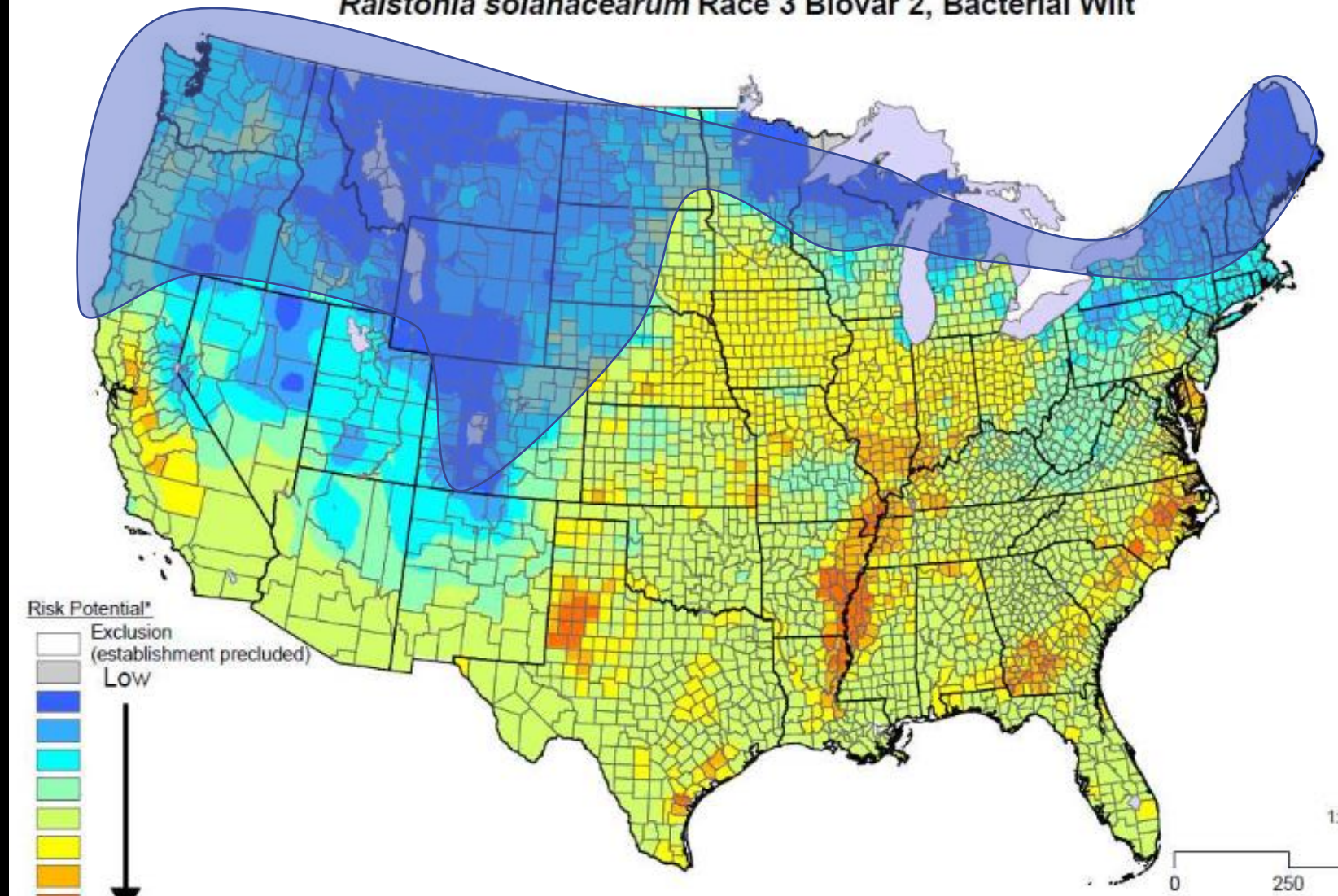


*The Risk map is a combination of the Host and NAPPFAST maps. A Risk map depicts with a relative scale, the potential areas that are unsuitable or highly suitable for growth and establishment. It is possible to directly compare values between maps of the same type (e.g. Risk to Risk).

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service collected the data displayed for internal Agency purposes only. These data may be used by others; however, they must be used for their original intended purposes.

Source: NASS 2007; USFS FIA; NAPPFAST
North America Albers Equal Area Conic (1983)
Data contact: Dan Borchert, USDA CPHST, Raleigh
Map created: March 2010 by USDA CPHST, Raleigh

Risk Map
Ralstonia solanacearum Race 3 Biovar 2, Bacterial Wilt



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Select Agents List

USDA Only Agents - Plants

- Peronosclerospora philippinensis (Peronosclerospora sacchari)
- Phoma glycinicola (formerly Pyrenochaeta glycines)
- Ralstonia solanacearum
- Rathayibacter toxicus
- Sclerophthora rayssiae
- Synchytrium endobioticum
- Xanthomonas oryzae

All new seed potato diseases are soil-borne or water borne

Viruses: Tobacco rattle virus
Potato moptop virus

Prokaryotes: *Ralstonia solanacearum* Race 3 Bv. 2
Dickeya dianthicola

Eukaryotes: Potato wart
Potato cyst nematode

Potato wart is sporadically found in new fields in PEI.

Managed through quarantine.

Globodera rostochiensis
Golden cyst nematode

Globodera pallida
Pale cyste nematode

Image: Ulrich Zunke,
University of Hamburg,
www.forestryimages.org

Christopher Hogger, Swiss Federal Research Station for Agroecology and Agriculture, www.forestryimages.org

1941 - Golden nematode discovered in NY in 1941.

Confined to nine counties in New York.

Present throughout Quebec

The PCN known as pale cyst nematode was discovered in Idaho in 2006.

US varieties lack resistance to Pale Cyst Nematode

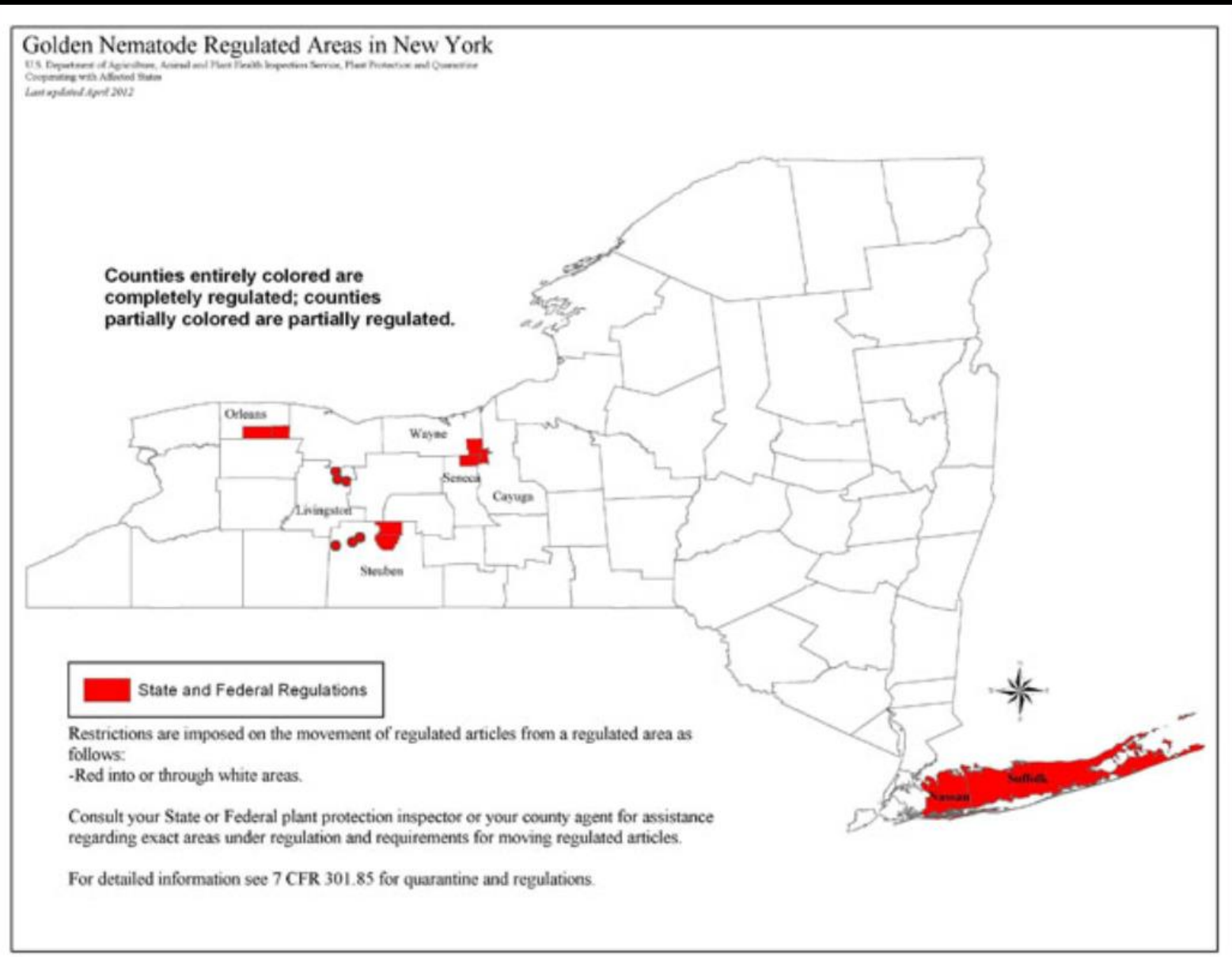
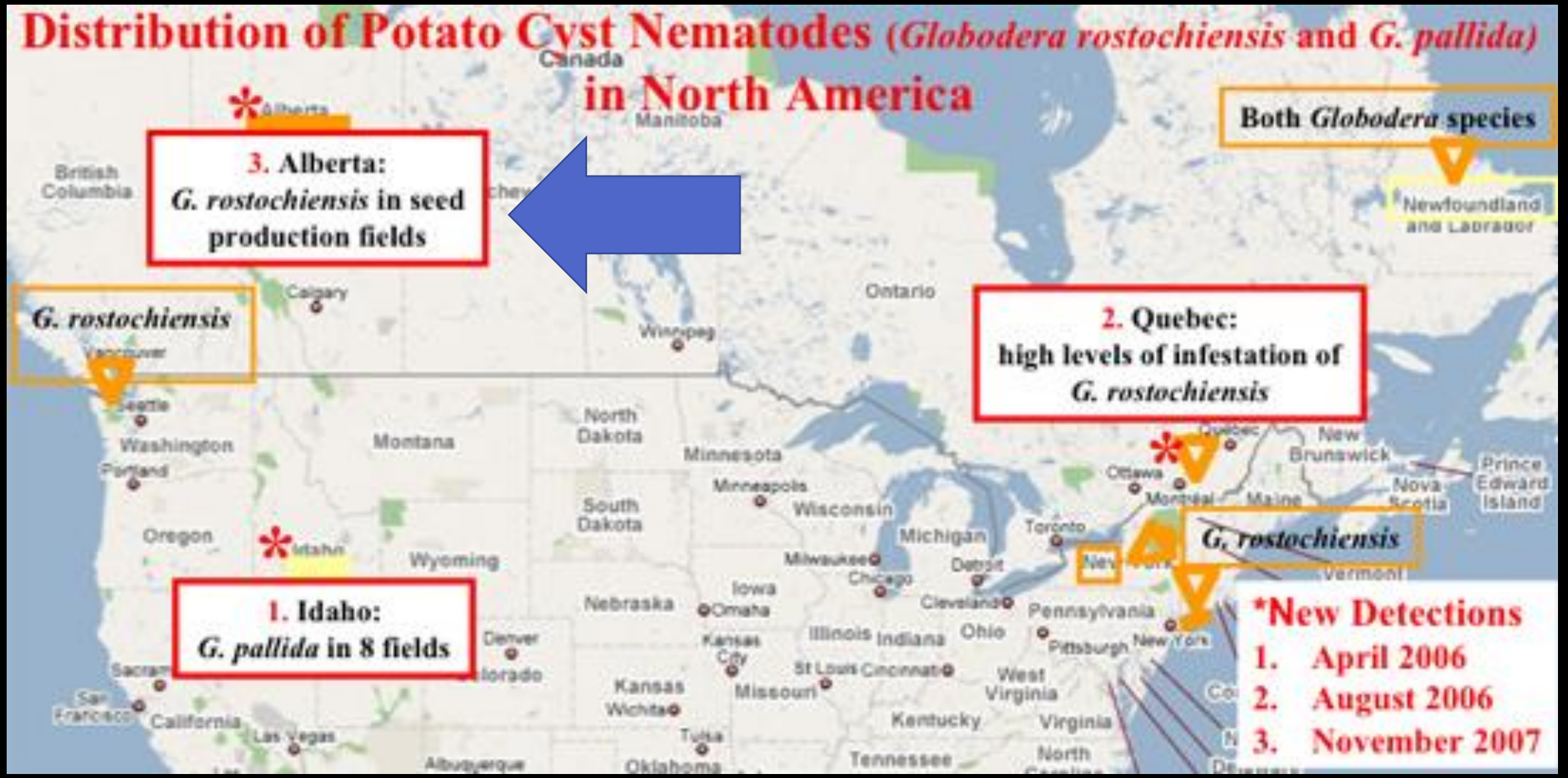
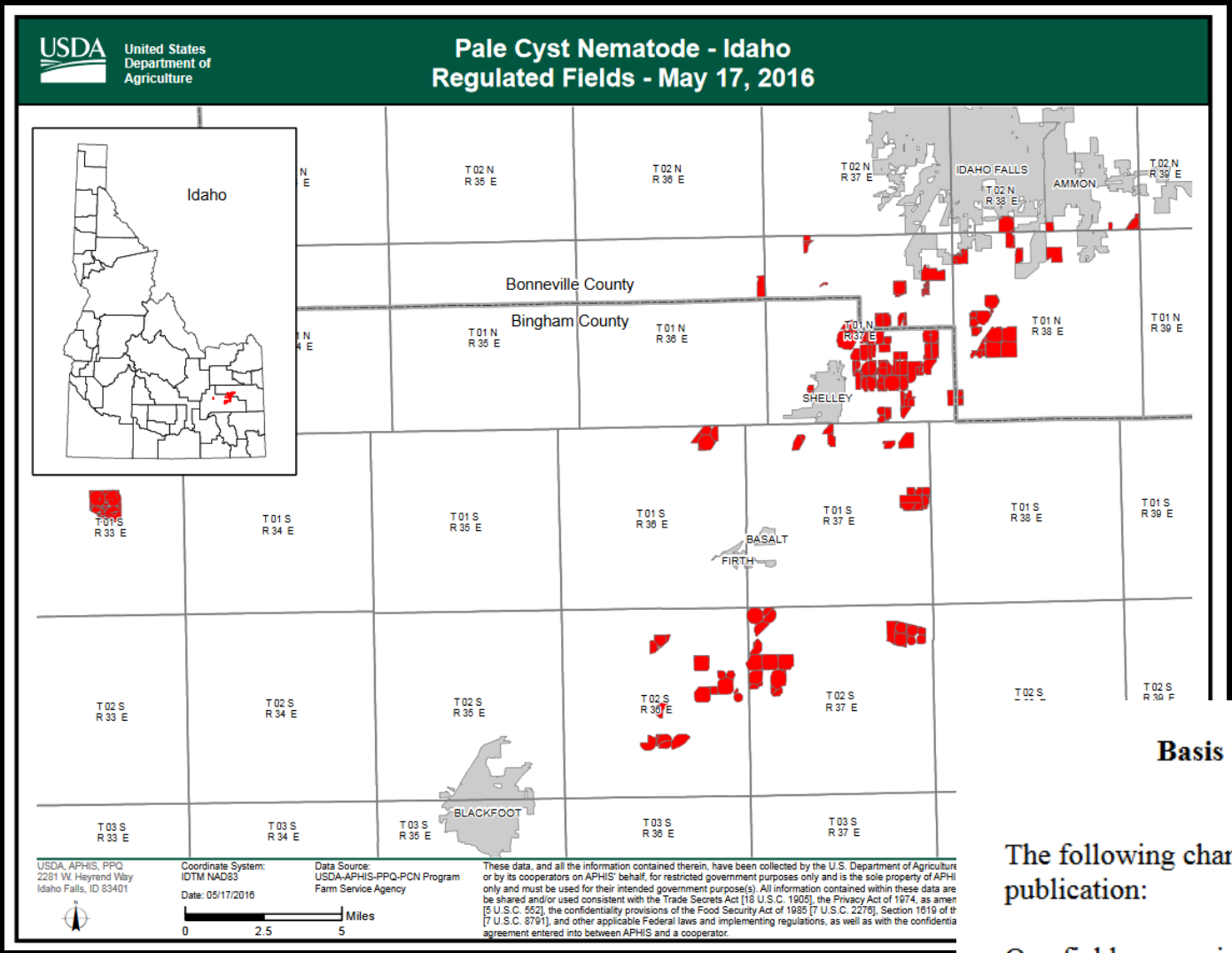


FIGURE 2-1-1 Map of Golden Nematode Regulated Areas in the State of New York (February 2012)


Distribution of Potato Cyst Nematodes (Globodera rostochiensis and G. pallida) in North America
Canada
Manitoba
British Columbia
3. Alberta: G. rostochiensis in seed production fields
Both Globodera species
Newfoundland and Labrador
G. rostochiensis
Calgary
Ontario
Winnipeg
Vancouver
2. Quebec: high levels of infestation of G. rostochiensis
Seattle
Washington
Portland
North Dakota
Montana
Minnesota
Minneapolis
Wisconsin
South Dakota
Oregon
Idaho
Wyoming
Michigan
Toronto
Milwaukee
Chicago
Detroit
Ottawa
Montreal
New Brunswick
Maine
Nova Scotia
Prince Edward Island
G. rostochiensis
Vermont
1. Idaho: G. pallida in 8 fields
Nebraska
Iowa
Omaha
Cleveland
Pennsylvania
Pittsburgh
New York
Illinois
Indiana
Ohio
Kansas City
Denver
Colorado
Sacramento
San Francisco
California
Las Vegas
St Louis
Cincinnati
West Virginia
Kansas
Wichita
Missouri
Kentucky
Virginia
Tulsa
Albuquerque
Oklahoma
Tennessee
North
*New Detections
1. April 2006
2. August 2006
3. November 2007



As of February 2015

475,000 soil samples screened

2,897 acres infested of over 300,000 acres of potato cropland.

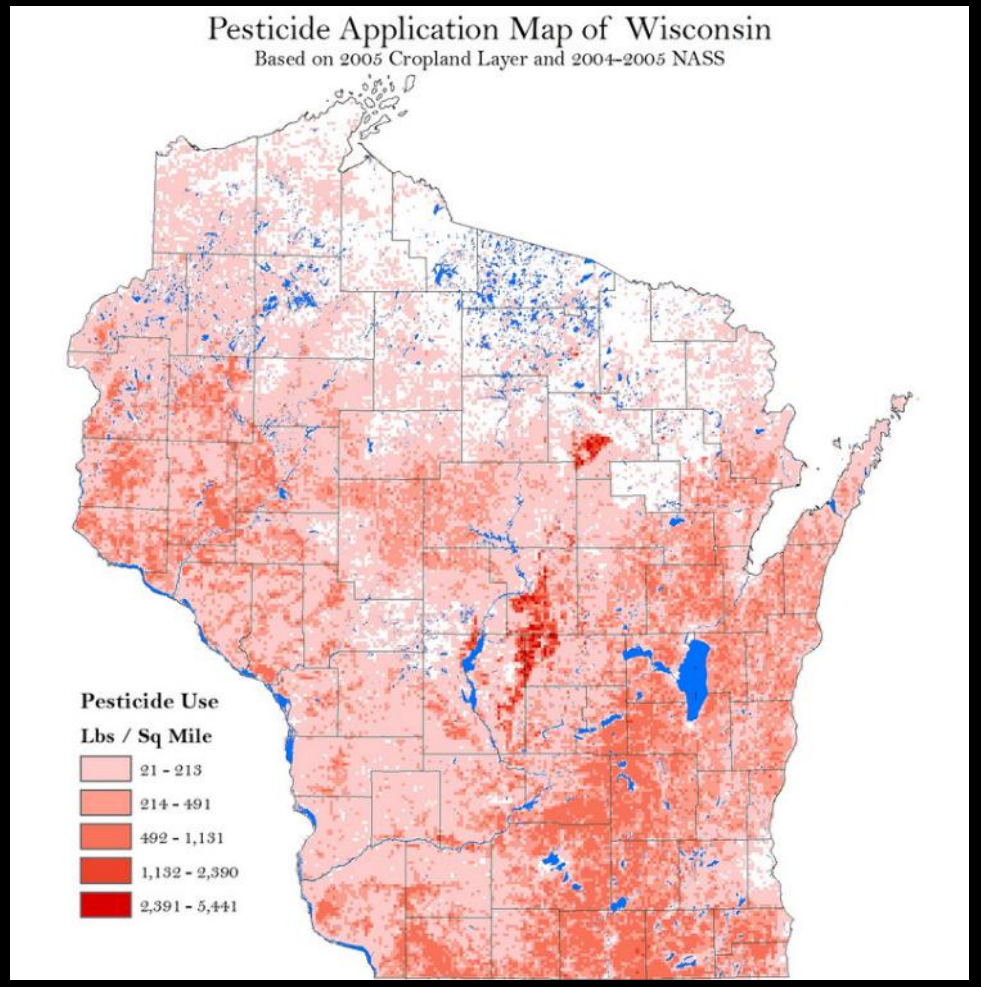
Basis for changes to the Pale Cyst Nematode (PCN) Regulated Area
May 17, 2016

The following change has been made to the PCN regulated area since the February 25, 2016, publication:

One field, approximately 75 acres, has been released from regulation under the Federal PCN Final Rule (effective April 29, 2009). The locations of field deregulated after completing a release protocol comprised of a sequence of surveys with negative laboratory results for PCN, in accordance with the Federal PCN Final Rule, subpart 301.86-3(d) (2) *Removal of fields from quarantine – Associated fields*, are as follows: Bingham County— T01S, R36E, Section 1.

This change brings the current regulated area to 9,853 acres, of which 2,897 acres are infested fields.

USDA Won’t Pay Claims After Poisoning Idaho Cattle In Modern Farmer By Dan Nosowitz on April 26, 2016



INNATE™

SUSTAINABILITY **ADVANTAGES**

DIFFERENCES BETWEEN A CONVENTIONAL POTATO AND SIMPLOT'S INNATE™ POTATO

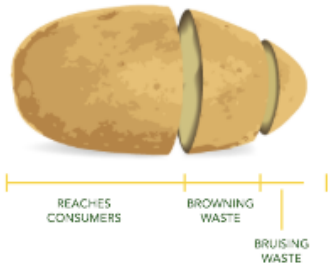
40
BILLION LBS

Annual United States' production of potatoes

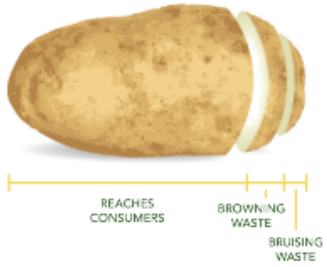
400
MILLION LBS

Annual U.S. saved waste if all fresh russets were Innate™ potatoes

CONVENTIONAL



SIMPLOT INNATE™



ADDITIONAL SAVINGS

$$$
$80 million in producer costs

CO_2
60 million lbs of CO2 emissions

8.7 billion gallons of water

170,000 acres of pesticide sprayings