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Soybean Cyst Nematode: Coming to a Field Near You?

www.soilecology.ca

Soil Ecology
University of Manitoba

@soilecologyUMan

Mario Tenuta
Department of Soil Science

Presentation to Agvise Seminar
Portage La Prairie, Manitoba
March 14, 2018

University of Manitoba

Important Tip

- Important stuff is indicated in Green
- All other stuff is optional, feel free to do something else
- Suggestions to do
  - Follow Mario on Twitter
  - Check what Trump has said today
  - Funny cat videos https://www.youtube.com/watch?v=hY7m5jjJ9mM

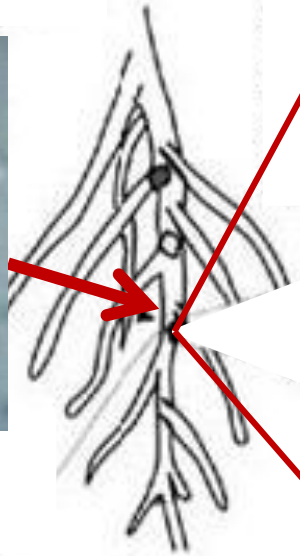
Soybean Cyst Nematode (SCN)

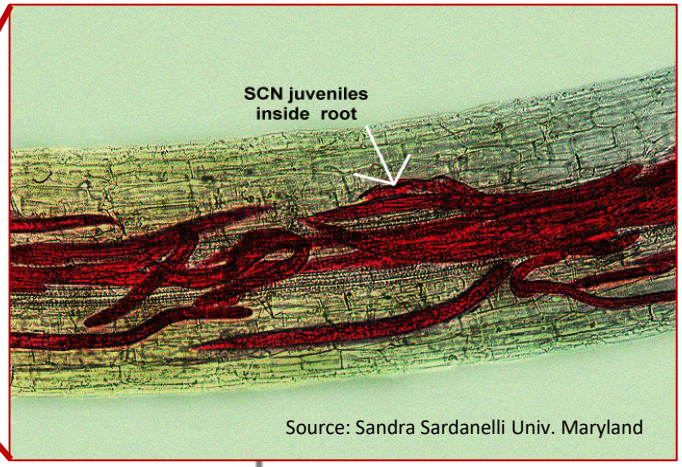
- Is a nematode (round worm) that parasitizes roots of soybean
- Like people, not all nematodes are bad, but SCN is bad

The Life of a SCN Female

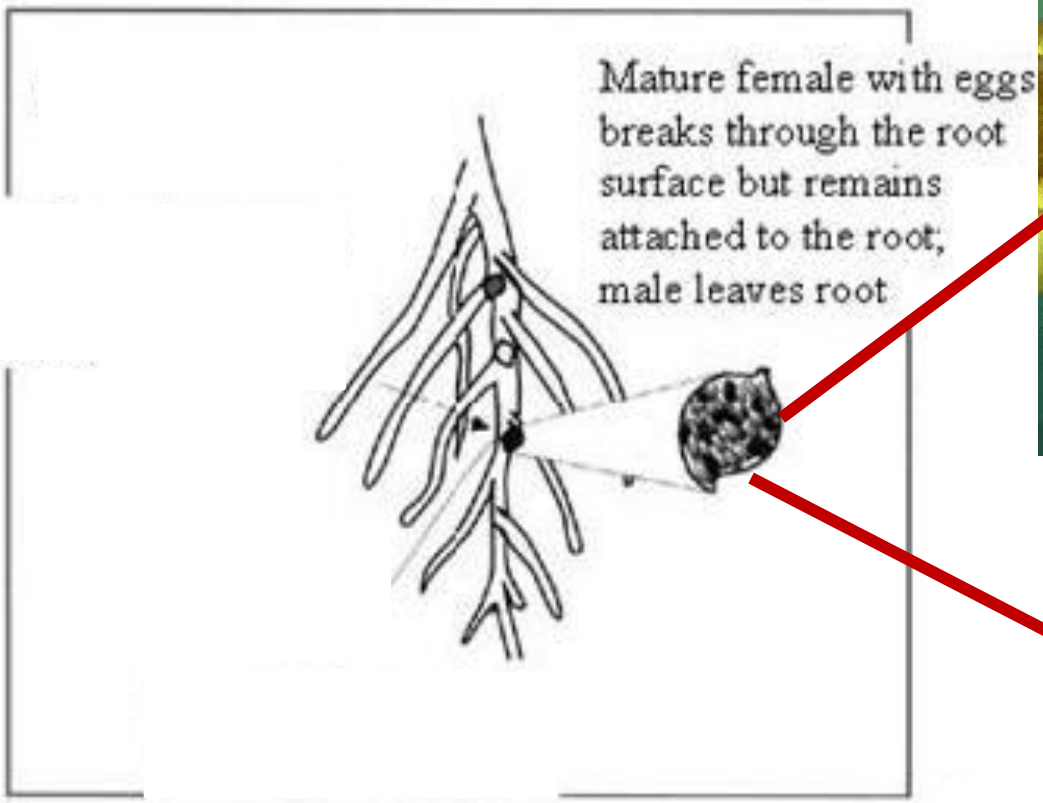
Soil

Root

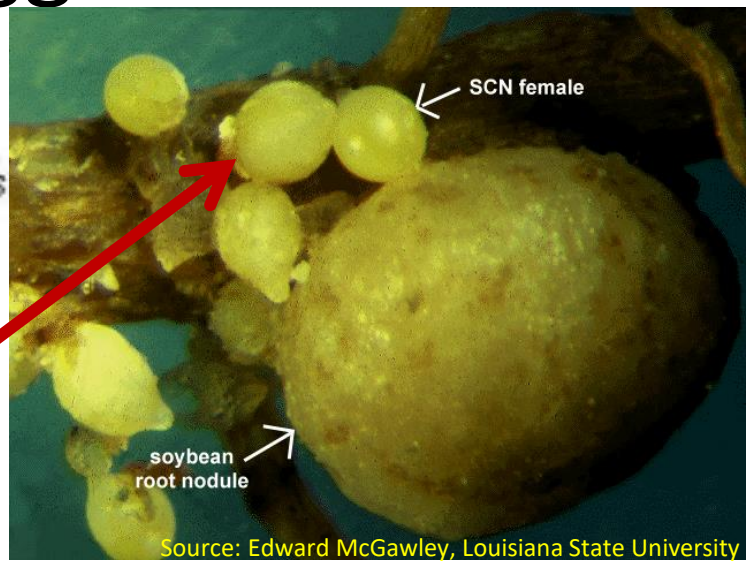




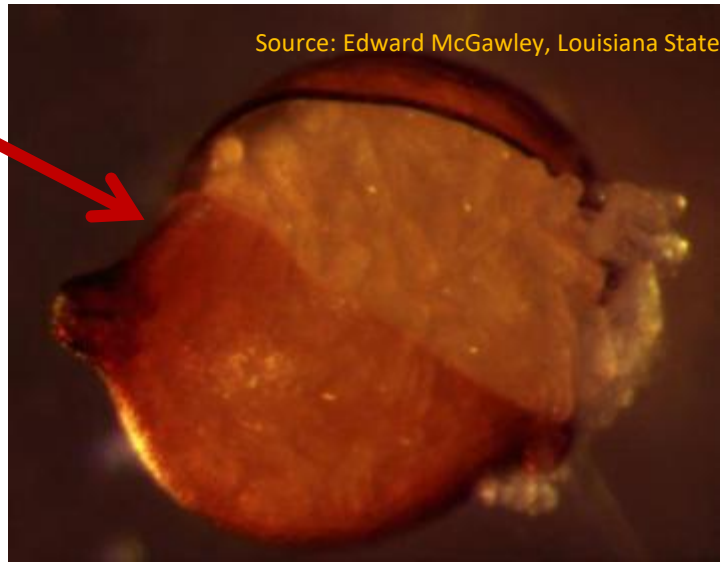
Female Settles Down to Feed and Produce Eggs



Source: Greg Tylka Iowa State Univ.

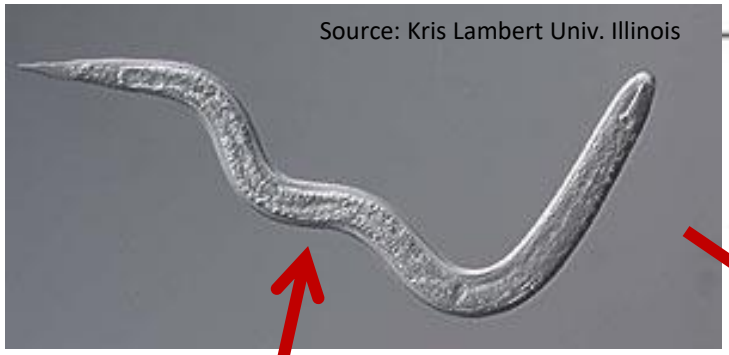


Source: Edward McGawley, Louisiana State University



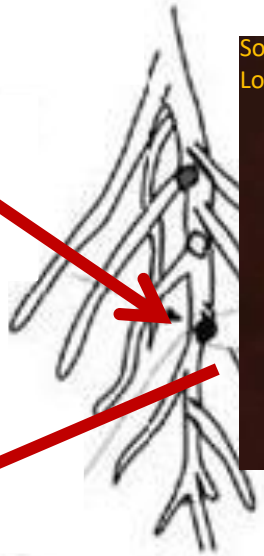
Source: Edward McGawley, Louisiana State Univ

Female Becomes Cyst Eventually Rupturing and Releasing Eggs



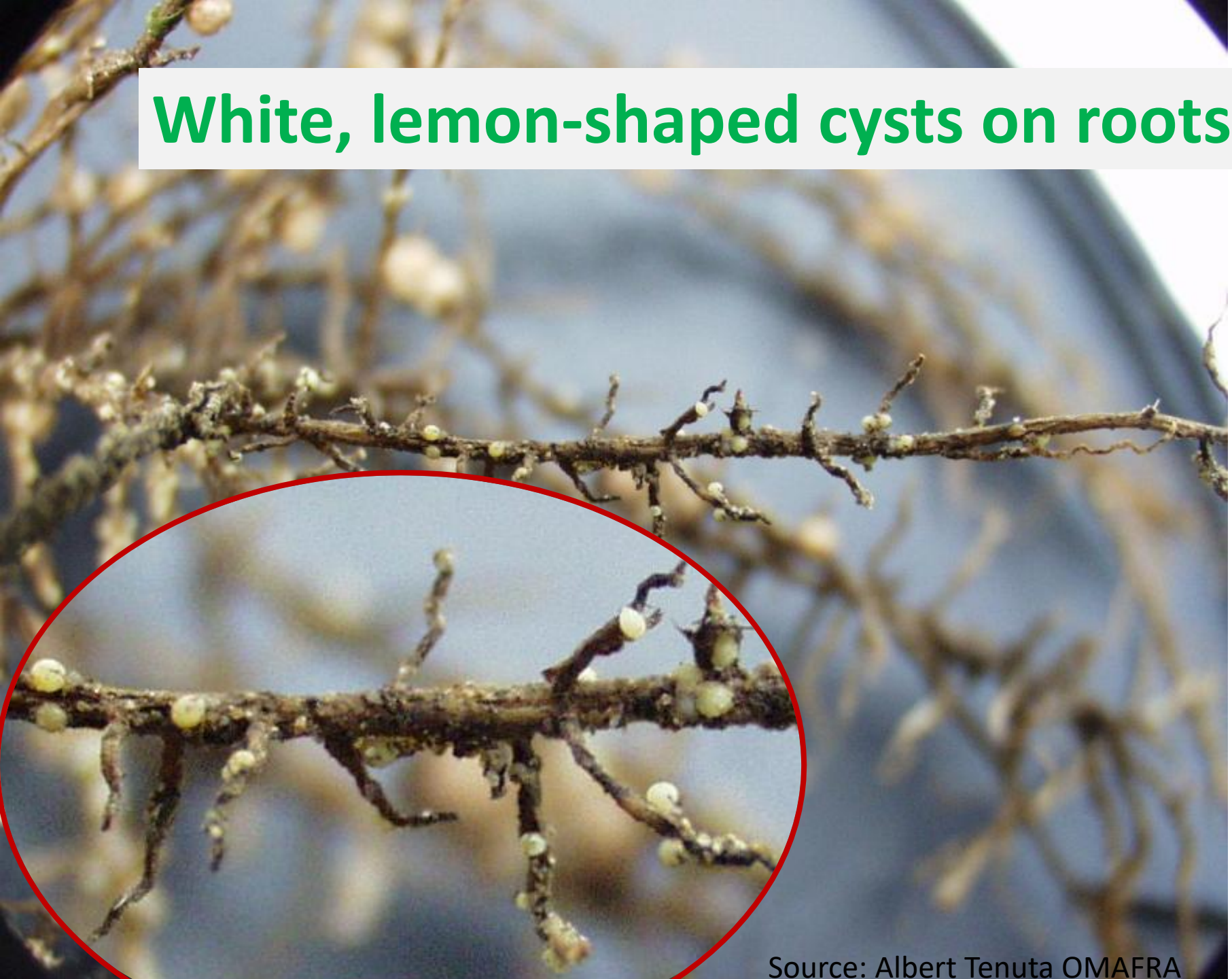
Soil

Source: Edward McGawley, Louisiana State University



Eggs released in soil, develop into juveniles

White, lemon-shaped cysts on roots



Source: Albert Tenuta OMAFRA

Damage Patches in Fields

Source: American Phytopathology Society

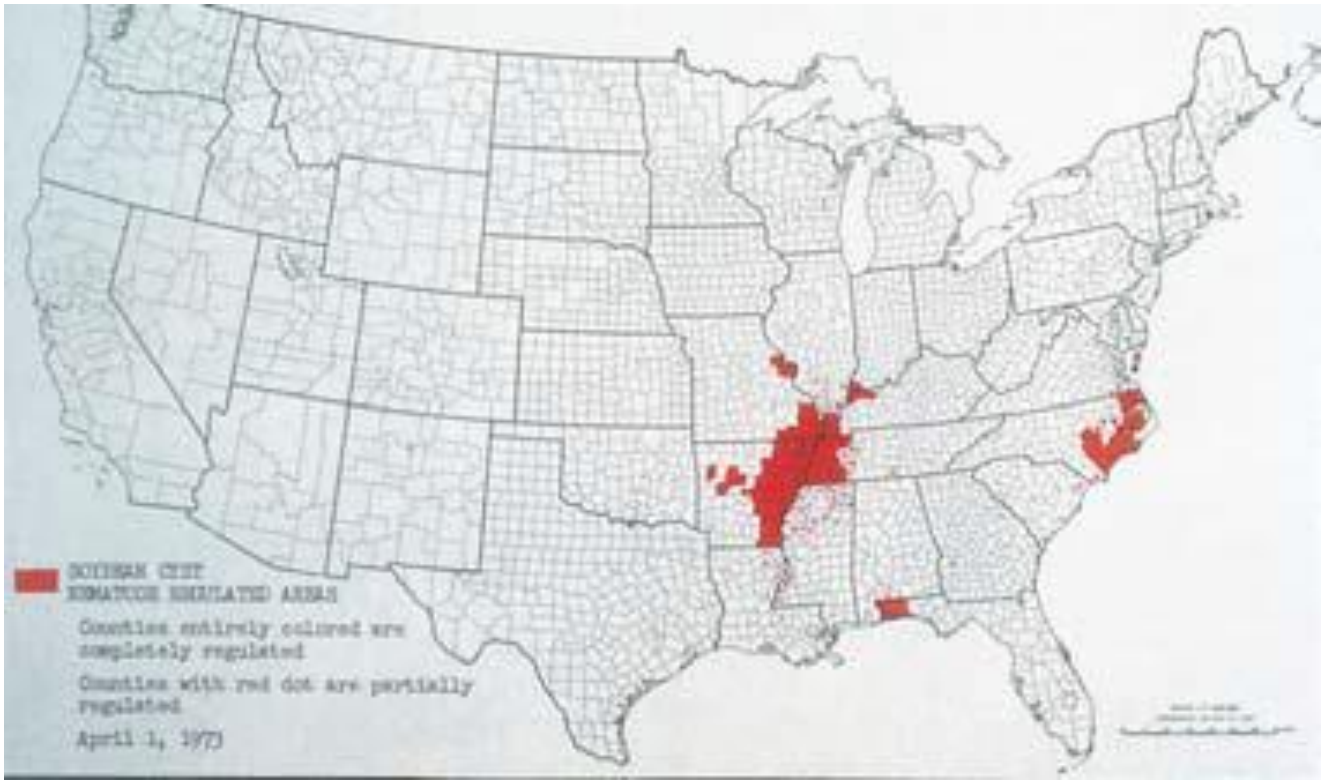
Source: Albert Tenuta OMAFRA

SCN is Spreading to all Soybean Areas of Canada and U.S.

- Japan in 1880
- North Carolina in 1954
- Moved rapidly from there through much of soy growing area of the U.S.
- Minnesota in 1978
- Ontario in 1987
- North Dakota in 2003

The Quick March North

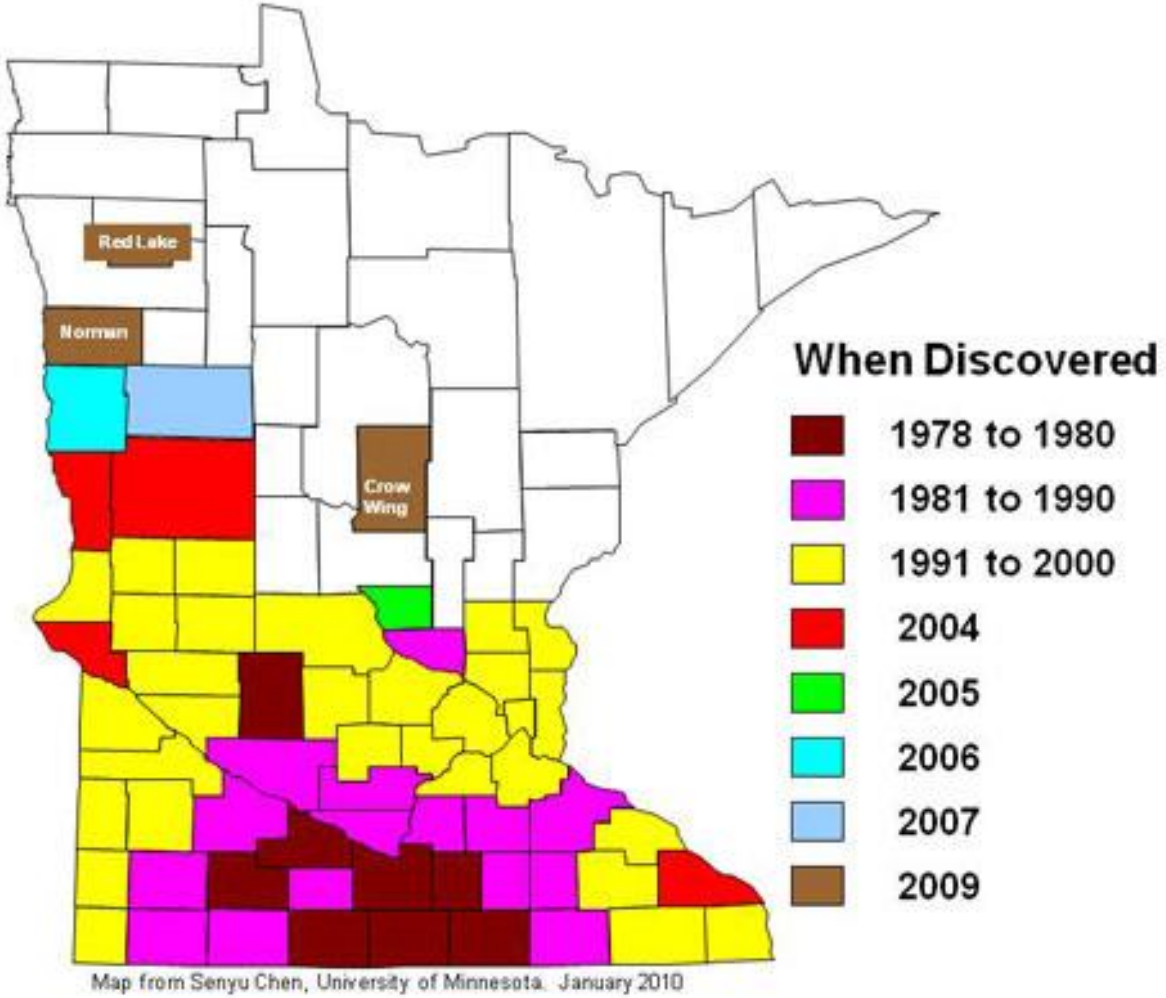
SCN in the U.S. (1973)



Spread of SCN Took U.S. Nematologists by Surprise

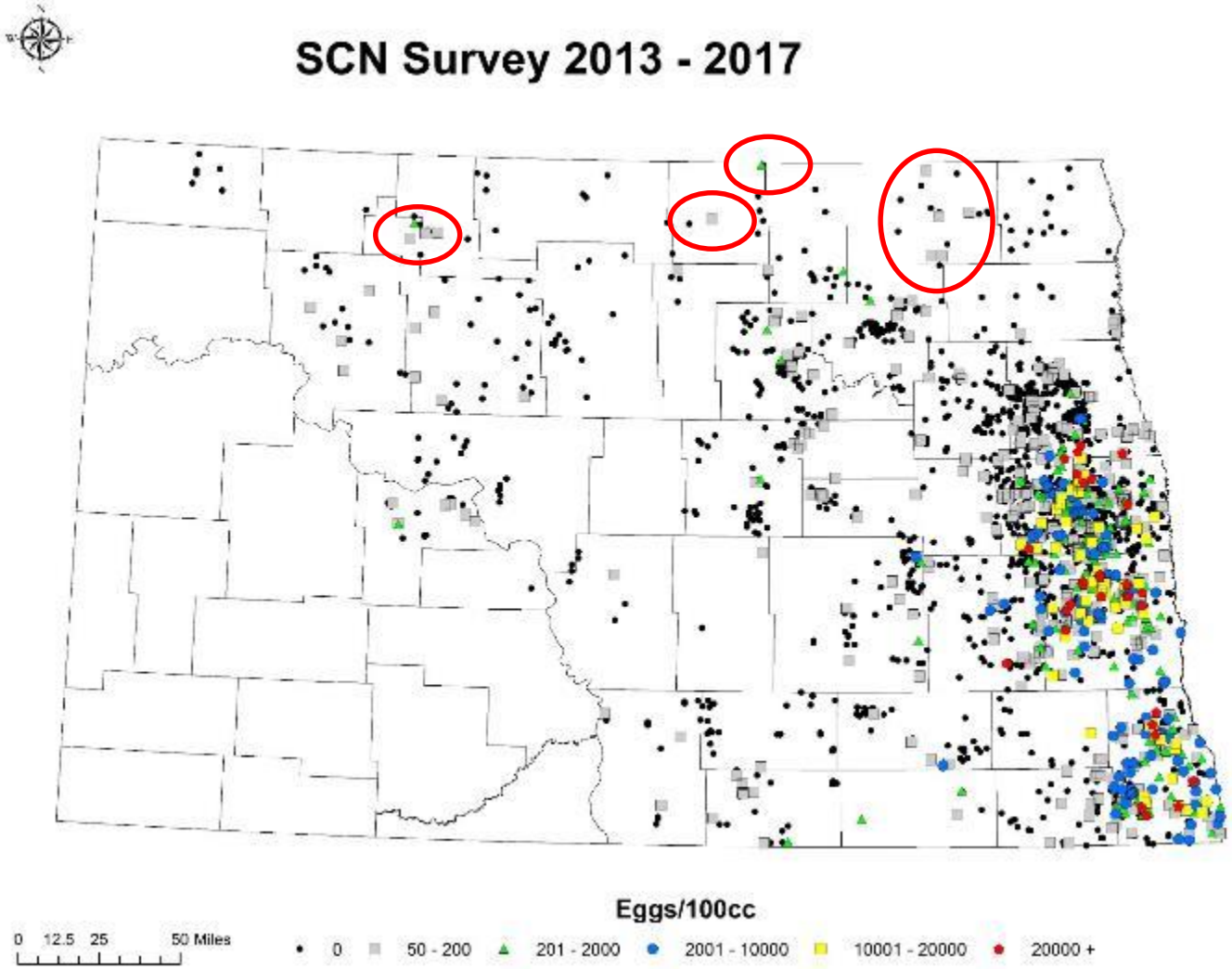
- Doesn’t like cold soil (wrong)
- Doesn’t like clay soil (wrong)

SCN in Minnesota (2009)



Minnesota counties infested with soybean cyst nematode

SCN Survey in North Dakota



Can be Confused with Drown Outs

Can be Confused with Iron Chlorosis

Source: Jay Goos North Dakota State University

Effects of SCN on Soybean

What does it do?

- Takes away nutrients
- Water update disrupted
- Interferes with nodulation
- Damages roots (holes)

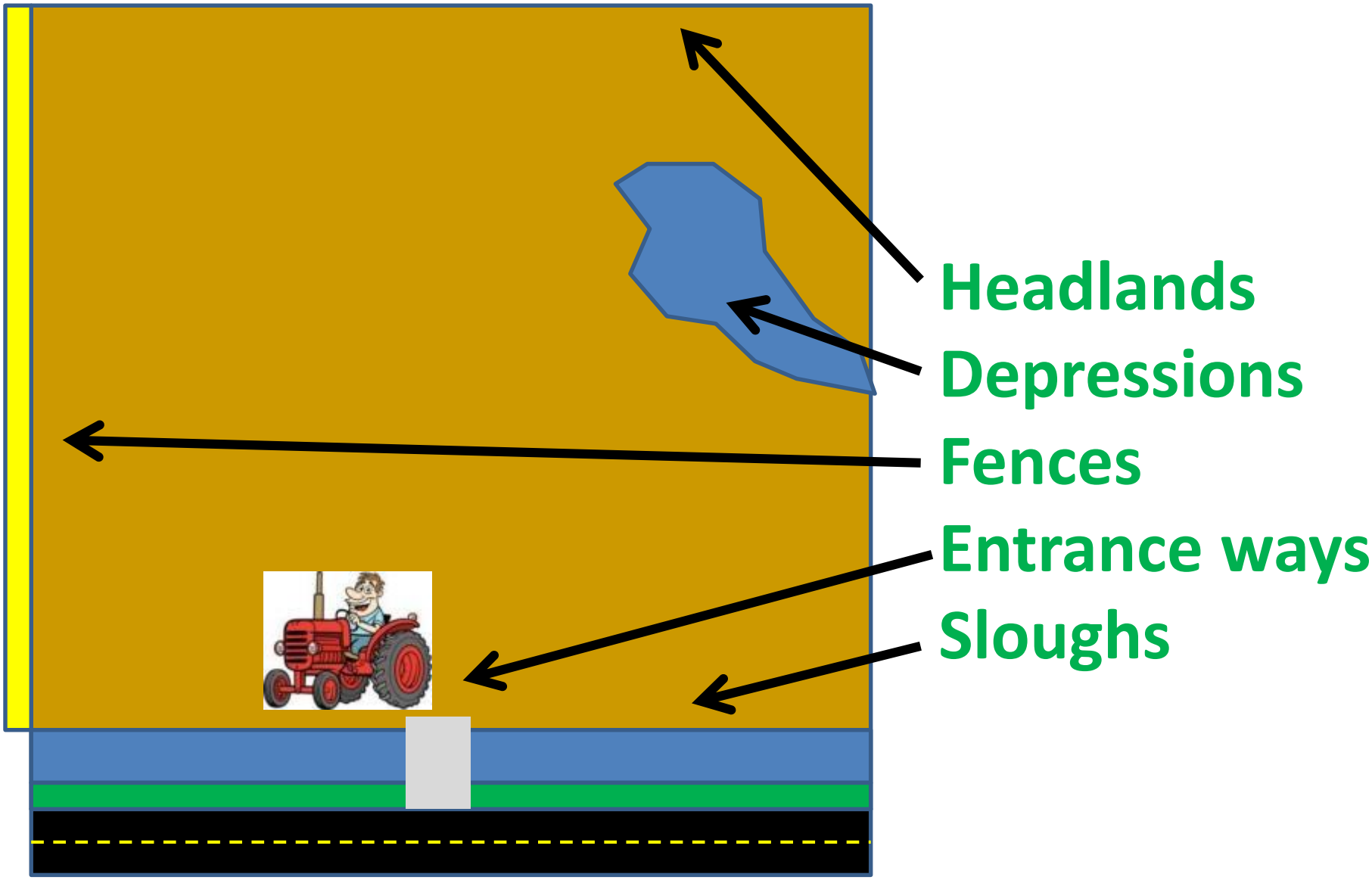
Field symptoms?

- **Yellowed plants**
  - **Resembles Iron Chlorosis**
- **Stunted plants**
  - **Uneven height**
- **Early maturity**
- **Reduction of yield**
- **Fewer pods**
- **Damage shows earlier on sands**

Avoid Host Plants in Fields

Crop Plants	Weed Plants
Adzuki Bean	American Vetch
Alsike Clover	Carolina Vetch
Bird's-foot Trefoil	**Common Chickweed**
Common Vetch	Common Mullein
Cowpea/Black-eyed Pea	**Field Pennycress**
Crimson Clover	Hemp Sesbania
Crownvetch	Henbit
Pinto, **Navy**, **Cranberry**, **Black**, **Kidney**,	Hop Clovers
Great Northern, Snap Bean	Milk Vetch
Hairy Vetch	Mouse-ear Chickweed
Lespedezas	Pokeweed
Lima Bean	Purple Deadnettle
Lupines	**Purslane**
Mung Bean	**Shepherd's Purse**
Pea	**Wild Mustard**
Soybean	Winged Pigweed
Sweet Clover	Wood Vetch

Risk Areas in Fields



Prevent Soil Movement Between Fields

- Purchase clean used equipment
- Wash implements and tires between fields
- Don’t drive pickups between fields
- Clean footwear

Source: Greg Tylka Iowa State Univ.

Source: Sandra Sardanelli Univ. Maryland

Prevent Birds From Landing on Fields

Use Resistant Soy Varieties

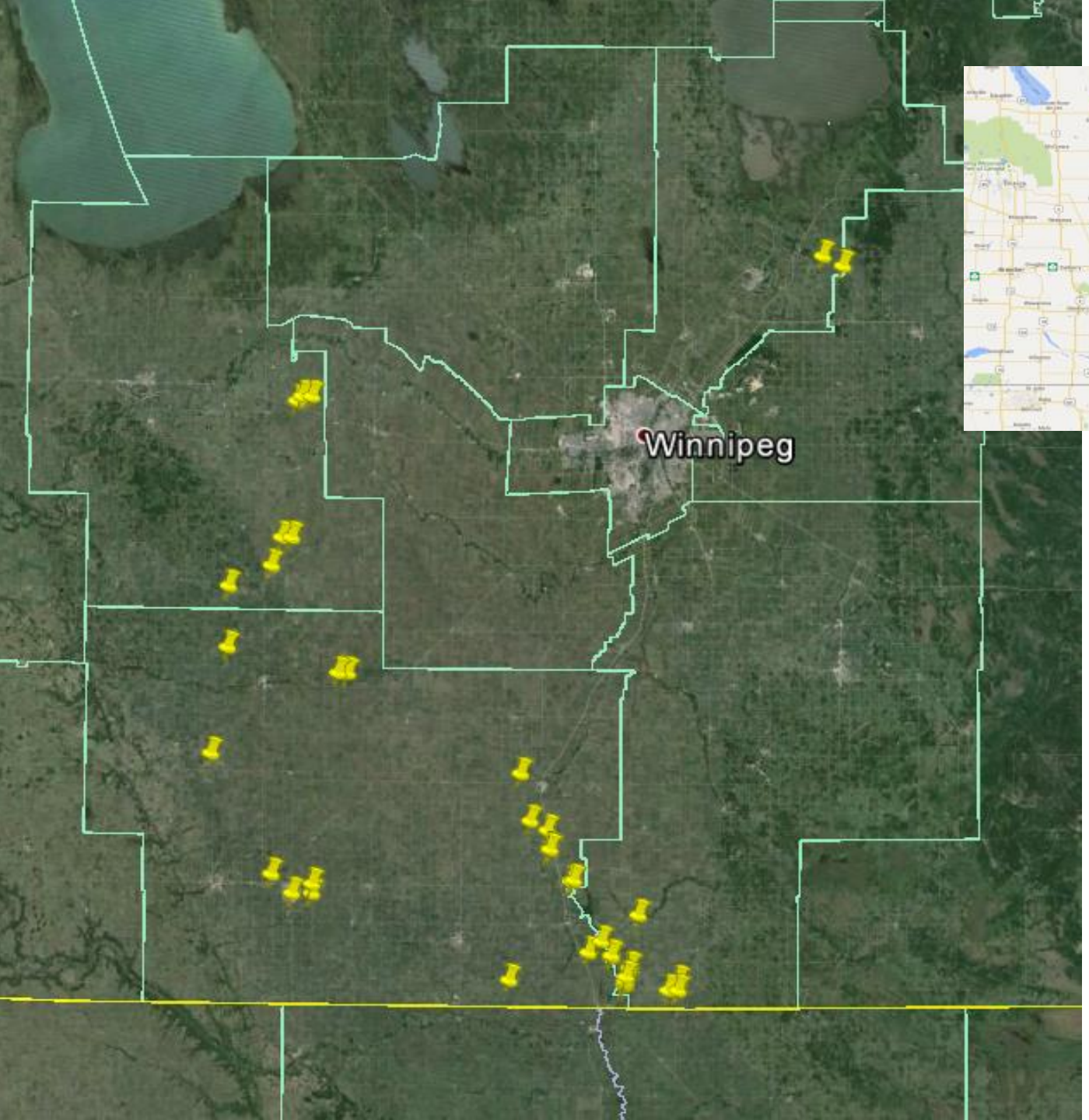
Source: Albert Tenuta OMAFRA

SCN in Manitoba?

- Canadian Food Inspection Agency (CFIA) has done some survey work of random fields
- CFIA found in survey of potato soil in 2010 what seemed to be a lot of SCN in one field
- CFIA has removed SCN as a Regulated Pest in Canada and thus will not survey fields any longer

SCN Survey of Manitoba 2012-2015

- 76 soybean fields sampled
- > 5500 soil samples
- 487 composite samples for processing
- Priority fields based on
  - Proximity to water courses from U.S. that flood
  - Number of soybean years
  - History of dry beans
  - Sampled prone areas of fields

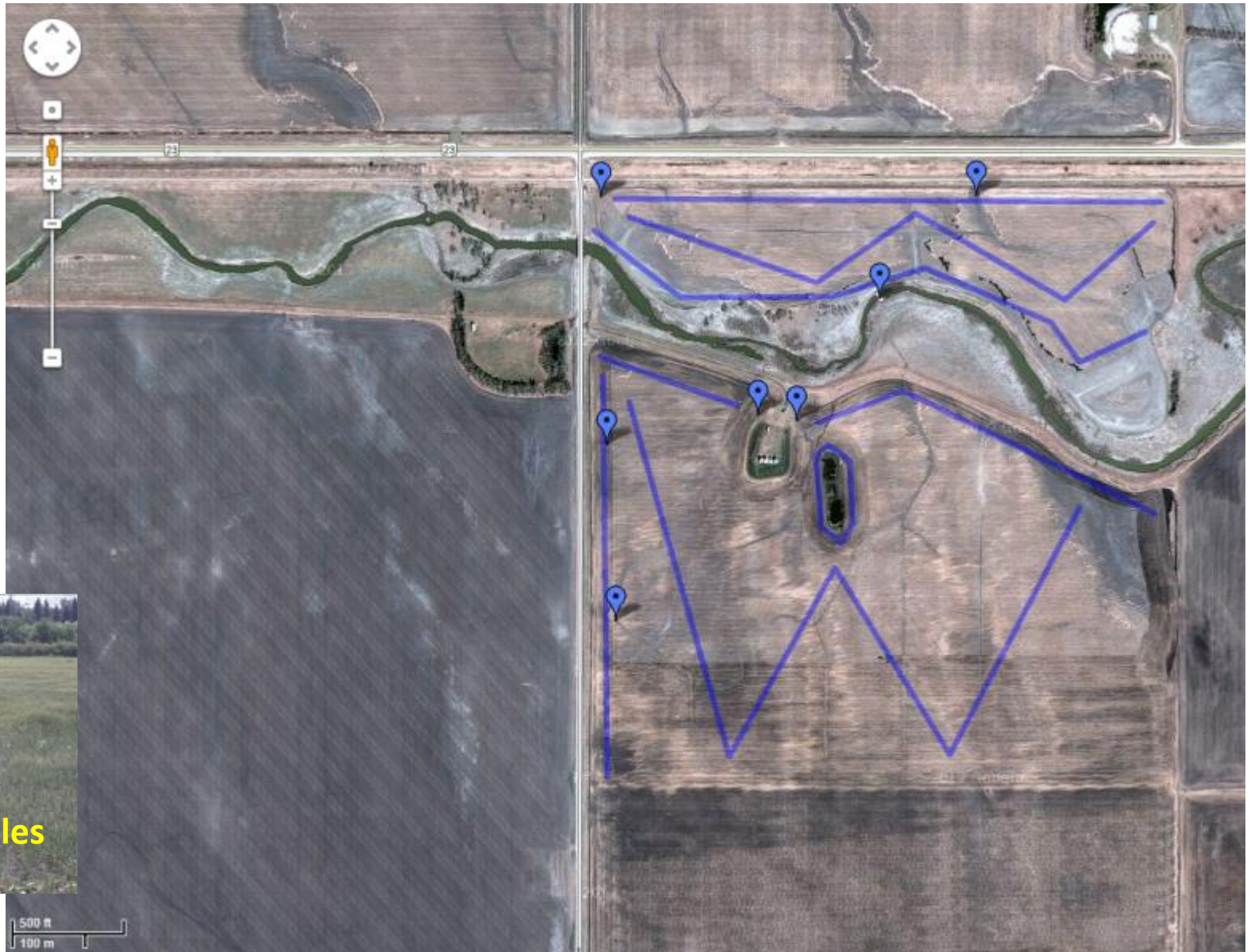


2015

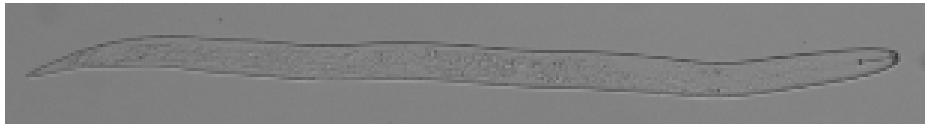
35 fields sampled
Oct/Nov 2012

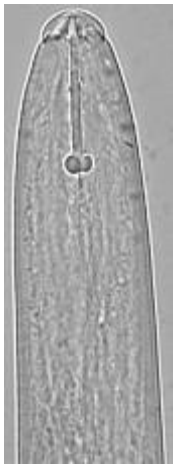
13 fields sampled
July/Aug 2013

Collecting Soil Samples

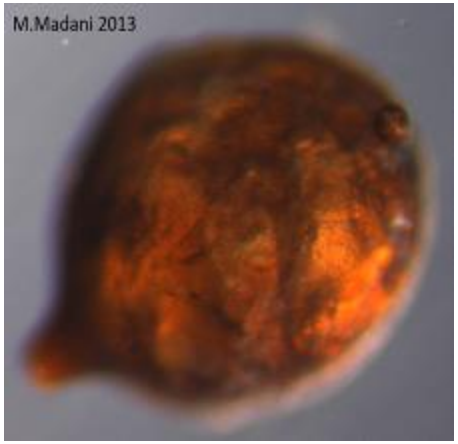


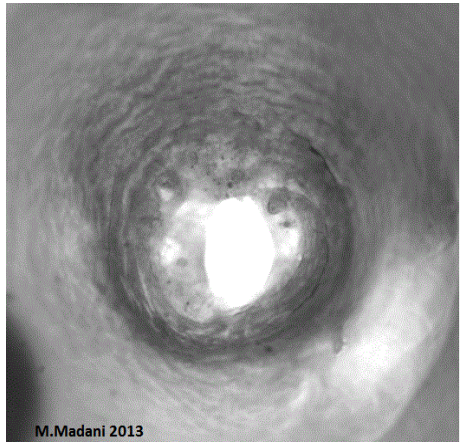
Juveniles and Cysts



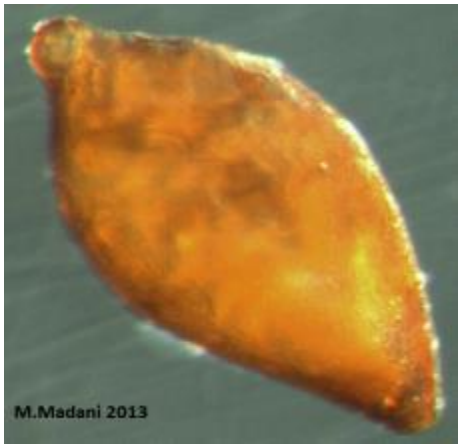


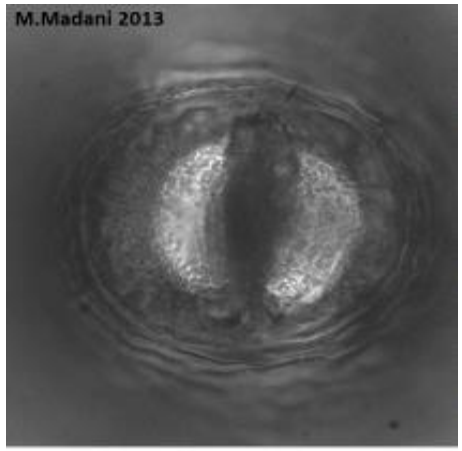
Circumfenestrate





Bifenestrate





Results 2012/13

- 37 composite samples from 22 fields had cysts
- Total of 60 cysts recovered
- 26 cysts were not damaged
- 23 cysts had circumfenestrate vulval cone structures – *Cactodera*, *Punctodera*, *Betulodera*
- 3 cysts were bifenestrate – *Heterodera*

Results

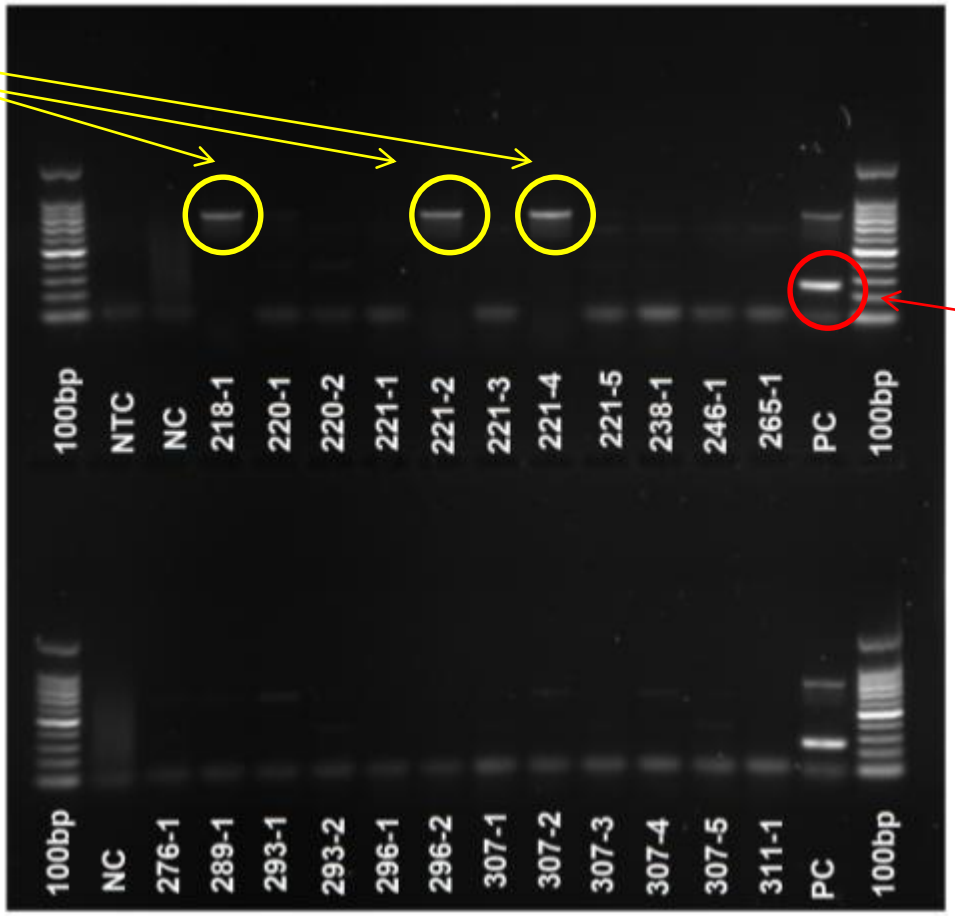
- 15 circumfenestrate cysts had eggs or juveniles
- 1 bifenestrate cyst had eggs and juveniles
- ITS sequencing, species-specific PCR
- Circumfenestrate cysts ITS matched *Cactodera*
- Bifenestrate cyst ambiguous – *Heterodera* by morphology, SCN by 2/3 primer sets, *Cactodera* by ITS sequencing

Results 2014/15

- 28 fields sampled
- 205 composite samples analyzed
- 32 samples had cysts, but only a few each
- Most cysts were round and not lemon shaped
- Cone top patterns circumfenestrate
- 6 cysts yielded DNA for analysis, failed to be SCN

Species Specific PCR for SCN in 2015

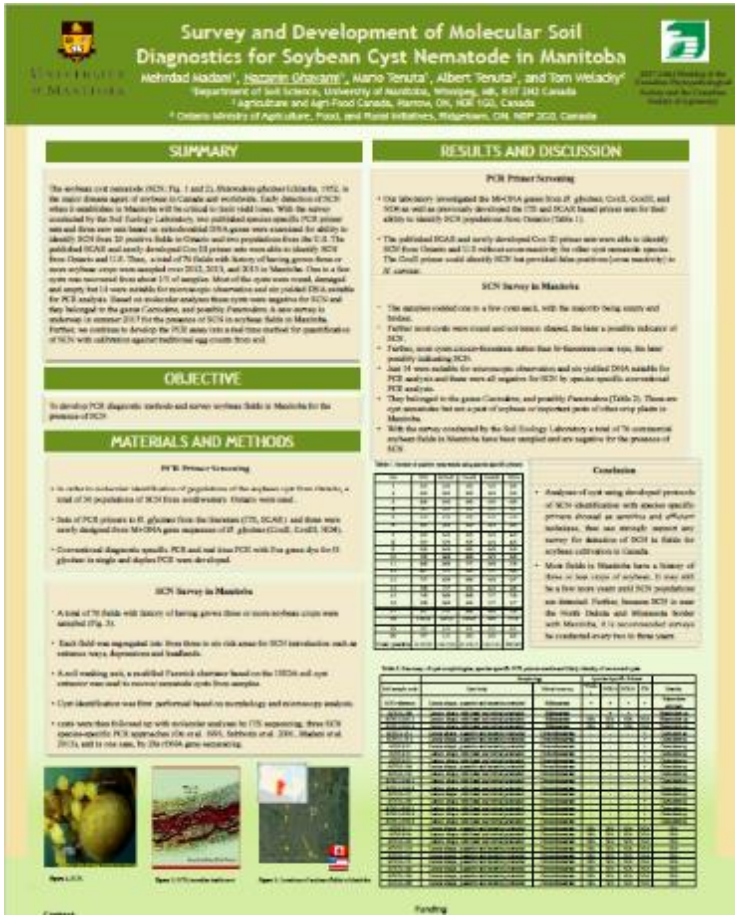
3 cysts yielding quality DNA but not positive For SCN



Positive control SCN yielding good DNA and giving band for SCN

SCN and Manitoba

- Cysts with quality for morphological and molecular analysis belonged to genera *Punctodera* and *Cactodera*
- Likely not of economic concern but on weeds
- But!!! Most of Manitoba's +1,200,000 acres of soybean acres is relatively new to production, thus over next 5-10 years likely establishment of SCN in Manitoba



See poster Ghavami

Manitoba 2017/2018 SCN Survey

- Fall 2017, 28 soybean fields soil sampled
- Samples have been extracted and being analyzed now for cysts

PhD student: Nazanin Ghavami

SCN Emerging Issue for Dry Beans

plant disease

Editor-in-Chief: Alison E. Robertson
Published by The American Phytopathological Society

February 2017, Volume 101, Number 2
Page 391
https://doi.org/10.1094/PDIS-09-16-1257-PDN

DISEASE NOTES

First Report of the Soybean Cyst Nematode *Heterodera glycines* Infecting Dry Bean (*Phaseolus vulgaris* L.) in a Commercial Field in Minnesota

G. P. Yan, **A. Plaisance**, **I. Chowdhury**, **R. Baidoo**, **A. Upadhaya**, **J. Pasche**, **S. Markell**, and **B. Nelson**, North Dakota State University, Department of Plant Pathology, Fargo 58108-6050; and **S. Chen**, University of Minnesota, Department of Plant Pathology, St. Paul 55108.

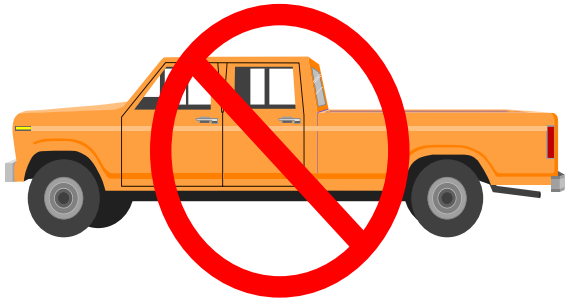
- 2016 stunted patches in dark-red kidney bean field
- Roots infested with SCN females
- Soybean last grown in 2010

Results

- We have not found a field positive for SCN yet
- But the search goes on…..

Scout for SCN

- Fields more than 3 years of soybean
- Get out of the truck and walk
- 30-45 days after emergence, gently lift roots with spad, dunk in bucket of water, look for females using a hand lens
- Collect soil samples and SCN test (Agvise or Soil Ecology Lab U Manitoba)



How to Check Roots

http://www.nwroc.umn.edu/Cropping_Issues/2010/July_20/SoybeanCystNematodeScouting/index.htm

Soil Sampling for SCN

- Every third soybean crop year
- Sampling in fall following crop harvest and before soil freezes
- Following soybean harvest, sample directly within harvested rows before tillage
- Following other crops, sample after fall tillage, if you till
- Sample top eight inches
- Use a soil push probe or small diameter soil auger
- Take 15 cores for a sample from every 20 acres
- Sample specifically for trouble soybean area

More on Soil Sampling

- Put cores into a bucket
- Mix the cores and place into a ziplock freezer bag
- Label both sides of bag with marker for name, legal, date, field sample number
- Keep bag out of sun
- Place in refrigerator
- Drop off samples to Agvise as you would do for soil fertility testing
- SCN is not a regulated pest, so call Mario if samples come back positive

Exam Study Points

- SCN can silently rob yield
- SCN is confused with other crop problems
- SCN is marching in our direction and is inevitable
- Can delay and lessen damage by
  - Clean machinery, tires and footwear
  - Know your field risk areas
  - Dig plants to scout fields
  - Weed suppression
  - Avoid tight rotations
  - Don’t rotate with edible beans and pea
  - SCN soil test
  - Use resistant varieties
  - Bird suppression
- Scout for cysts on roots, soil sample every 3rd soy crop
- You need to know everything for the exam!

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Acknowledgements

Numerous colleagues for pictures

Partners: Dennis Lange, Kristen Podolsky, Holly Derksen, growers, Tom Welacky (AAFC Harrow), Albert Tenuta (OMAFRA)

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Invitation: John Lee

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Three Things Are Forever

- Diamonds
- Taxes
- SCN