AGVISE Soybean Cyst Nematode Project Update: Are our soybean SCN resistance sources still working?

2022 Soil Fertility Seminars

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Agronomist, AGVISE Laboratories

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Outline

- What is SCN?
- Why should we care about SCN in the Canadian Prairies?
- Soybean genetic resistance to SCN
- AGVISE SCN Project
- Management options
- Update on SCN numbers

SCN-resistant soybean variety on left and SCN-susceptible variety on right.

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https://blog-crop-news.extension.umn.edu/2021/09/soybean-varieties-with-non-88788-scn.html

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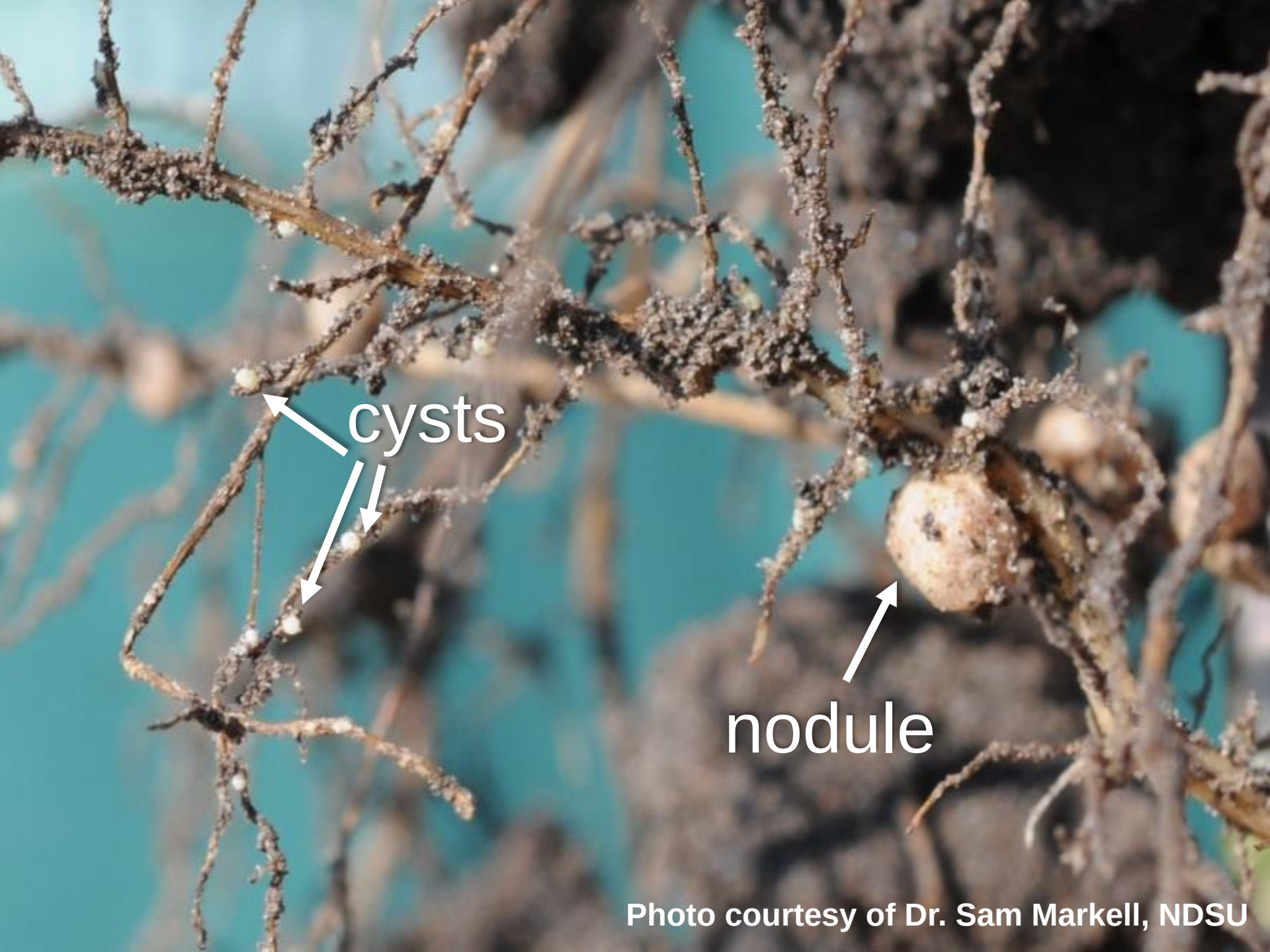
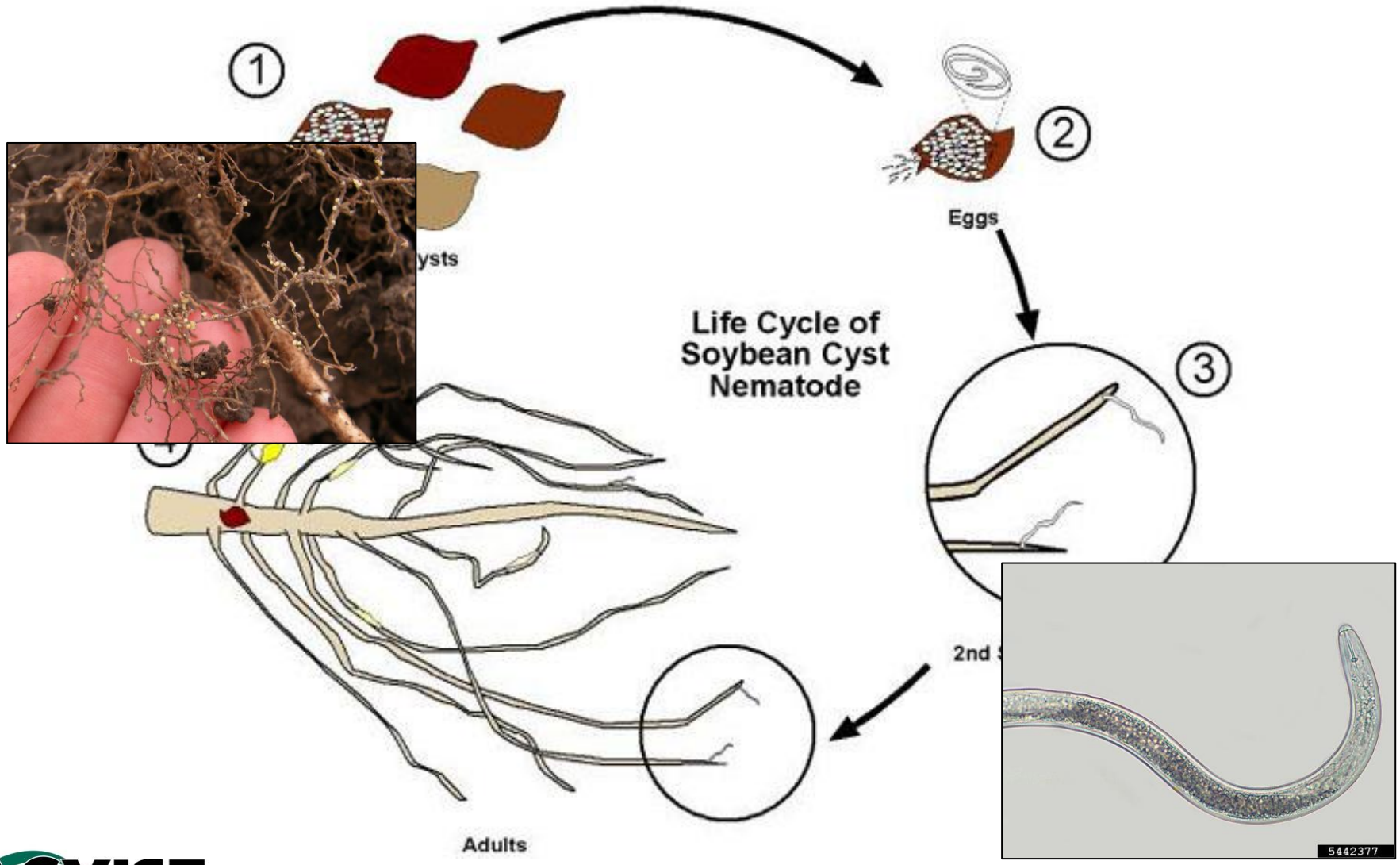


Photo courtesy of Dr. Sam Markell, NDSU

SCN Life Cycle



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www.entm.purdue.edu/nematology/lifecycle.html; Jonathan D. Eisenbeck, Virginia Polytechnic Institute and State University; https://soybeanresearchinfo.com/soybean-disease/soybean-cyst-nematode-scn/

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SCN: A quiet yield robber

- Cause over $1.5 billion in soybean yield loss annually in the United States
- Does not cause obvious above-ground symptoms until SCN is present at very high levels
- 30% yield loss can occur without any above-ground symptoms, making the pest hard to detect
- Capacity to survive long term without a soybean host
  - Dry beans also host SCN
- First reported:
  - Minnesota - 1978
  - South Dakota - 1995
  - North Dakota - 2003
  - Manitoba - 2019

Photos courtesy of Mike Janssen

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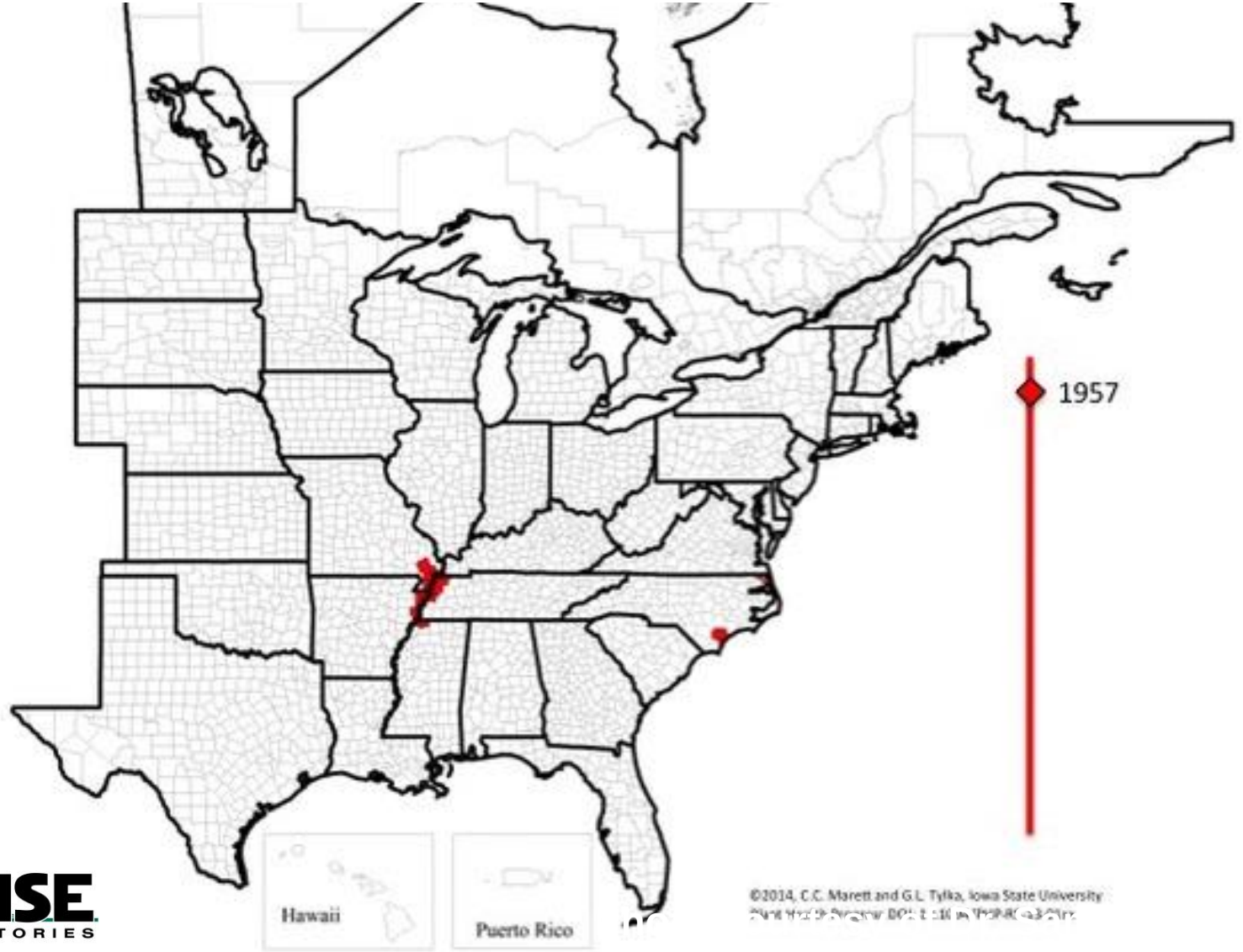
Bandara, A.Y., Weerasooriya, D. K., Bradley, C.A., Allen, T. W., and Esker, P. D. 2020. Dissecting the economic impact of soybean diseases in the United States over two decades. PLoS One 15:e0231141

SCN has marched north over time



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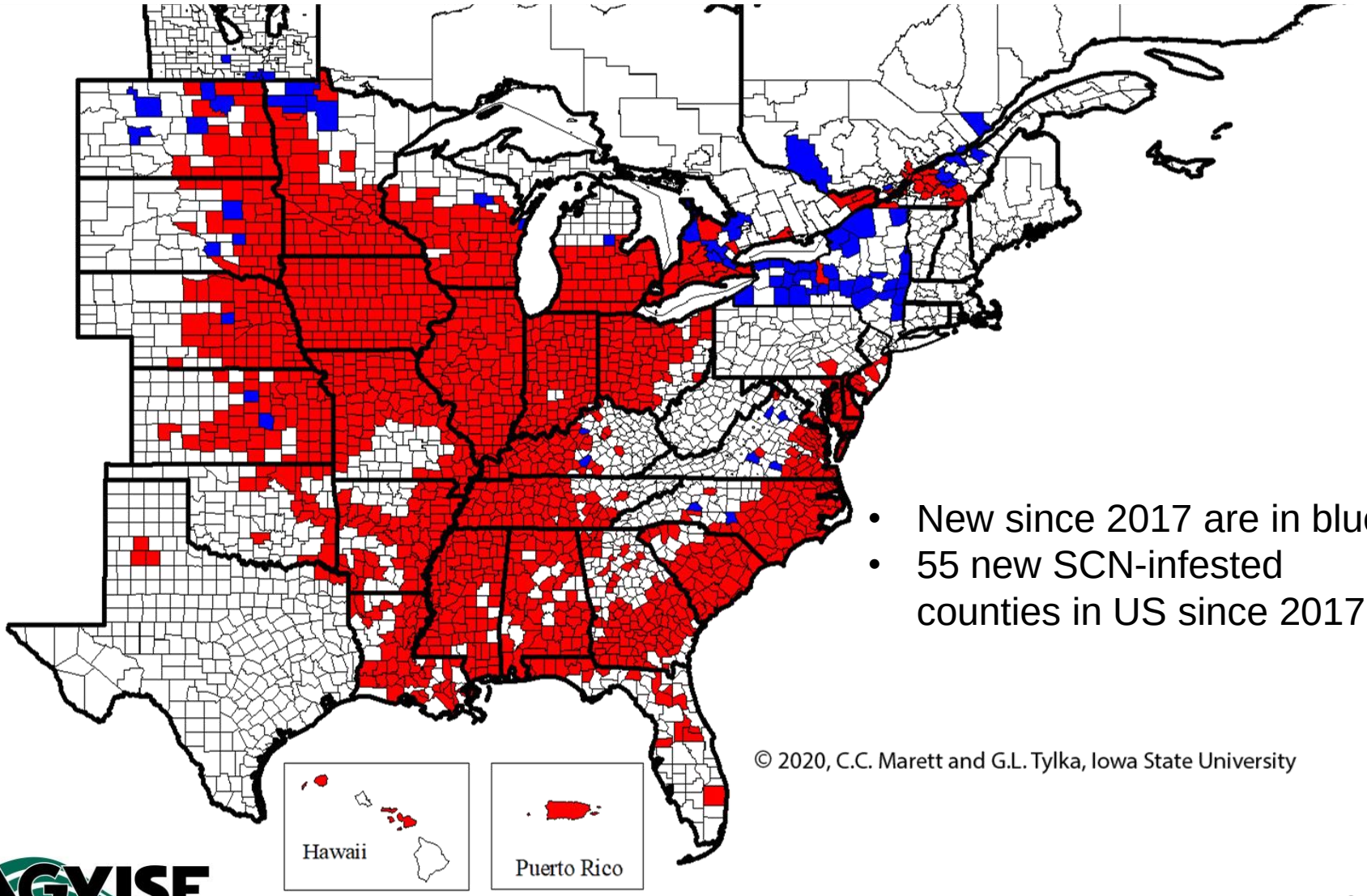
Known SCN-infested counties as of 2020



- New since 2017 are in blue
- 55 new SCN-infested counties in US since 2017

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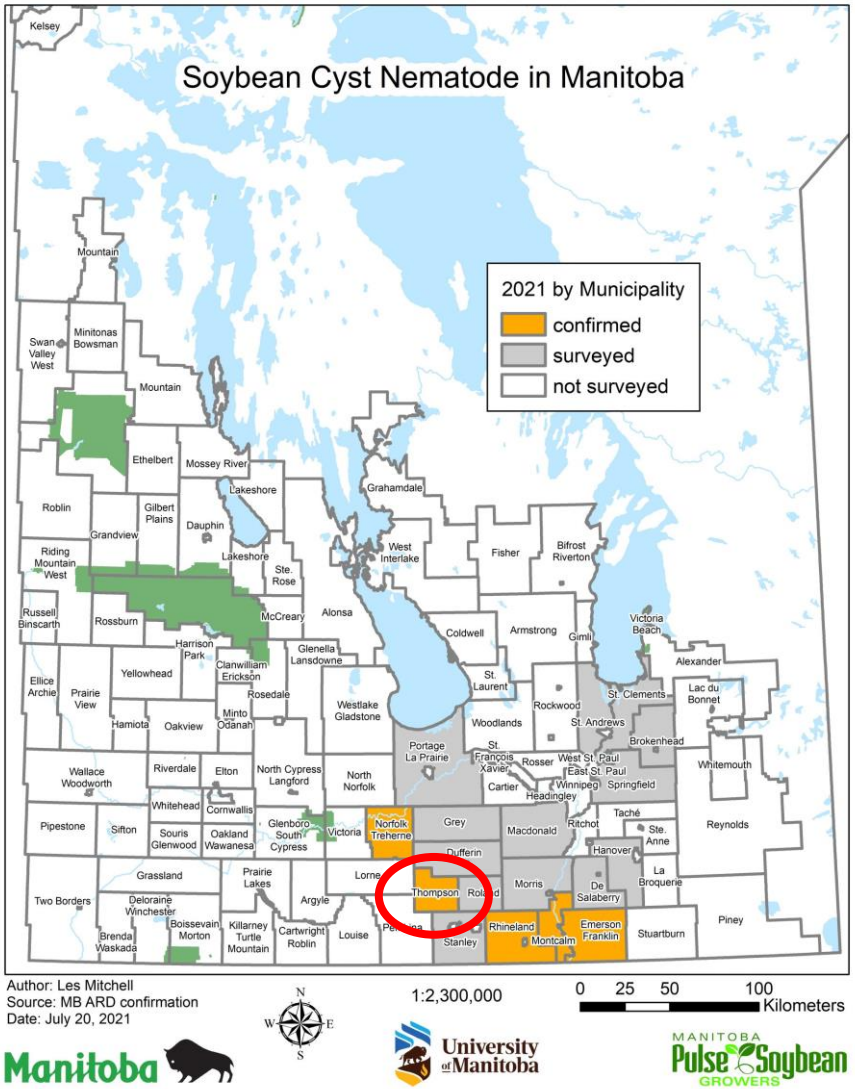
SCN has marched north over time

- R.M. Thompson confirmed to have SCN in 2021



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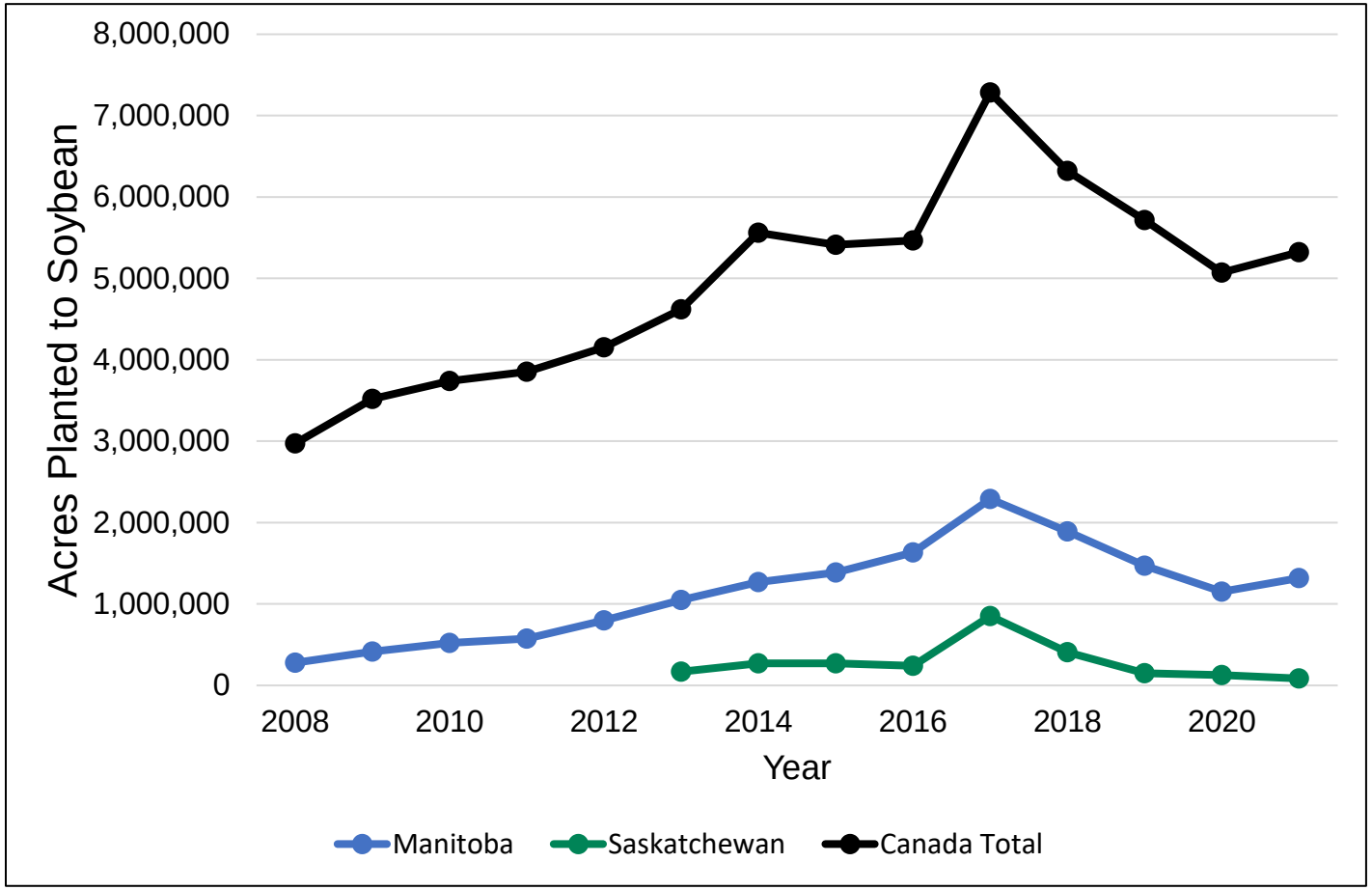
Seed Soybean Acreage in Canada 2008 - 2021



Source: Statistics Canada. Table 001-0017 – Estimated areas, yield, production and average farm price of principal field crops, in metric units, annual

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SCN-resistant soybean variety on left and SCN-susceptible variety on right.

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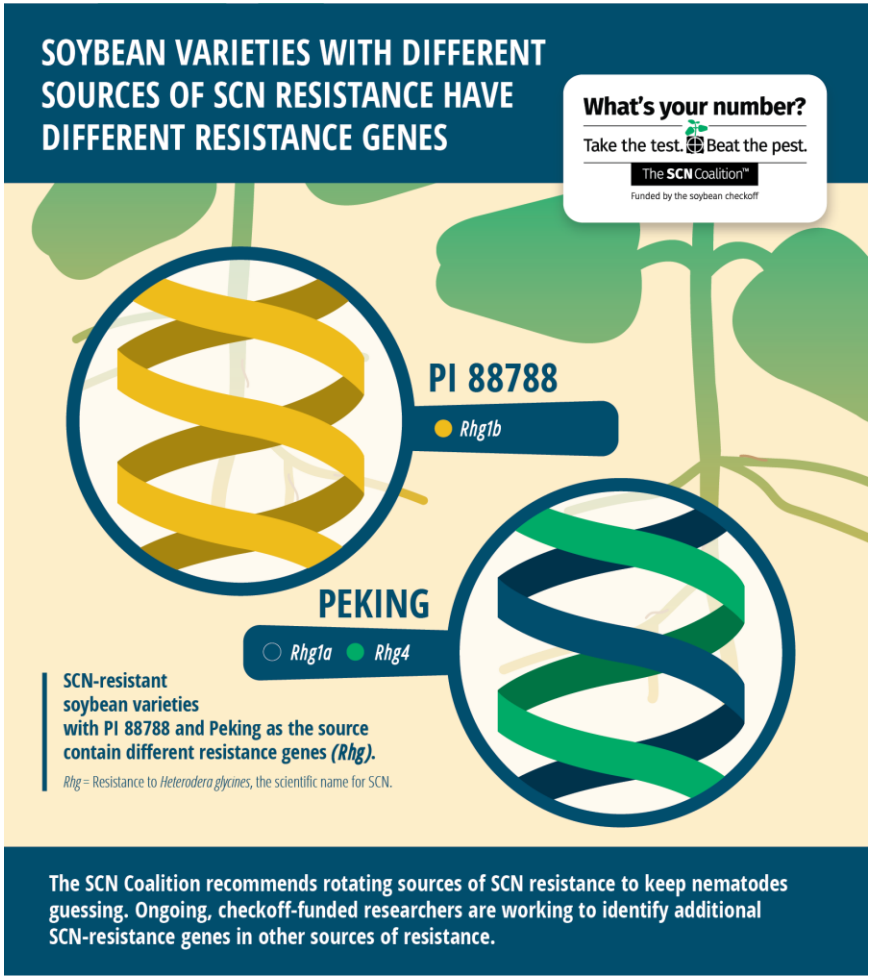
SCN Resistance Sources

- PI 88788 - Most common resistance source
- PI 54840 (Peking) - 2nd most common resistance source
- These are both breeding lines, not resistance “genes”
- SCN resistance is conferred through multiple, interconnected genes that vary in expression level in different varieties



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https://crops.extension.iastate.edu/cropnews/2020/11/scn-resistant-soybean-varieties-iowa-numbers

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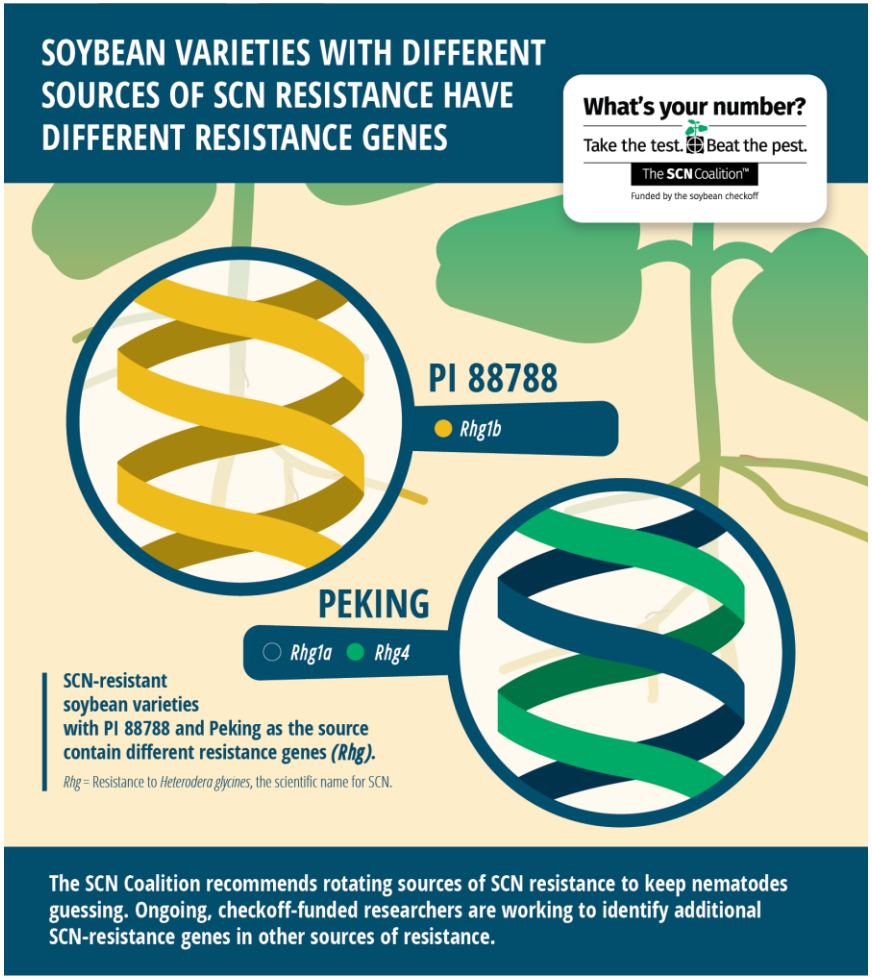
Not all PI 88788 or Peking varieties deliver the same level of resistance to SCN!



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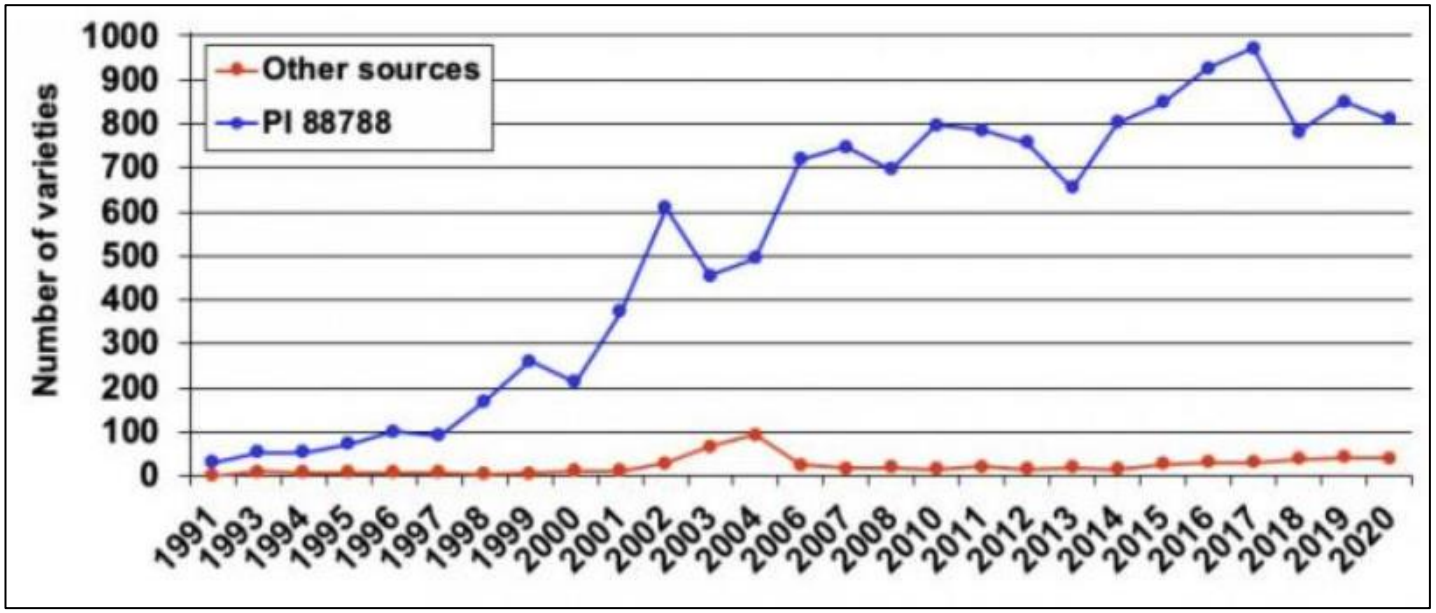
How dominant is the PI 88788 resistance source in the current soybean market?

- Other sources of resistance to SCN exist but are very hard to find in commercially available soybean varieties

Figure showing the availability of SCN-resistant soybean varieties in Iowa from 1991 to 2020



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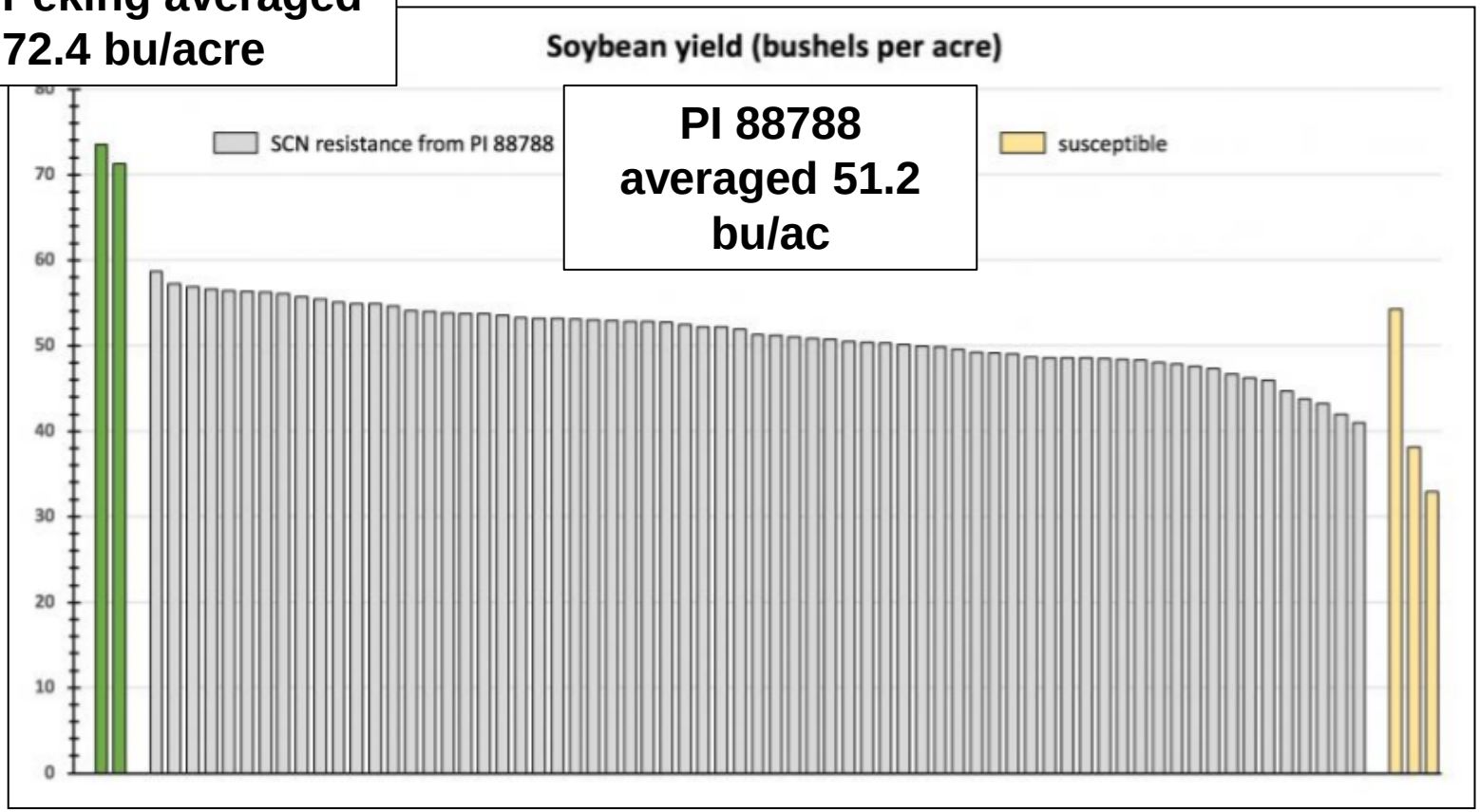
Resistance to SCN resistance

- Long-term exposure of SCN populations to one source of resistance (PI 88788) has lead to the development of SCN populations resistant to PI 88788
  - Not only an issue in Iowa, but across the Midwest
- Very few commercially available soybean varieties use resistance sources other than PI 88788

https://crops.extension.iastate.edu/cropnews/2020/01/income-scn-infested-fields-can-be-200-acre-less-pi-88788-peking-resistance

Evaluation of soybean varieties resistant to SCN in Iowa – 2019, **Yield**

Peking averaged 72.4 bu/acre



Trial conducted in SE Iowa, 72 total soybean varieties: 2 Peking, 67 PI 88788, 3 SCN susceptible

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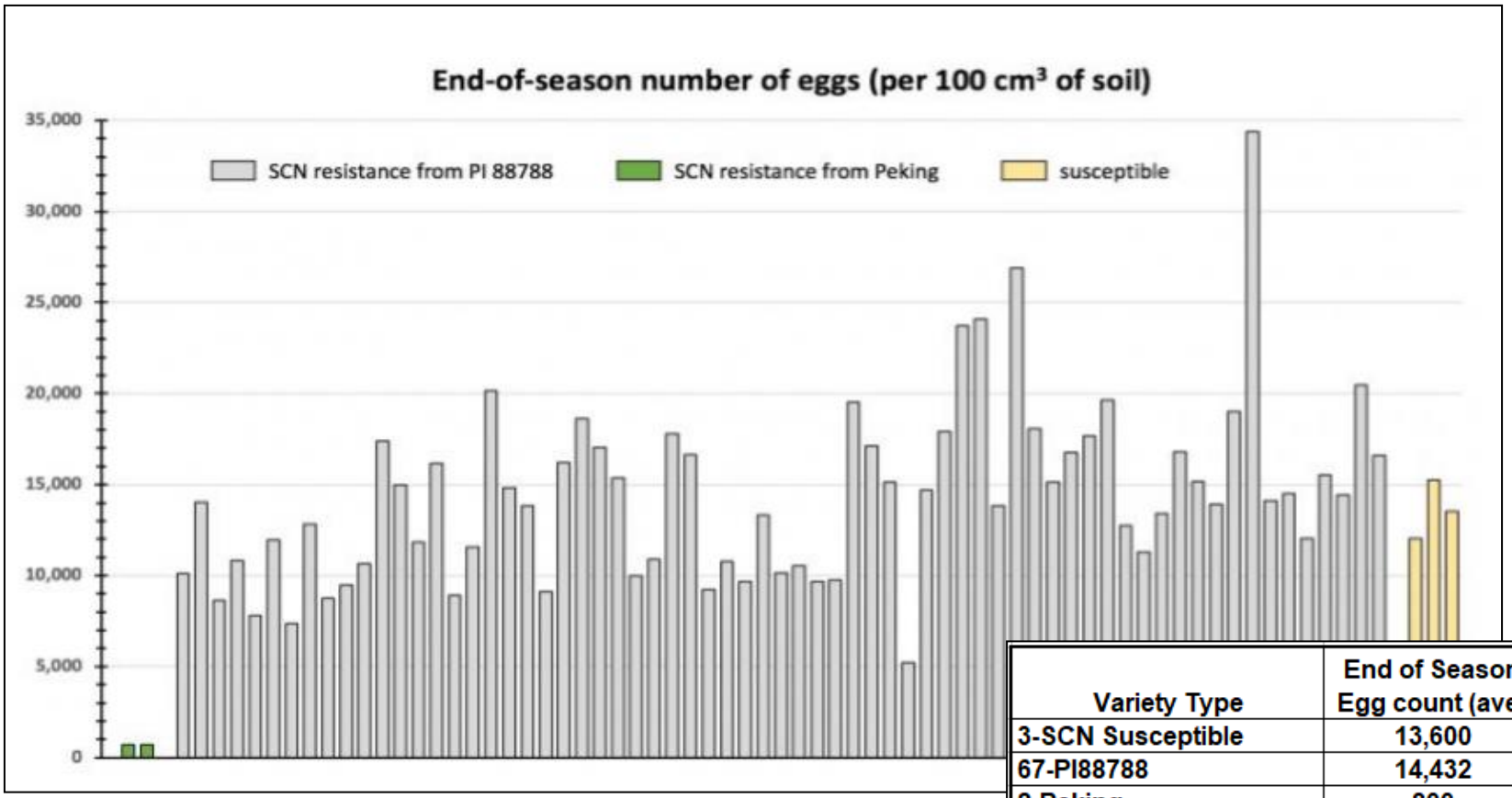
Tylka et al., 2020
https://crops.extension.iastate.edu/cropnews/2020/01/income-scn-infested-fields-can-be-200-acre-less-pi-88788-peking-resistance

Evaluation of soybean varieties resistant to SCN in Iowa – 2019, **SCN eggs**



Variety Type	End of Season Egg count (ave.)
3-SCN Susceptible	13,600
67-PI88788	14,432
2-Peking	800

End-of-season SCN egg numbers for 72 soybean varieties in an experiment near Fruitland, IA.

Beginning season SCN egg count = 4,687

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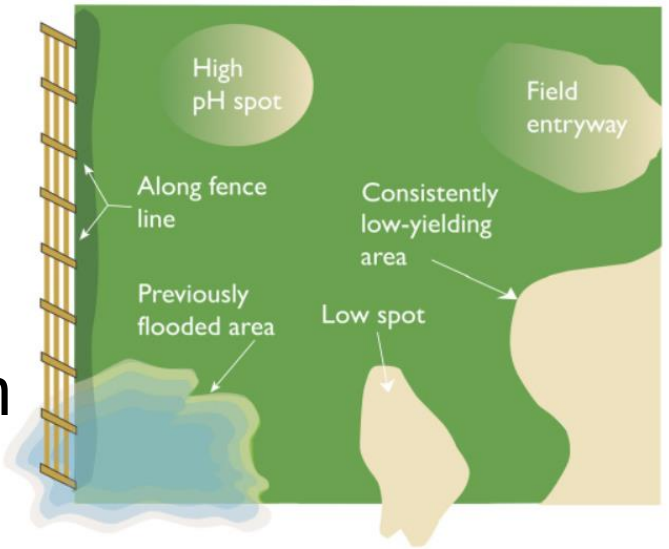
Sampling for SCN – Sampling for presence



- Identify which fields you want sampled
  - Fields intended for soybean or dry bean
- Sample at end of growing season (around harvest, before tillage)
  - Coincides with highest egg counts
- Collect 10-20 cores (15 to 20 cm depth) from the soybean row (target roots, where SCN would be)
- Target areas of the field likely to contain SCN
  - Field entry points, fence lines, ditches, flood-prone areas, inexplicable low-yielding areas
- Mix soil cores together and submit to laboratory

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Figure courtesy of Iowa State University

Sampling for SCN – Sampling to monitor

- Important for measuring how well your SCN management strategies are doing and for monitoring SCN resistance
- Two sampling times: early summer (June) and again around harvest (September)
- In the field where you know you have SCN and will be growing an SCN host crop (soybean, dry bean), choose one spot
  - Mark spot with flag and collect the GPS coordinates
  - Collect 8-10 soil cores (15 to 20 cm depth) from within the soybean row at that spot
  - Mix soil cores together and submit to laboratory
- In the fall (around harvest, before tillage), come back to that same spot and sample again

Fall numbers similar to Summer #'s
SCN management *is* working

Fall numbers much higher than Summer #'s
SCN management *is not* working

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Interpreting SCN egg count results

Soil Test Category	SCN Population (eggs/100 g soil)	University Guideline
Very low	<200	Susceptible soybean variety may be planted
Low	201-2,000	Resistant soybean variety should be planted
Medium	2,001 – 10,000	Resistant soybean variety may be planted, some yield loss expected
High	>10,000	Soybean should not be planted

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AGVISE 2020 SCN Resistance Tracking Project

Objective: Determine if there is a difference in SCN reproduction between soybean varieties with differing resistance traits

Sites: Five soybean fields near Benson, MN

Treatments:

- Peking
- PI 88788

Data collection: Sample for SCN in June, September

- Samples analyzed for SCN egg counts

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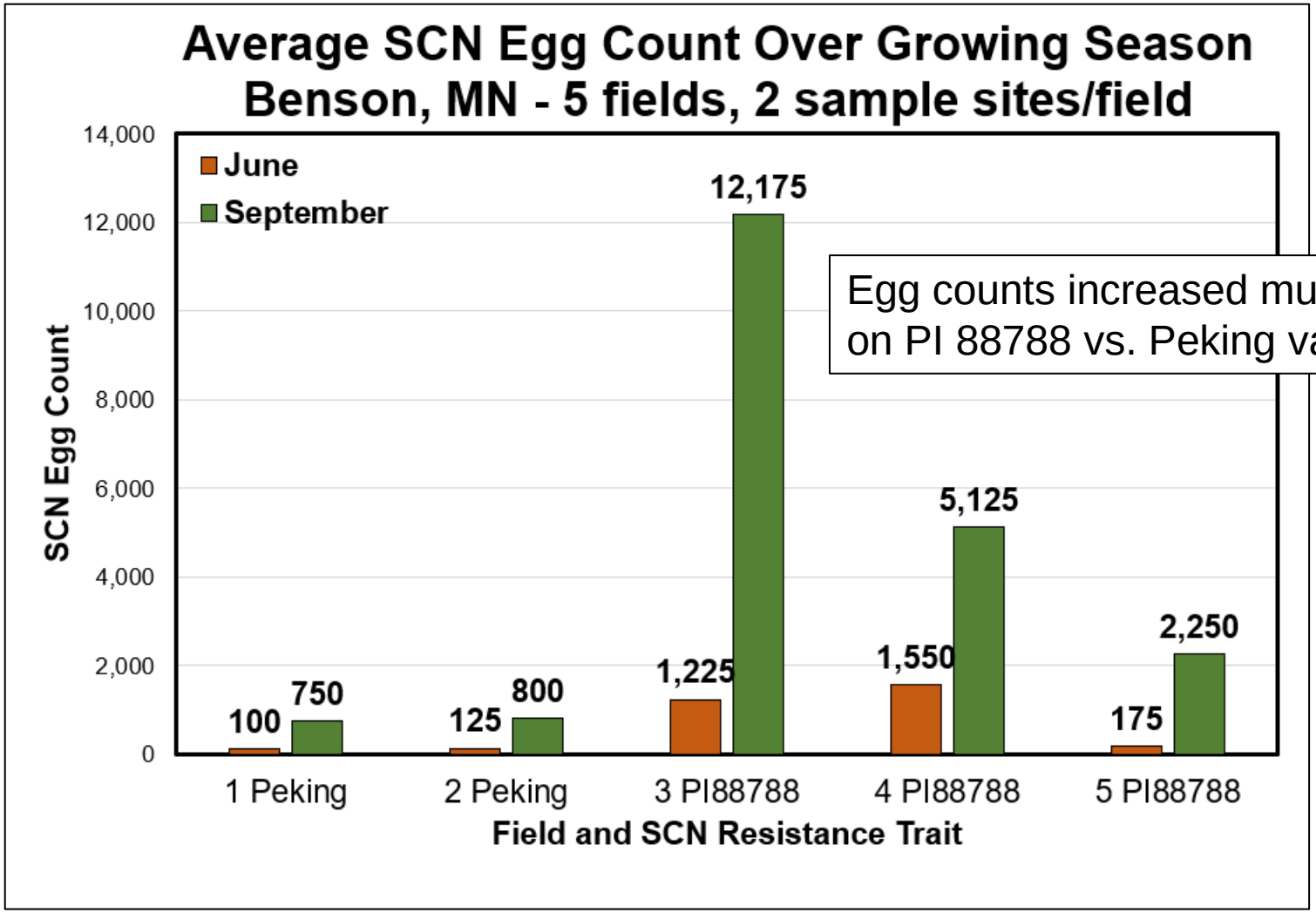

Egg counts increased much more on PI 88788 vs. Peking varieties

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AGVISE 2021 SCN Resistance Tracking Project

Objective: Determine if there is a difference in SCN reproduction and **soybean yield** between soybean varieties with differing resistance traits

Sites: Six soybean fields near Benson, MN

Treatments (both varieties planted in strips within fields):

- Peking
- PI 88788

Data collection: Sample for SCN in June, September

- Samples analyzed for SCN egg count
- Final yield collected

Project completed in cooperation with Clyde Tiffany, Pioneer Agronomist

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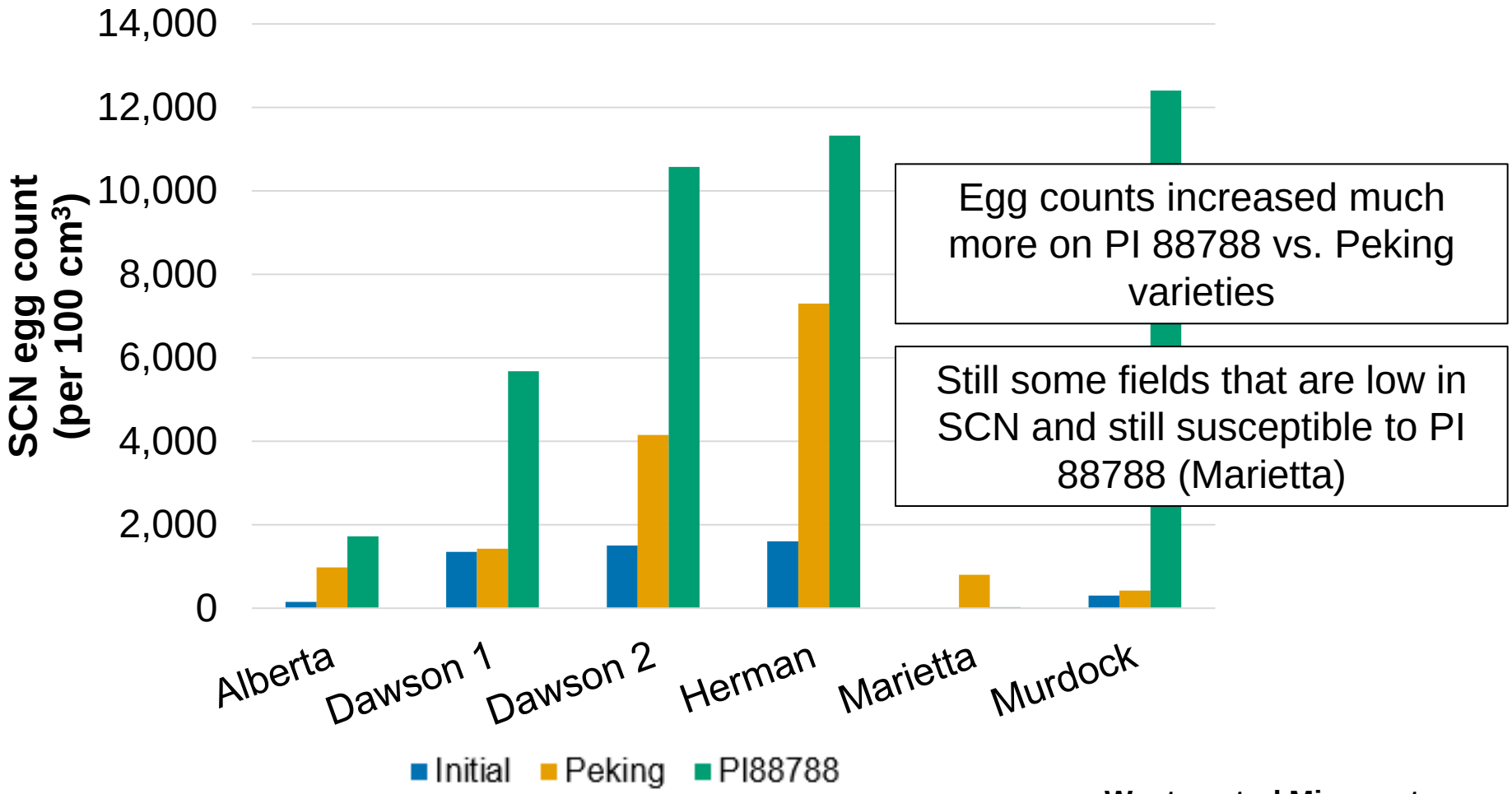
SCN Control with Peking vs. PI 88788



West central Minnesota
September 2021

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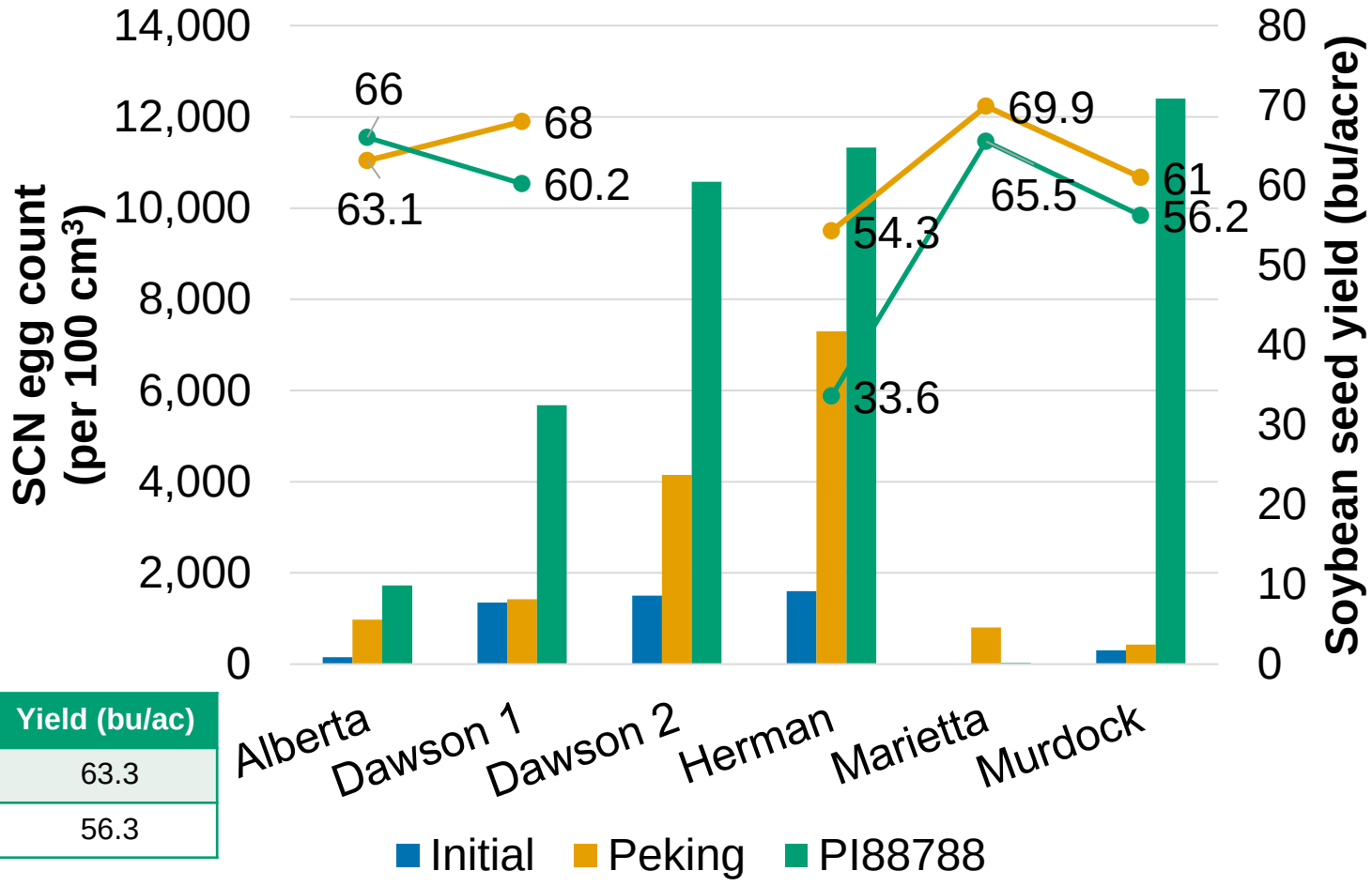
SCN Control with Peking vs. PI 88788



Trait	Yield (bu/ac)
Peking	63.3
PI 88788	56.3

West central Minnesota
September 2021

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What We've Learned

- PI 88788 resistance source is failing to reduce SCN egg production in many soybean fields in W MN
- Peking resistance source is outperforming PI 88788 in reducing SCN egg production in W MN, maintaining soybean yield
- Fields without high levels of SCN and without SCN resistance to PI 88788 do still exist (Marietta); impossible to know without a test
- Sampling in early summer and at harvest is an effective way to monitor SCN management tactics and SCN resistance on a field basis

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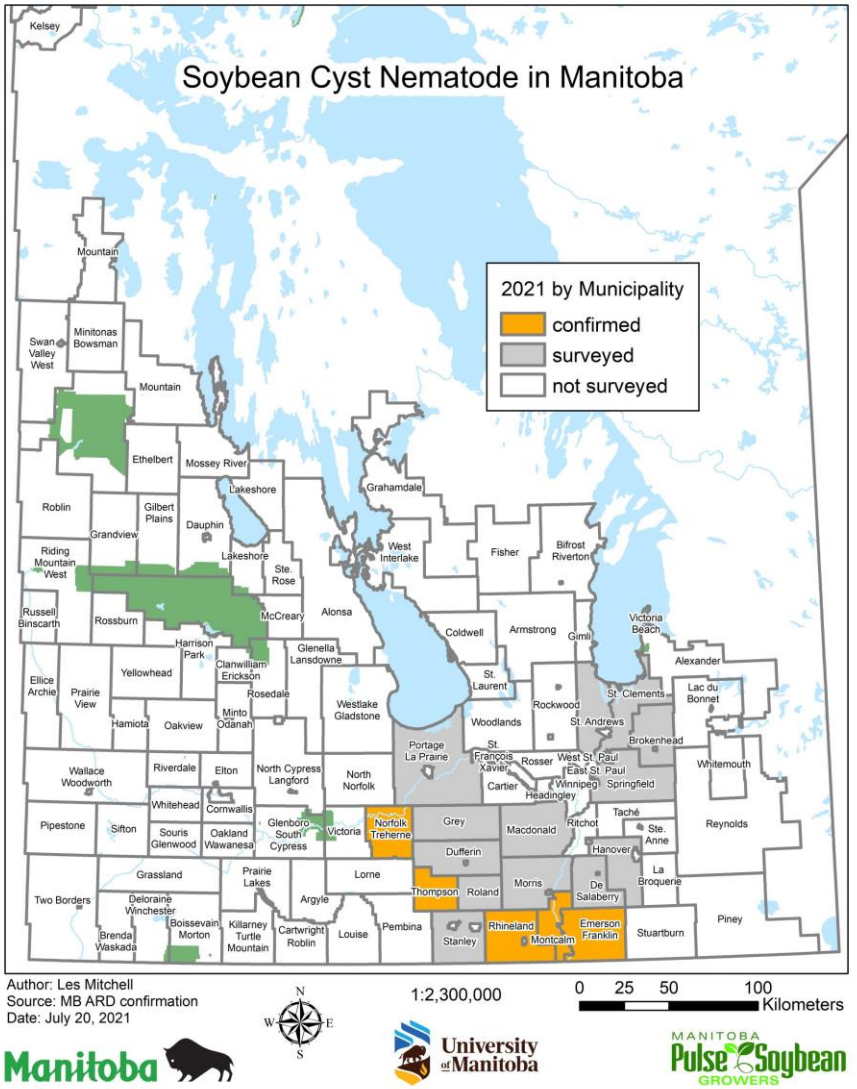
Preventing SCN

- An ounce of prevention is worth a pound of cure
- Anything that spreads soil spreads nematodes
  - Wind, water, wildlife, humans
- Buying equipment? Clean the equipment WELL where you buy it



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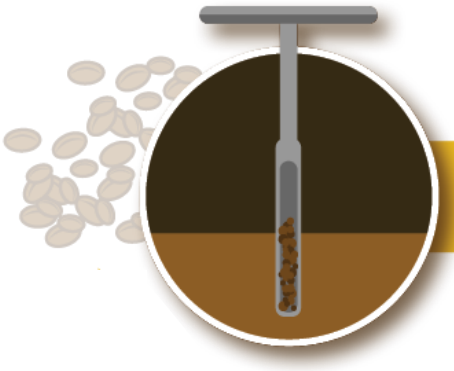
Managing SCN



The SCN Coalition recommends that farmers work with their advisors and develop a plan to actively manage SCN:

Test your fields to know your numbers.

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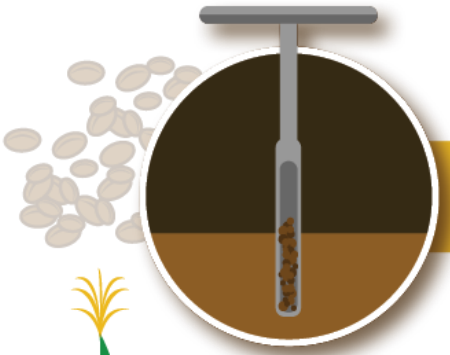
Managing SCN



The SCN Coalition recommends that farmers work with their advisors and develop a plan to actively manage SCN:

Test your fields to know your numbers.

Rotate resistant varieties.*

Rotate to non-host crops.

Consider using a seed treatment nematicide.

** SCN populations can adapt to individual resistant varieties as well as to sources of resistance such as PI 88788 and Peking. So, rotating to a different resistant variety – even if it's still PI 88788 – may help slow the buildup of SCN populations.*

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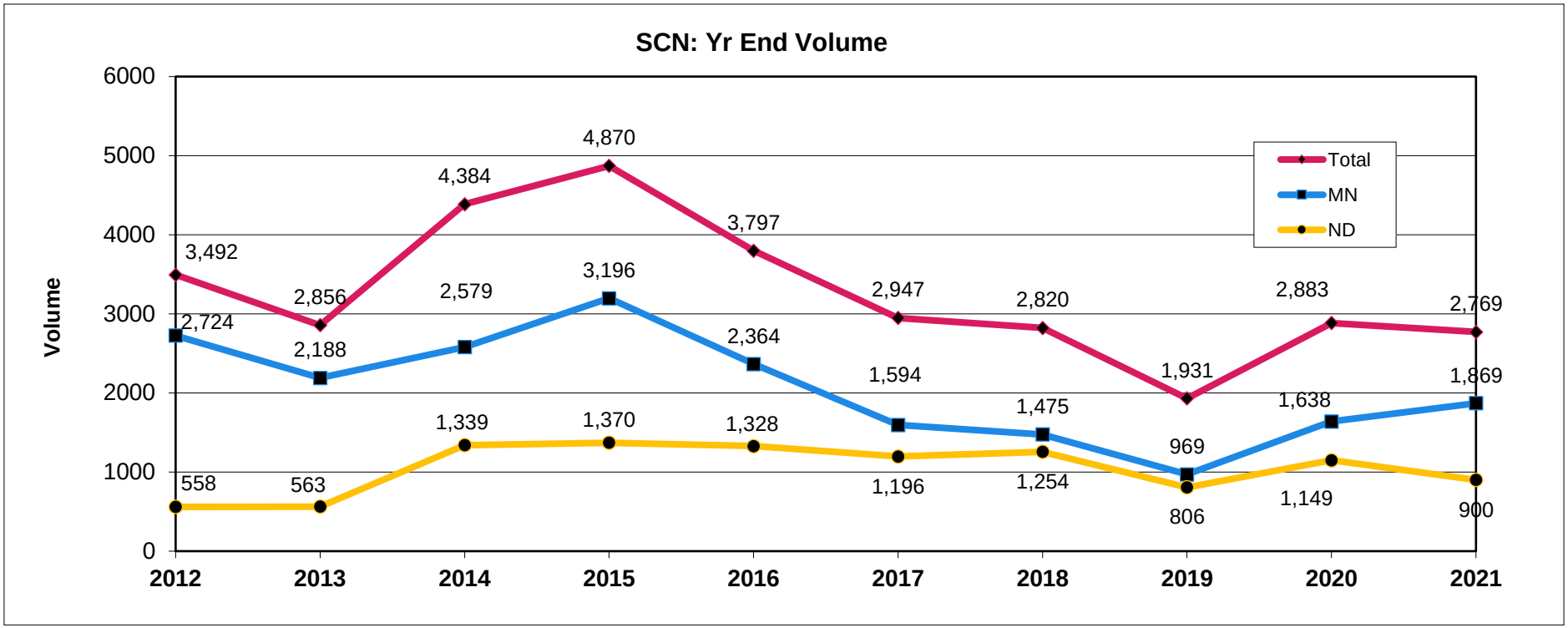
SCN samples analyzed in Benson, MN



Final Thoughts

- We need to be thinking about SCN here on the Canadian Prairies
- Testing your soybean fields for SCN is the first step in managing the problem
- PI 88788 resistance source is failing in MN
- Variety selection is crucial; talk with your soybean seed reps and ask if they're breeding soybean varieties with Peking and PI 88788 for your area

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Thank you!

Are there any questions?

Email me at jodi@agvise.com