SCN Management for 2025 and Beyond

Greg Tylka, Iowa State University

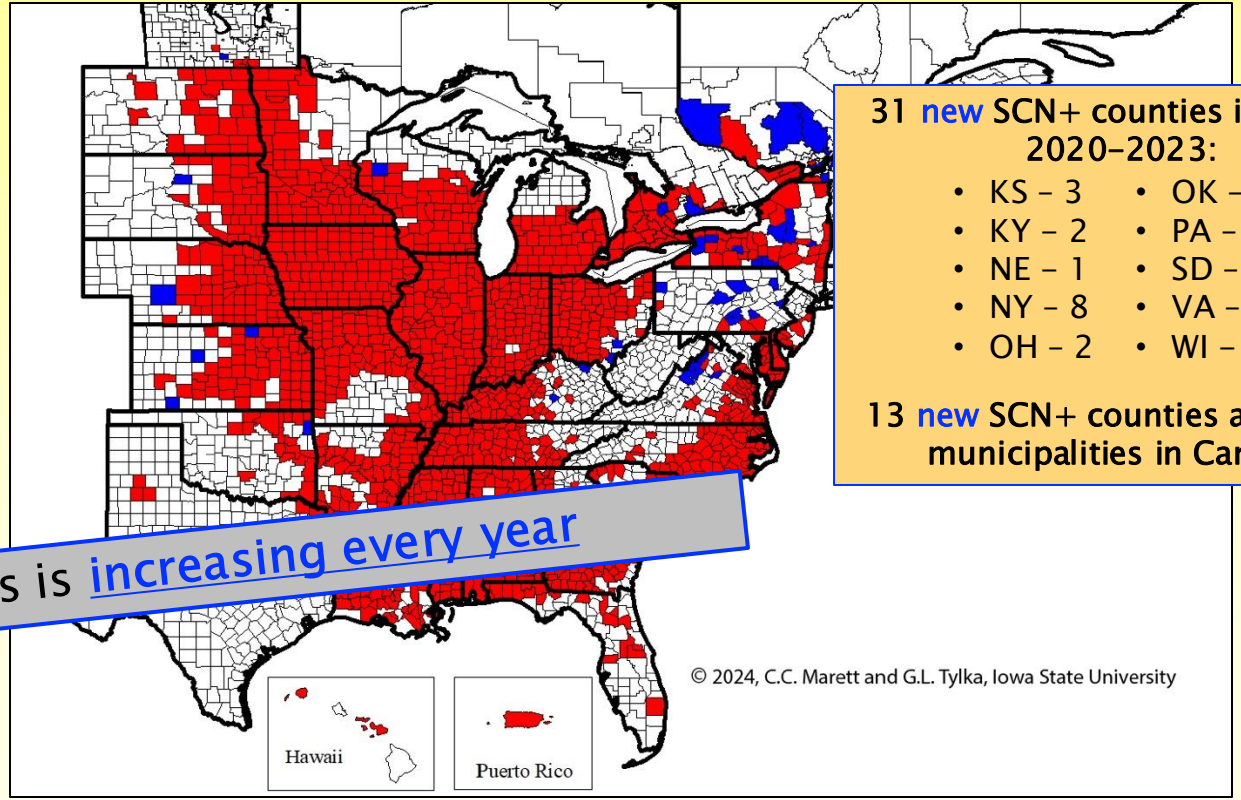
Soybean Cyst Nematode (SCN)

- most damaging pathogen of soybean in the Midwest
  - In U.S. and Ontario, $1.5 billion yield loss annually from 1996 through 2016.

- yield loss is increasing every year

Known Distribution of SCN in the U.S. and Canada 1954 through 2023

West Virginia is only soybean state in which SCN has not been found



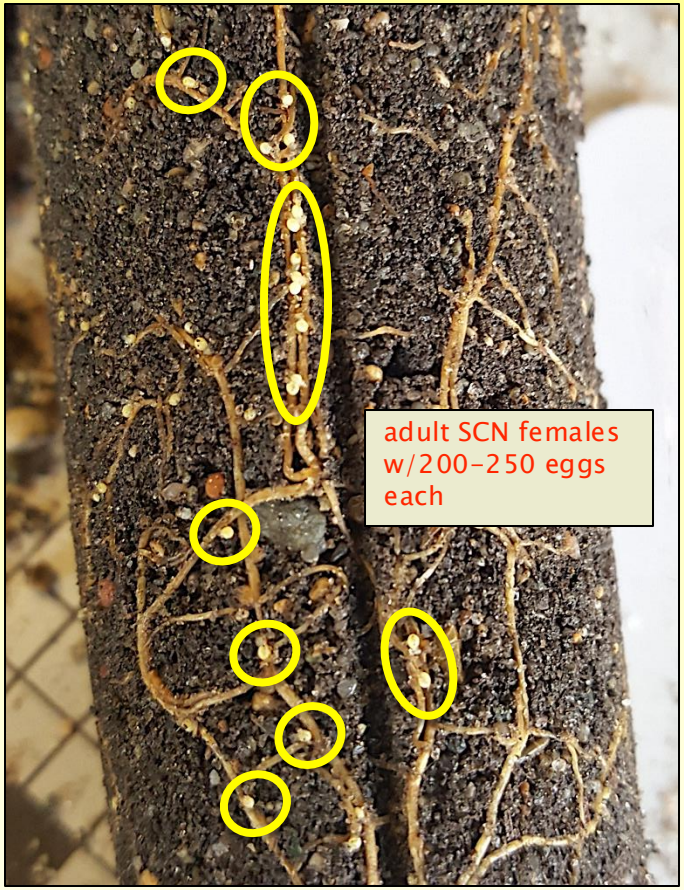
31 new SCN+ counties in the US 2020–2023:

- KS – 3
- KY – 2
- NE – 1
- NY – 8
- OH – 2
- OK – 1
- PA – 8
- SD – 1
- VA – 4
- WI – 1

13 new SCN+ counties and rural municipalities in Canada

yield loss is increasing every year

SCN-infested fields often do not show obvious stunting and/or yellowing!

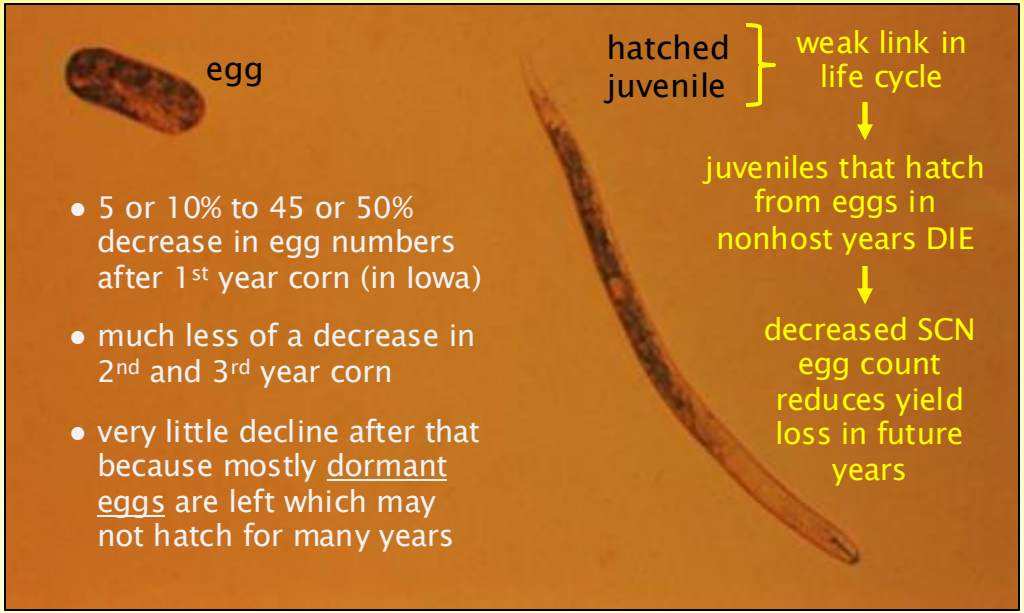


yield loss is increasing every year

Tools to Manage SCN

- nonhost crops (corn)
- resistant soybean varieties
- nematode-protectant seed treatments

Nonhost Crops (corn)



SCN females full of 200–250 eggs

SCN cyst full of 200–250 eggs

No nonhost crop is better or worse at reducing SCN numbers (as far as we know).

There is no reliable way to "trick" or increase SCN eggs to hatch when nonhosts are growing.

Tools to Manage SCN

- nonhost crops (corn)
- resistant soybean varieties

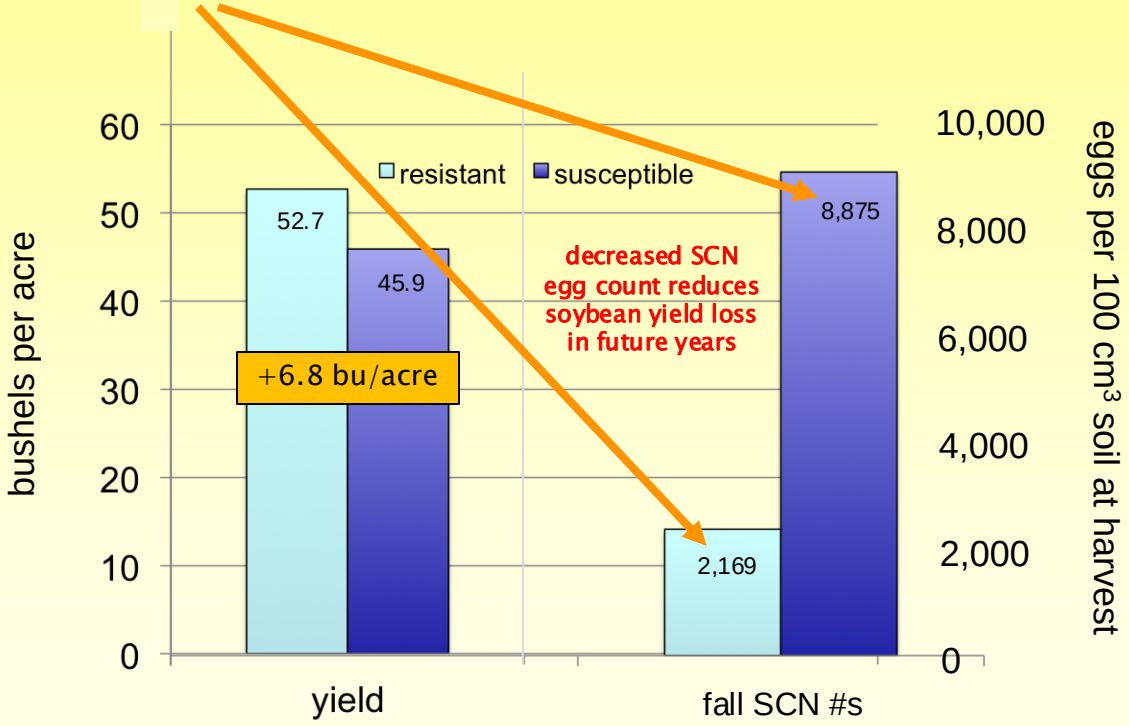
SCN-resistant Soybean Varieties

susceptible soybean variety

resistant soybean variety

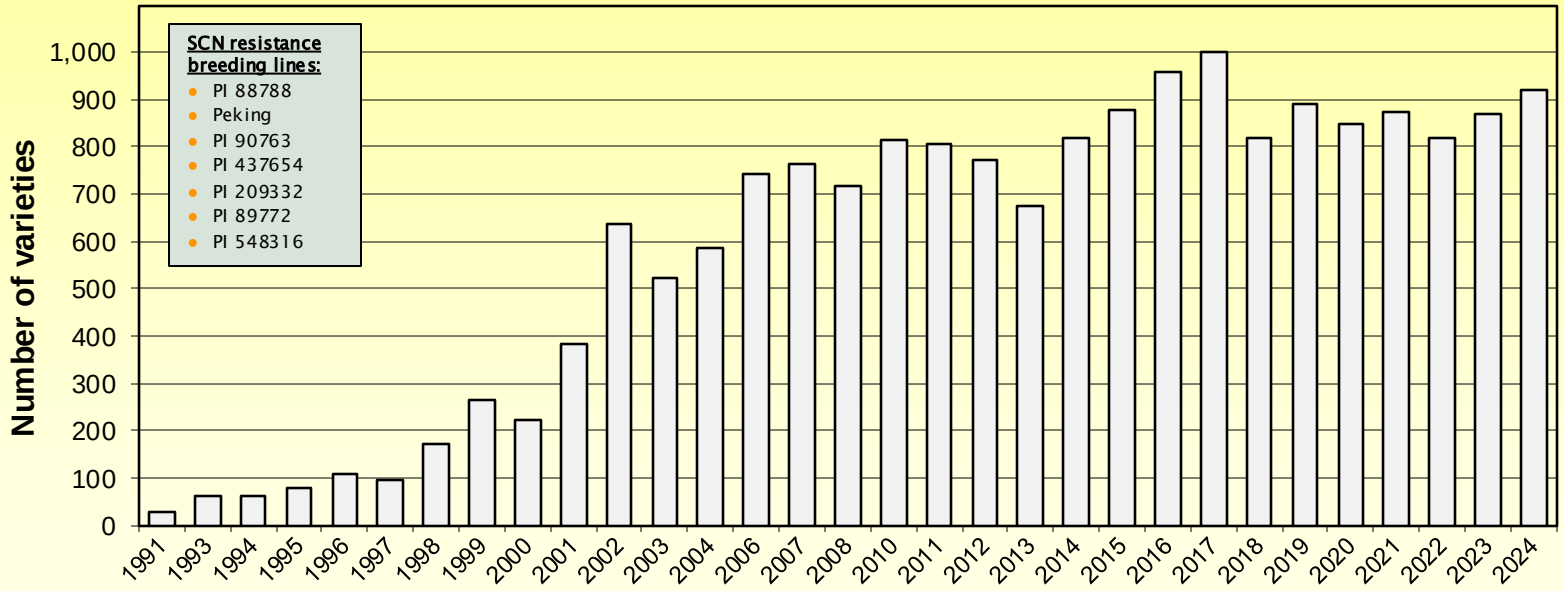
Yield and SCN Control
SCN-resistant vs Susceptible Soybean Varieties in the 1990s

(1,310 eggs/100 cm³ at planting)



Number of SCN-resistant Soybean Varieties Available for Iowa 1991 – 2024

late MG 0, 1, 2, 3



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Number of SCN-resistant Soybean Varieties Available for Iowa 1991 – 2024

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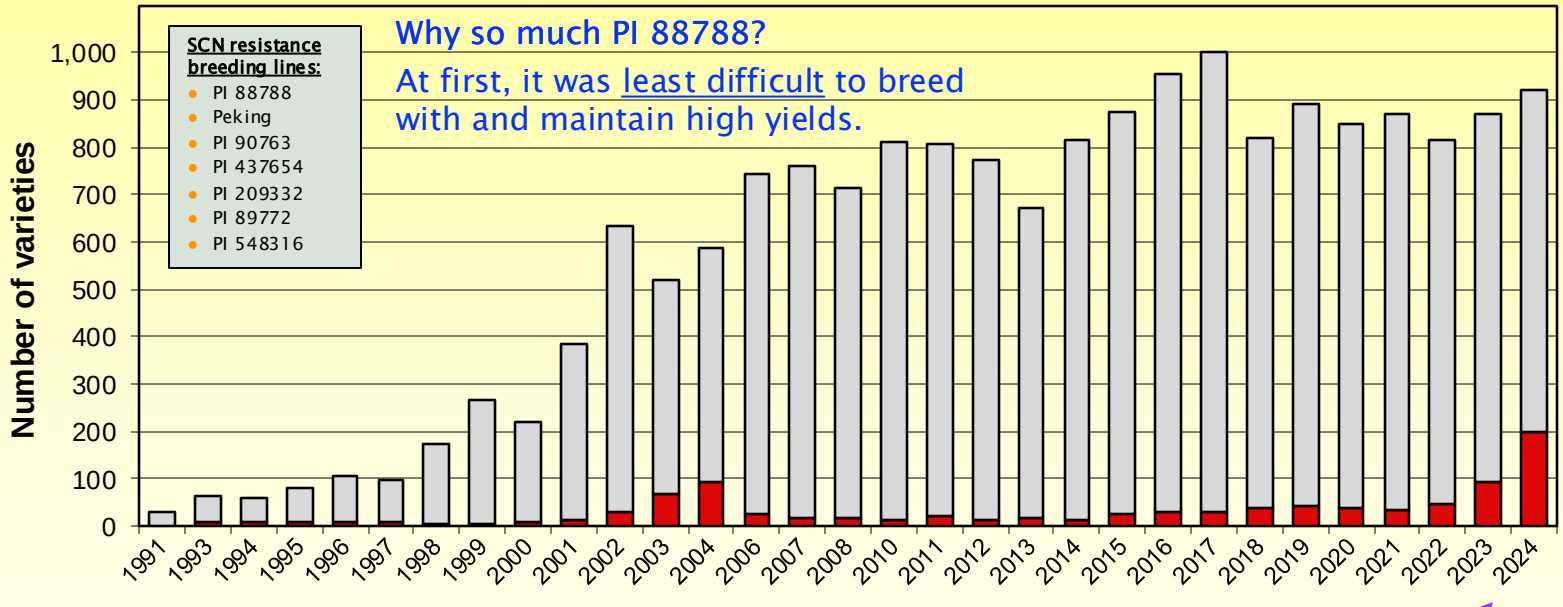

Search online for "ISU Extension CROP 1649"

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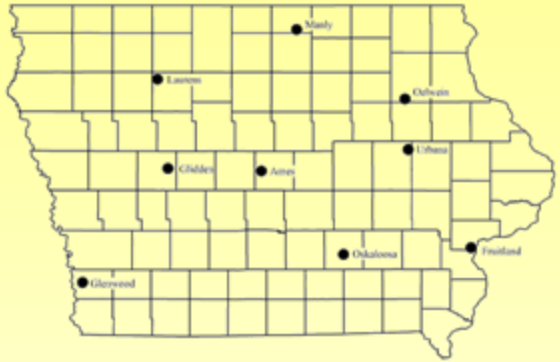
SCN-resistant Soybean Varieties

- not all resistant varieties yield equally; not all varieties suppress SCN #s equally

Iowa State University SCN-resistant Soybean Variety Trial Program



Search online for
"ISU Extension IPM 52"

experimental site selection

- three each year in northern, central, and southern Iowa
- arbitrarily selected **farmer fields**, always following corn
- experiments never on land used previously for plots
- 72 varieties per location, 4 replicate plots per variety
- same varieties studied in northern or central **or** southern Iowa

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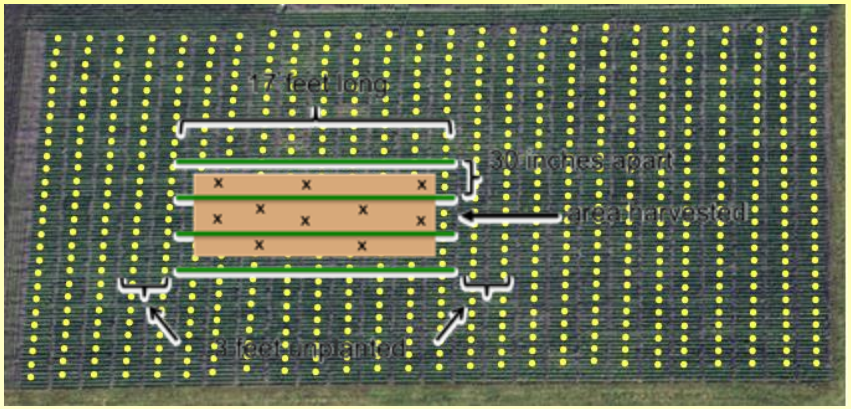
Iowa State University SCN-resistant Soybean Variety Trial Program



- we measure yield and collect a 10-core soil sample from each **4-row plot** at planting and at harvest to determine SCN egg numbers
- leftover soil from samples collected at planting is mixed, then reproduction of the SCN population in each field is measured on PI 88788 and Peking

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- Peking
- PI 88788
- susceptible

Percent reproduction (female index):

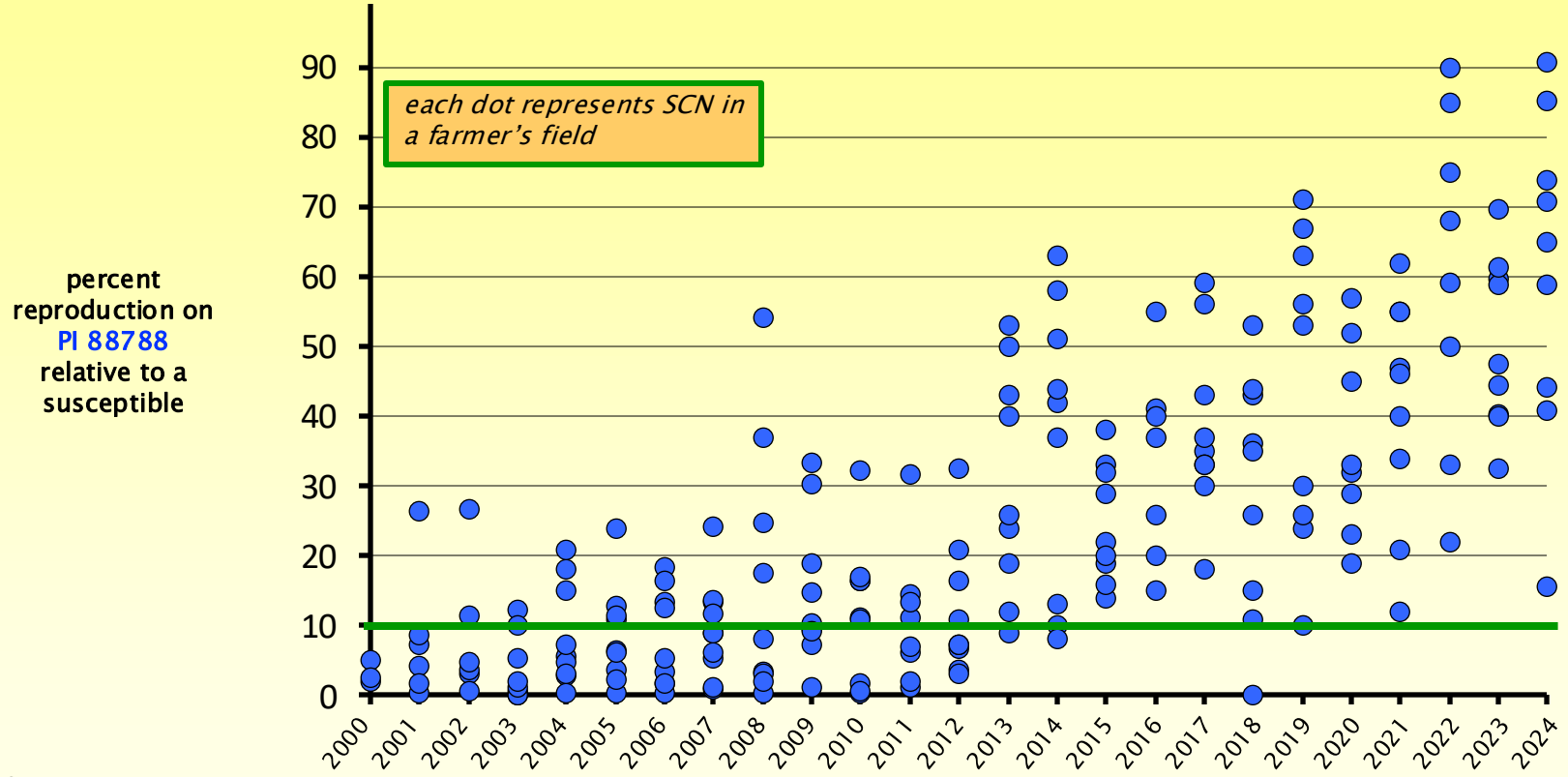
on PI 88788 ÷ # on susceptible

on Peking ÷ # on susceptible

scientific definition of effective resistance against SCN: ≤10%

Reproduction of Iowa SCN populations on PI 88788:

- 25 growing seasons
- 210 Iowa field locations



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Reproduction of Iowa SCN populations on Peking:

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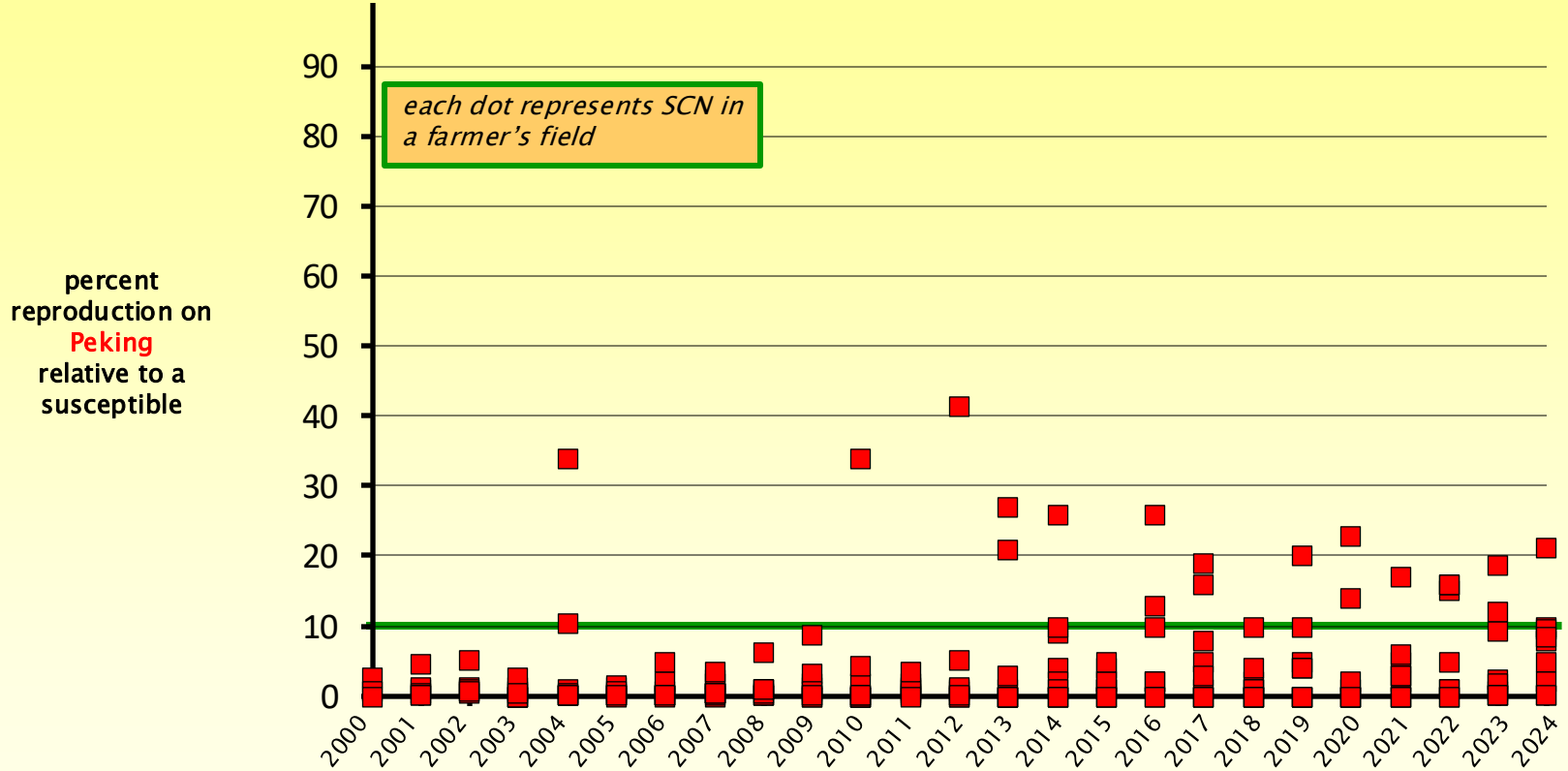

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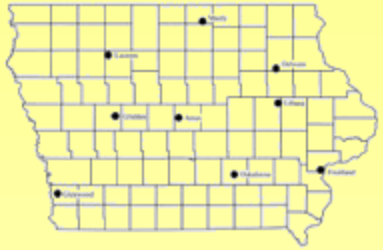
Fruitland (SE Iowa) 2019

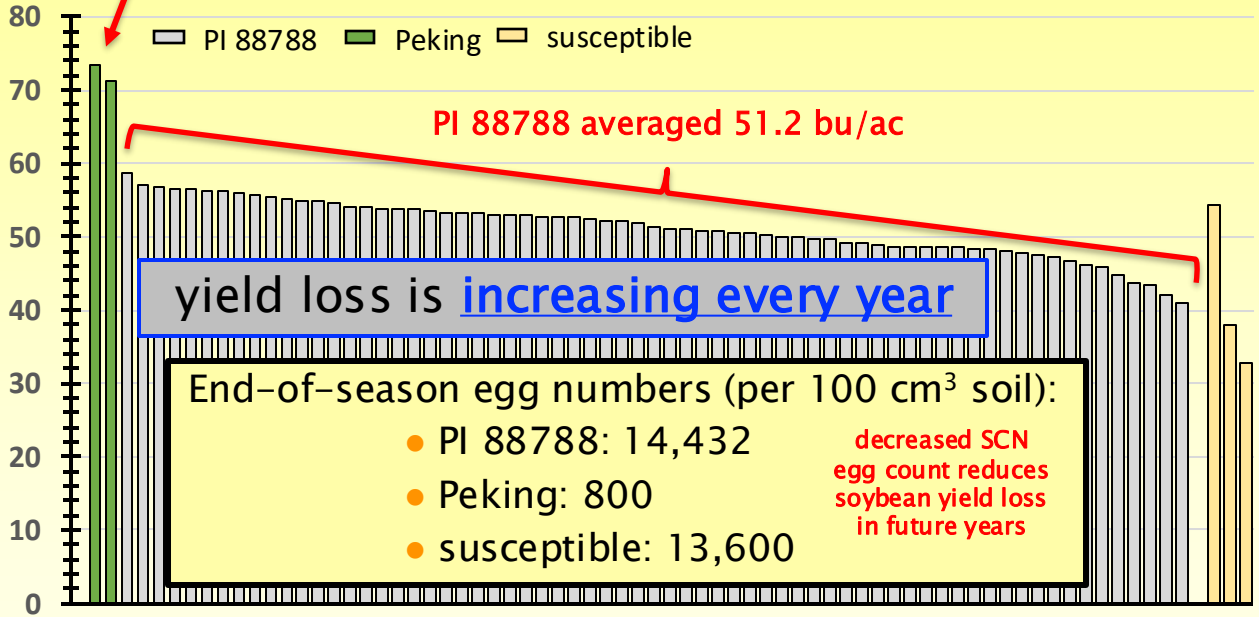


Peking averaged 72.4 bu/ac

- P_i = 4,687 eggs per 100 cm^3 soil
- 71% reproduction on PI 88788
- 0% reproduction on Peking

72 varieties

- 67 PI 88788
- 2 Peking
- 3 susceptible



21.2 bu/ac x $9/bu (2019) = $191/ac lost income

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Fruitland (SE Iowa) 2023

72 varieties

- 61 PI 88788
- 9 Peking
- 2 susceptible

decreased SCN egg count reduces soybean yield loss in future years

Brand	Variety	Relative Maturity	Resistance	Herbicide Technology[1]	SCN # (eggs/100cc)[2]	SCN RF[3]	Yield (bu/acre)
Hoegemeyer Hybrids	3413 E	3.4	Peking	E3	350	0.3	80.3
Champion	3234EN	3.2	Peking	E3	425	0.4	79.2
Xitavo	XO 2963E	2.9	Peking	E3	1,050	1.0	79.1
Hoegemeyer Hybrids	2763 E	2.7	Peking	E3	425	0.4	76.9
Stine	27EE32	2.7	Peking	E3	1,075	1.1	75.8
Nutech	34N02E	3.4	Peking	E3	300	0.2	75.7
Xitavo	XO 3224E	3.2	Peking	E3	200	0.2	75.4
Beck	3300E3	3.3	Peking	E3	500	0.3	74.8
Stine	33EG02	3.3	Peking	E3	775	0.6	73.3
NK	NK30-B2E3	3.0	PI 88788	E3	11,475	6.1	63.9
Champion	324E Blend	3.2	Peking/PI 88788	E3	7,775	5.7	62.4
AgriGold	G3279E3	3.2	PI 88788	E3	15,225	9.7	62.3
FS HiSOY	HS 33E20	3.3	PI 88788	E3	12,625	14.0	60.7
Kruger	K3814XF	3.8	PI 88788	XF	14,075	9.9	60.6
LG Seeds	LGS3434XF	3.4	PI 88788	XF	7,600	12.2	60.4
ASGROW	AG39XF3	3.9	PI 88788	XF	17,150	14.9	60.0
NK	NK35-E3	3.5	PI 88788	E3	22,175	35.5	59.5
Xitavo	XO 3483E	3.4	PI 88788	E3	10,750	10.8	59.0
LATHAM	L 3479 E3	3.4	PI 88788	E3	13,925	9.8	58.6
FS HiSOY	HS 35E10	3.5	PI 88788	E3	19,750	10.1	57.1
P3	2331E	3.1	PI 88788	E3	12,600	9.7	57.0
Dyna-Gro	S31EN14	3.1	PI 88788	E3	12,150	24.3	56.7
Pioneer	P29A19E	2.9	PI 88788	E3	19,625	17.4	56.1
LG Seeds	LGS3216E3	3.2	PI 88788	E3	14,675	8.9	56.0
Pioneer	P37A18E	3.7	PI 88788	E3	36,825	36.8	55.0
Merschman	Monroe 2337E	3.7	PI 88788	E3	13,550	13.6	54.8
Xitavo	XO 3803E	3.8	PI 88788	E3	14,050	11.5	54.7
AgriGold	G3692XF	3.6	PI 88788	XF	24,700	32.9	54.2

9.4–16.4 bu/ac more than top-yielding variety with PI 88788

- P_i = 1,174 eggs per 100 cm^3 soil
- 48% reproduction on PI 88788
- 0% reproduction on Peking

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Laurens (NW Iowa) 2023

ISU Extension IPM 52

72 varieties

- 45 PI 88788
- 25 Peking
- 2 susceptible

Brand	Variety	Relative Maturity	Resistance	Herbicide Technology[1]	SDS Index[2]	SCN # (eggs/100cc)[3]	SCN RF[4]	Yield (bu/acre)
AgriGold	G2450XF	2.4	PI 88788	XF	1.9	5,275	1.4	75.5
LG Seeds	LGS2505E3	2.5	Peking	E3	1.1	400	0.2	73.2
Dyna-Gro	S25EN74	2.5	Peking	E3	3.3	675	0.2	73.1
LATHAM	L 1881 E3	1.8	Peking	E3	0.8	750	0.3	72.5
LG Seeds	LGS1832E3	1.8	Peking	E3	0.0	925	0.1	72.4
NK	NK19-T8E3S	1.9	Peking	E3	1.4	775	0.2	72.3
Hoegemeyer Hybrids	1903 E	1.9	Peking	E3	3.3	600	0.2	72.1
Champion	2093EN	2.0	Peking	E3	0.8	725	0.3	71.7
ASGROW	AG22XF3	2.2	PI 88788	XF	2.5	6,975	4.5	71.5
ASGROW	AG19XF3	1.9	PI 88788	XF	2.8	3,475	0.7	71.0
Cornelius	CB18XF88	1.8	PI 88788	XF	0.0	3,875	1.1	70.7
Hoegemeyer Hybrids	2484 E	2.1	Peking	E3	2.2	1,325	0.4	70.7
Kruger	K2115XF	2.1	PI 88788	XF	4.2	5,625	1.1	70.0
P3	2218E							69.9
NK	NK20-1							69.5
Champion	1994EN							69.4
AgriGold	G2107E3	2.1	Peking	E3	1.1	775	0.3	69.3
Xitavo	XO 1822E	1.8	PI 88788	E3	4.4	2,200	0.7	69.3
Golden Harvest	GH2004XF	2.0	PI 88788	XF	0.3	2,625	0.8	69.1
LG Seeds	LGS2364XF	2.3	PI 88788	XF	1.9	6,075	1.5	68.8
LATHAM	L 2031 E3	2.0	Peking	E3	1.1	1,025	0.6	68.5
Hoegemeyer Hybrids	2123 E	2.1	Peking	E3	3.1	1,425	0.3	68.1
Channel	2123RXF	1.9	PI 88788	XF	3.1	4,350	1.0	68.0
Loyal Brand	L2150E	2.1	PI 88788	E3	0.3	1,000	0.2	67.6
ASGROW	AG24XF3	2.4	PI 88788	XF	0.8	4,400	1.0	67.6
Pioneer	P18A73E	1.8	Peking	E3	1.1	500	0.1	67.6
Pioneer	P23A40E	2.3	PI 88788	E3	0.8	5,850	2.1	67.1
Xitavo	XO 1632E	1.6	PI 88788	E3	4.4	3,975	1.0	67.1
Stine	20EG02	2.0	PI 88788	E3	1.7	2,775	0.5	67.0
Golden Harvest	GH1973E3S	1.9	Peking	E3/STS	0.3	650	0.2	67.0
Nutech	22N03E	2.2	PI 88788	E3	0.8	2,825	0.9	66.9
Beck	2009XF	2.0	PI 88788	XF	16.1	3,125	1.1	66.7
NK	NK16-Z6E3	1.6	Peking	E3	11.7	475	0.2	66.4
Nutech	20N05E	2.0	PI 88788	E3	2.2	3,500	1.1	66.3
Loyal Brand	L2130E	2.1	PI 88788	E3	5.6	3,625	0.9	66.1
AgriGold	G2306XF	2.3	PI 88788	XF	2.2	4,750	2.0	65.6

Your yields may vary.

no significant difference

- P_i = 3,537 eggs per 100 cm^3 soil
- 60% reproduction on PI 88788
- 0% reproduction on Peking

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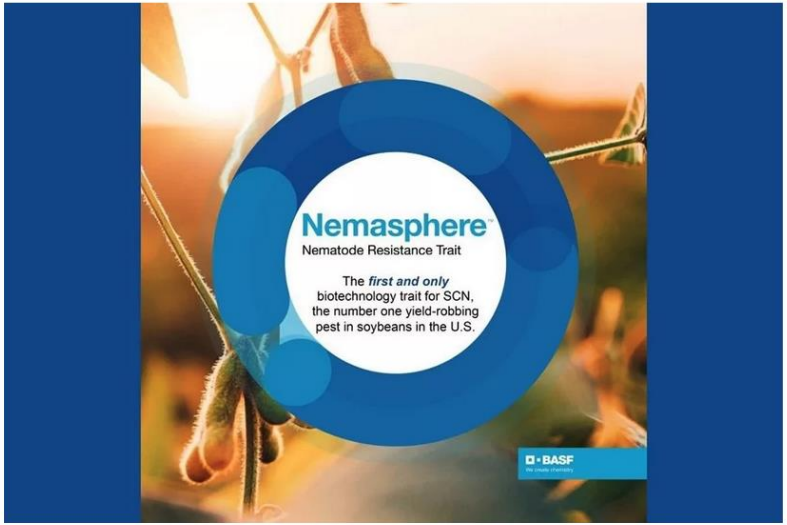
Nemasphere™

Bt-based SCN resistance approved by EPA in 2020 and will be available by 2028

BASF Introduces Nematode Resistant Trait for Soybeans

by Sabrina Halvorson | July 4, 2024

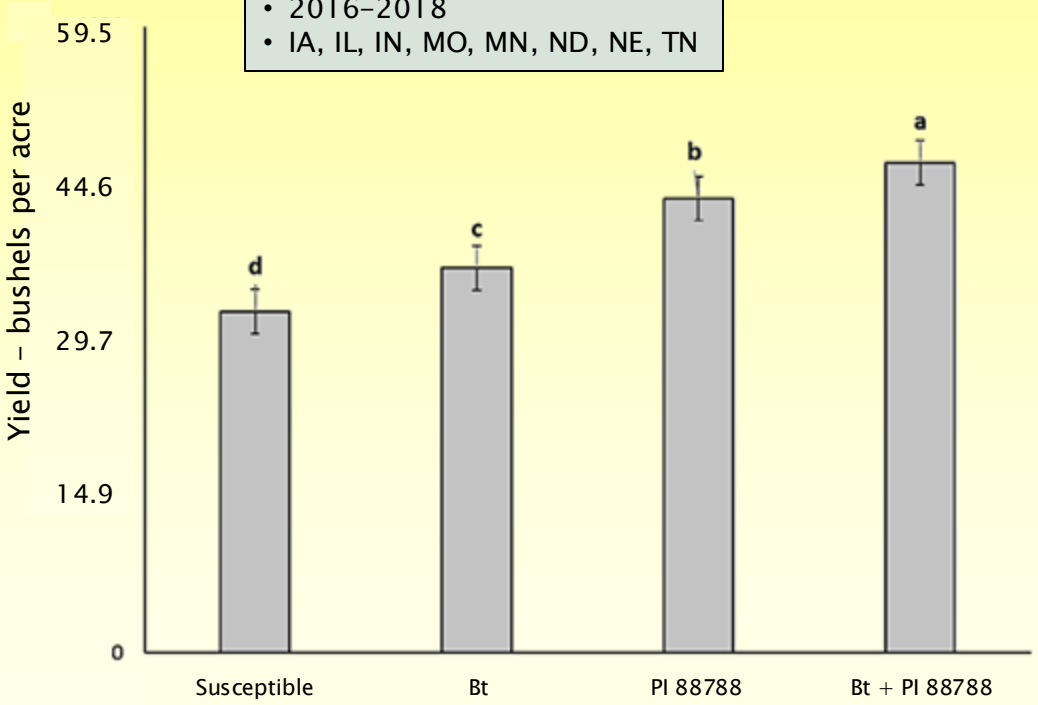


Soybean Cyst Nematode Management Improved by Combining Native and Transgenic Resistance

Michael McCarville, Julia Daum, Liqun Xiang, and Hal Moser, BASF Corporation

Plant Disease 2023, 107:2792-2798, https://doi.org/10.1094/PDIS-10-122-2515-RE

- 27 field experiments
- 2016-2018
- IA, IL, IN, MO, MN, ND, NE, TN



- "native" resistance = PI 88788
  = rhg1b
- "transgenic" resistance = Bt
  = GMB151

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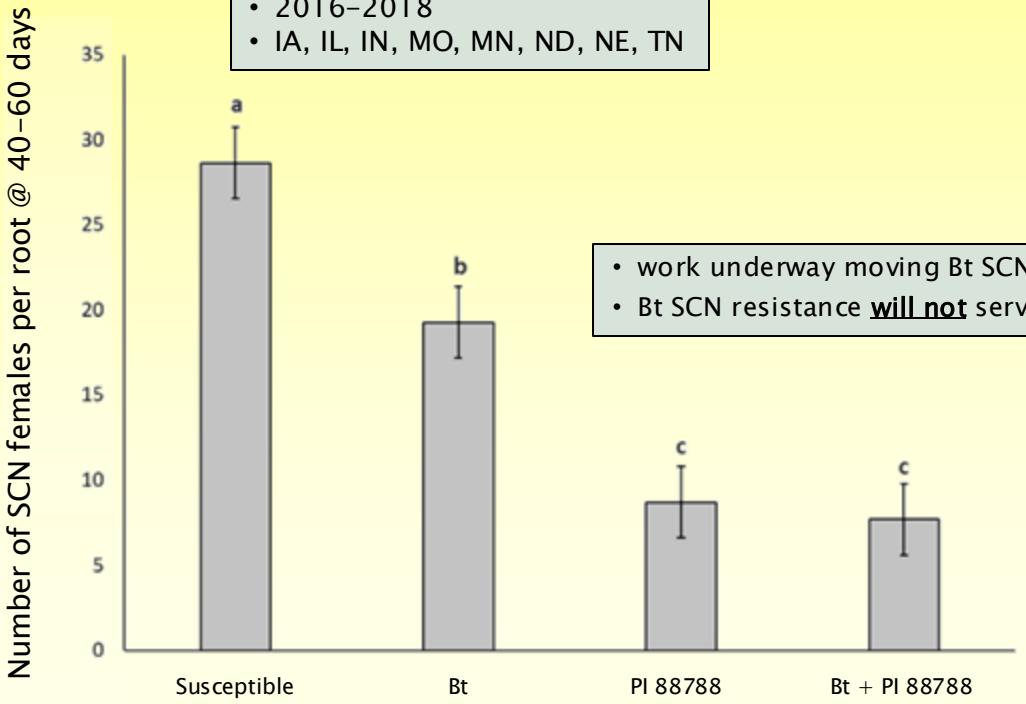
- "native" resistance = PI 88788 = rhg1b
- "transgenic" resistance = Bt = GMB151

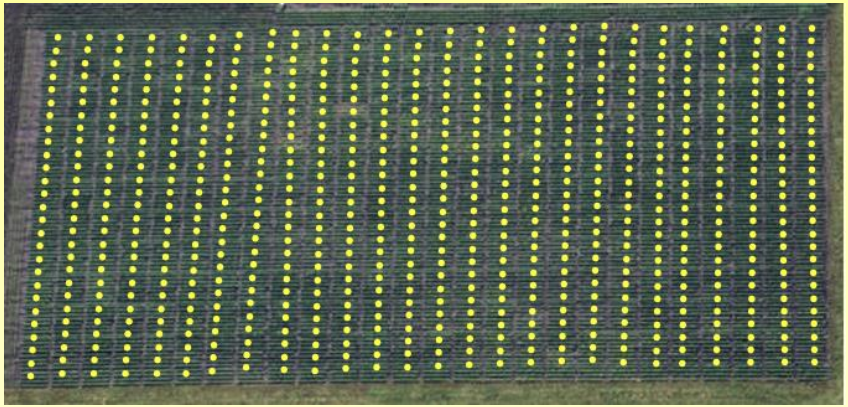


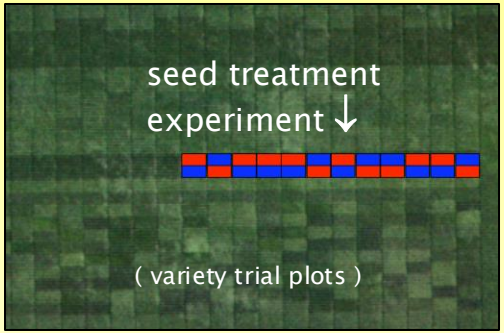
- work underway moving Bt SCN resistance into Peking background
- Bt SCN resistance **will not** serve as a separate, 3rd breeding line

Tools to Manage SCN

- nonhost crops (corn)
- resistant soybean varieties
- nematode-protectant seed treatments

Iowa State University SCN-resistant Soybean Variety Trial Program
Seed Treatment Testing Program





- we measure yield and collect a 10-core soil sample from each 4-row plot at planting and at harvest to determine SCN egg numbers
- 225 experiments since 2014, 9 experiments annually per seed treatment, 3 nematode seed treatment products each year
- 12 replications w/nematode product+base and 12 replications w/base alone

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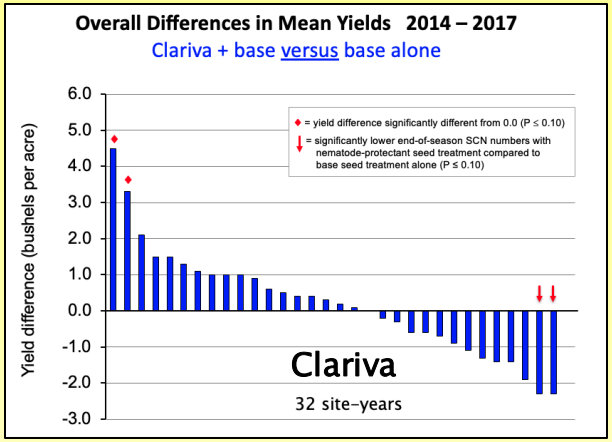
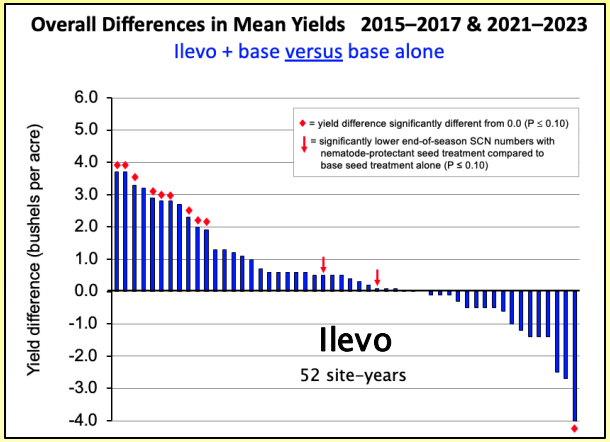
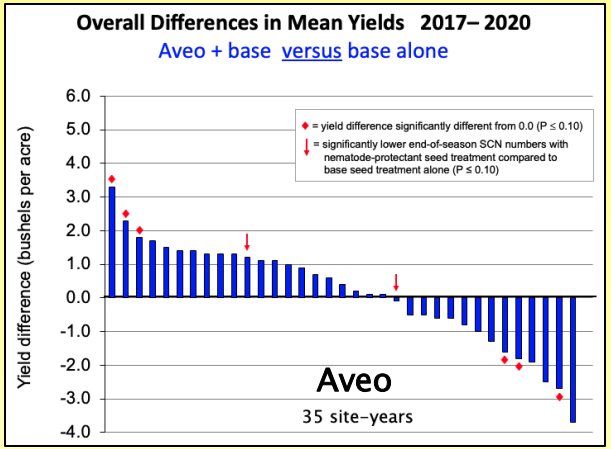
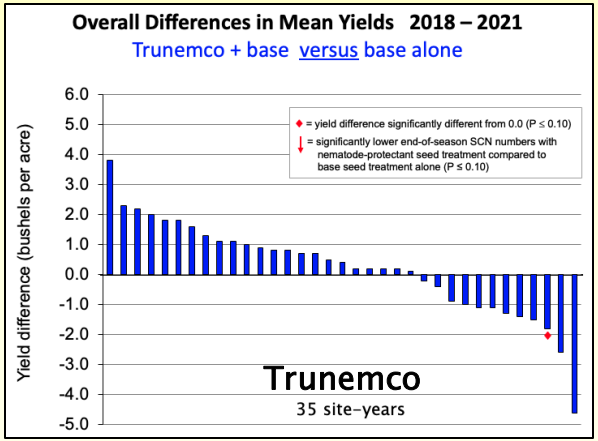
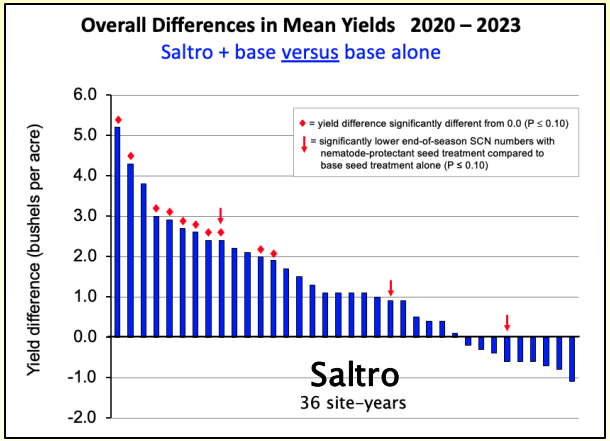


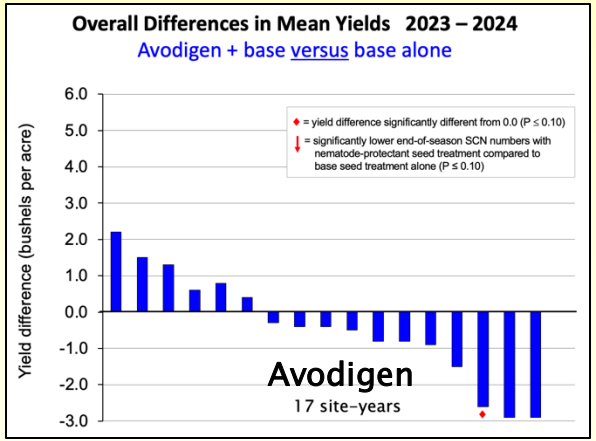


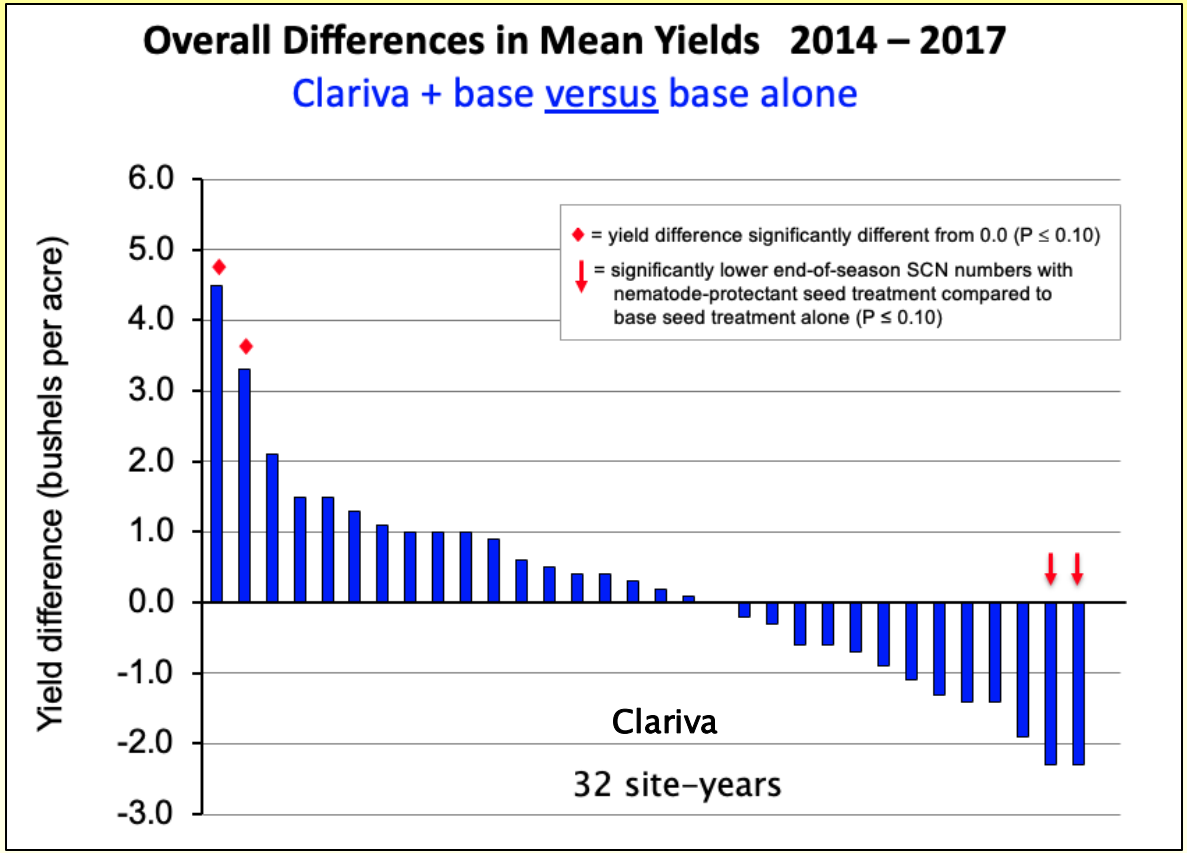


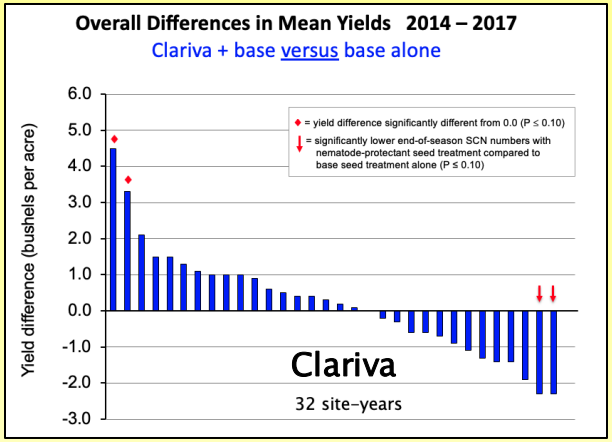
♦ statistically significant (P ≤ 0.10) yield difference; ↓ significant decrease in SCN #s

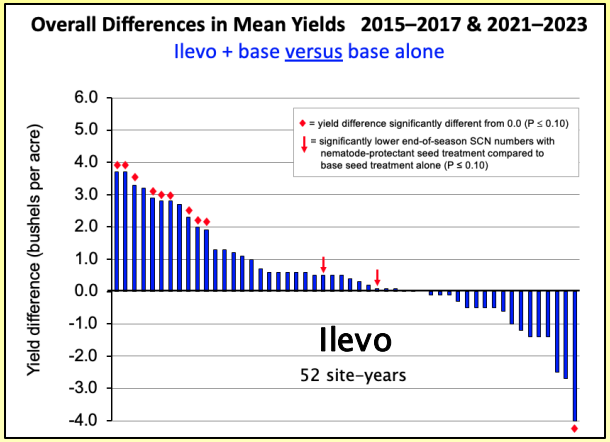


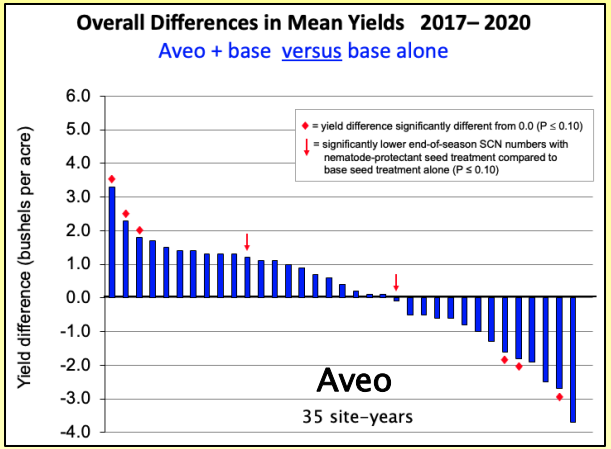





Overall Differences in Mean Yields 2014 – 2017
Clariva + base versus base alone
Yield difference (bushels per acre)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
♦ = yield difference significantly different from 0.0 (P ≤ 0.10)
= significantly lower end-of-season SCN numbers with nematode-protectant seed treatment compared to base seed treatment alone (P ≤ 0.10)
Clariva
32 site-years







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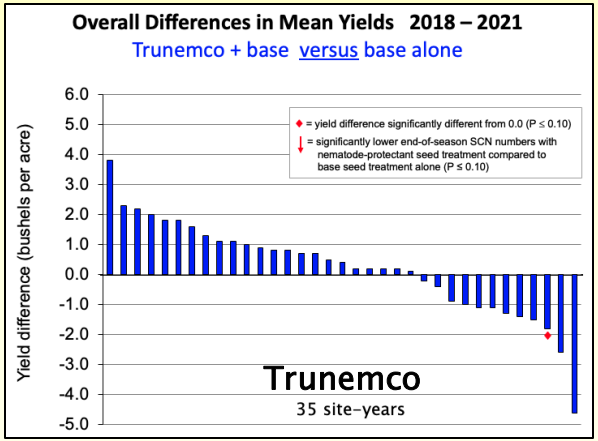

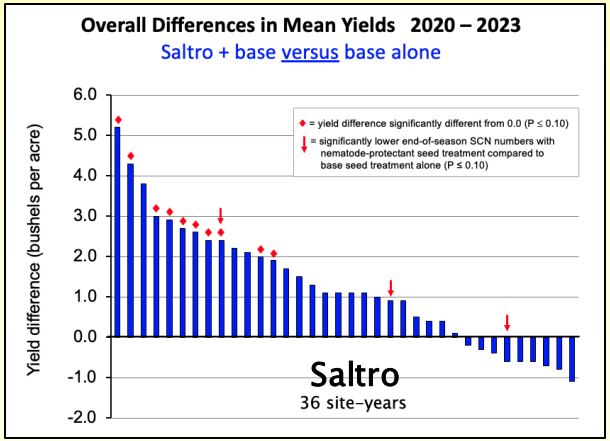

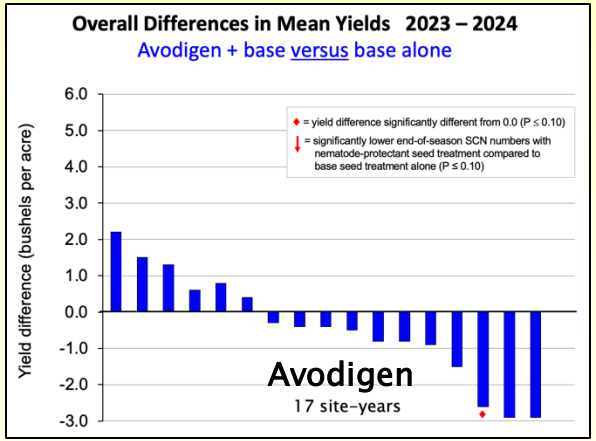

SCN Management Recommendations for Iowa
New

- start growing varieties with Peking SCN resistance in SCN-infested fields (200 Peking varieties available now)

Varieties with Peking SCN resistance for 2025

MG 2

95 varieties

MG 3

32 varieties

search for: “Quick Guide to Soybeans with Peking”

SCN Management Recommendations for Iowa
New

- start growing varieties with Peking SCN resistance in SCN-infested fields (200 Peking varieties available now)

- **never** grow varieties with Peking SCN resistance twice in a row

It is anticipated that SCN populations will adapt much quicker to Peking resistance than they did to PI 88788 resistance.

SCN Management Recommendations for Iowa
New

- start growing varieties with Peking SCN resistance in SCN-infested fields (200 Peking varieties available now)
- **never** grow varieties with Peking SCN resistance twice in a row
- alternate growing Peking resistance and PI 88788 resistance
- always rotate growing corn with SCN-resistant soybeans
- use seed treatments on soybeans for added yield protection

SCN Management for 2025 and Beyond

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