Economic Benefits of Neonicotinoid Insecticides in the U.S. and Canada

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Neonicotinoid Benefits Study Reports

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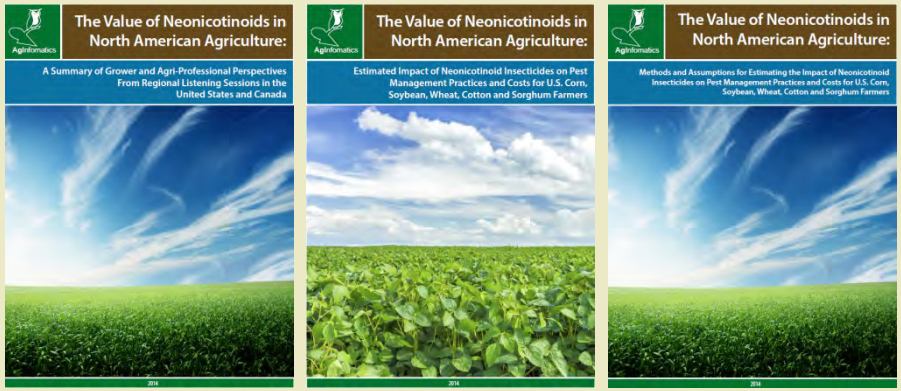
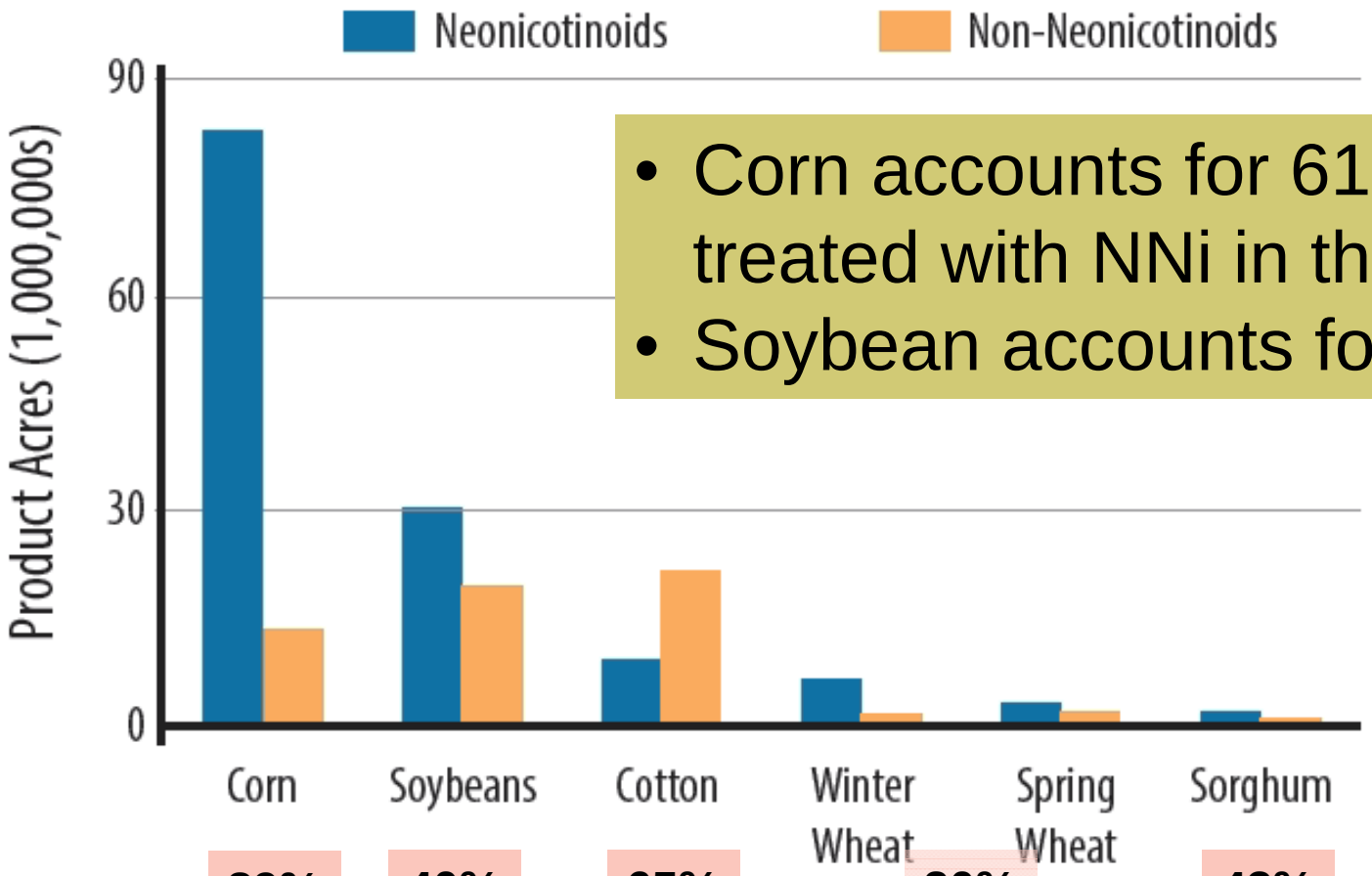
Agriculture



Turf & Ornamental

The most popular insecticide class for these crops (Mitchell) (GfK Kynetec 2010-2012 avg)

98% of NNi applied as seed treatments



- Corn accounts for 61% of acres treated with NNi in these crops
- Soybean accounts for 22%

% Acres Treated					
89%	40%	65%	20%	43%	

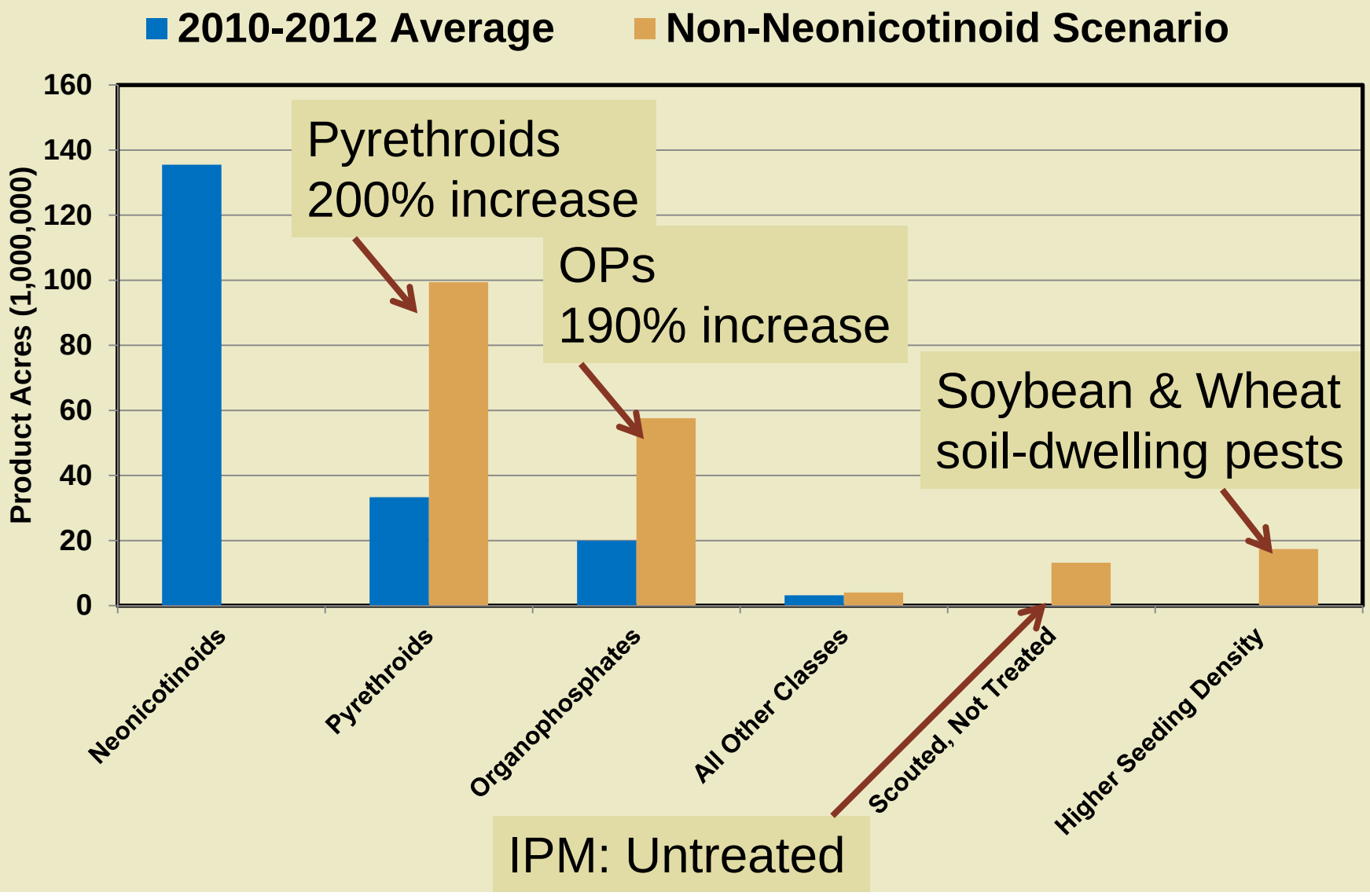
Neonicotinoid Target Pests

- Reported targets by farmers/consultants/retailers (% acres targeted) (2010-2012 GfK Kynetec average)
  - Wireworm (29%)
  - Seed Maggot (16%)
  - Corn Rootworm (15%)
  - White Grub (10%)
- **70% of neonicotinoid acres targeted at soil-dwelling pests**

Non-Neonicotinoid Counterfactual

- Reallocated neonicotinoid treated acres to non-neonicotinoid alternatives
  - based on market shares for other insecticides
  - by management system and target pest
  - GfK Kynetec data for 2010-2012
- **Issue: essentially no practical non-neonicotinoid alternatives to manage soil-dwelling pests in soybean & wheat**
  - Soil-dwelling pests are the reported targets for 31% & 73% of neonicotinoid acres respectively

Reallocation Impact on Insecticide Use



Cost Impacts

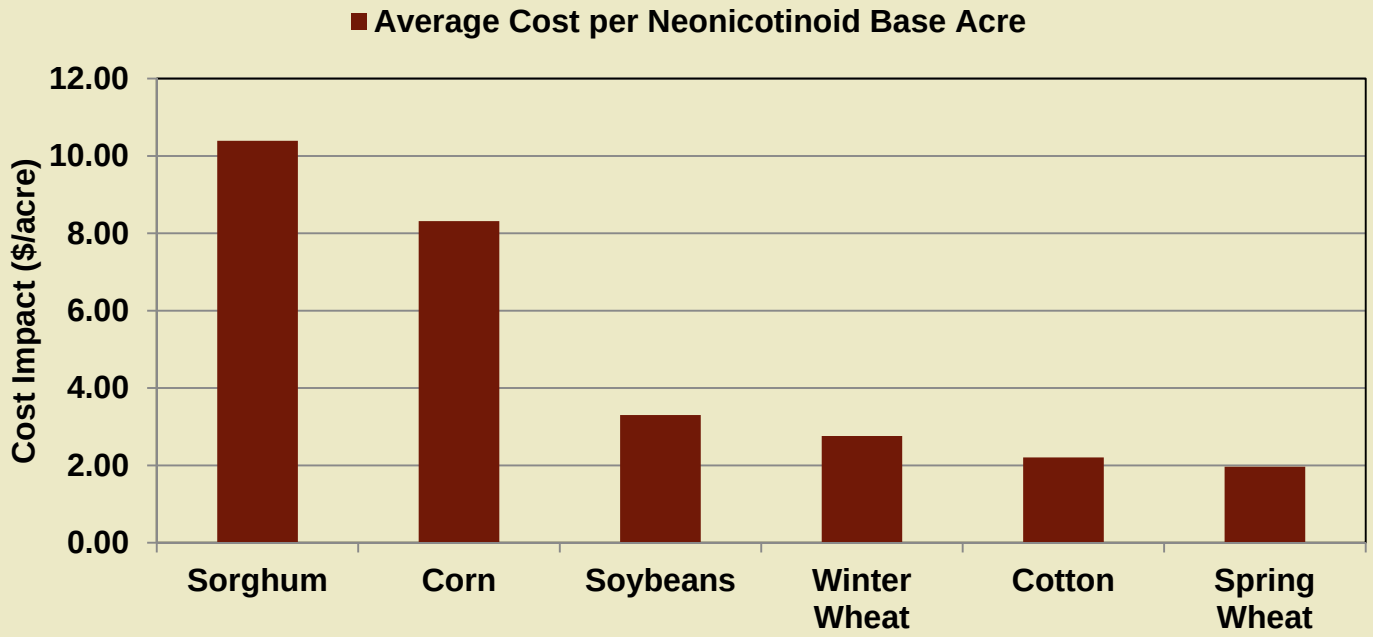
Projected net cost increase of $848M per year

Increased spending on **insecticides**: $157M

Increased spending on **applications**: $383M

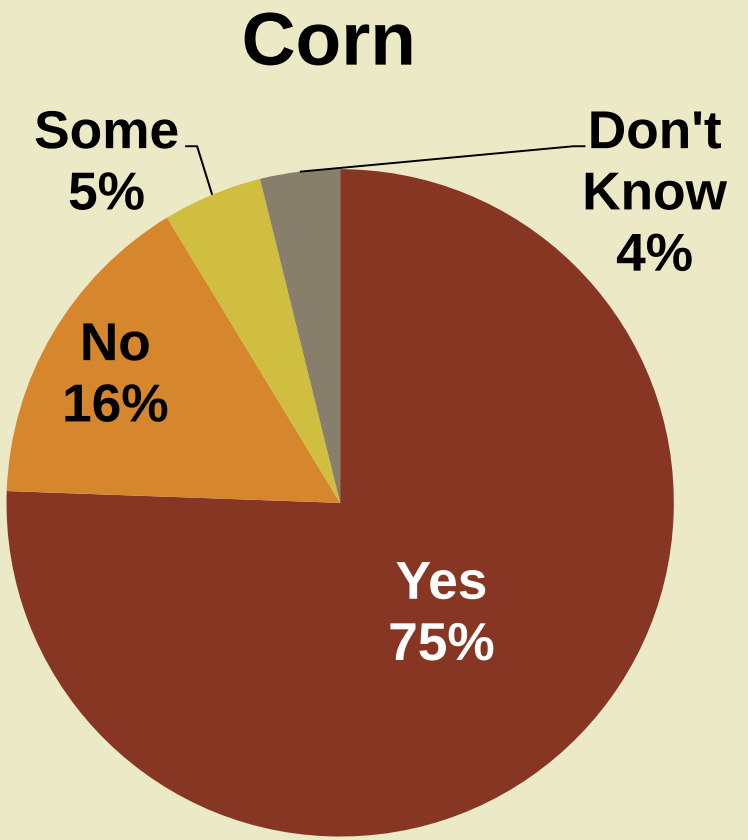
Increased spending on **field scouting**: $210M

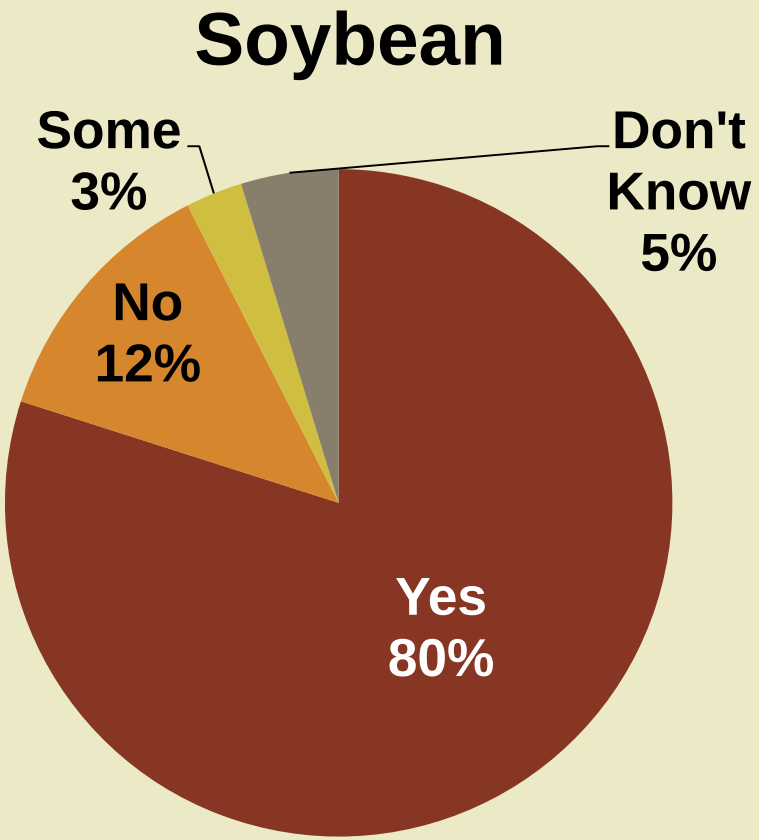
Increased spending on **seeds/replant**: $97M



Would You Have Used a Seed Treatment If You Could Get the Same Varieties Without It?

Hurley & Mitchell: Telephone survey: US: 500 corn, 500 coy, Canada: 500 canola, 120 corn, 120 soy





Additional Value (US$ per Treated Acre) Compared to Alternatives (Hurley & Mitchell)

	United States		Canada		
	Corn	Soybean	Corn	Soybean	Canola
Bt Corn	$19.78		$20.05		
Seed Treatment	**$13.38**	**$11.93**	**$12.02**	**$14.53**	**$12.85**
Soil Insecticide	$12.92				
Foliar Insecticide	$14.17	$13.48		$10.06	

Seed treatments worth about $12-$14.50/A to US and Canadian corn, soybean and canola farmers

Neonicotinoid seed treatments the most valued insect control method in North America:
$1.4 B for seed treatments, $1.3 B for Bt corn

Total Value (US$ Million)

Control Method	U.S.	Canada	Total
Seed Treatment	**$1,130**	**$301**	**$1,431**
Bt Corn	$1,248	$56	$1,304
Foliar Insecticide	$249	$57	$306
Soil Insecticide	$175	---	$175

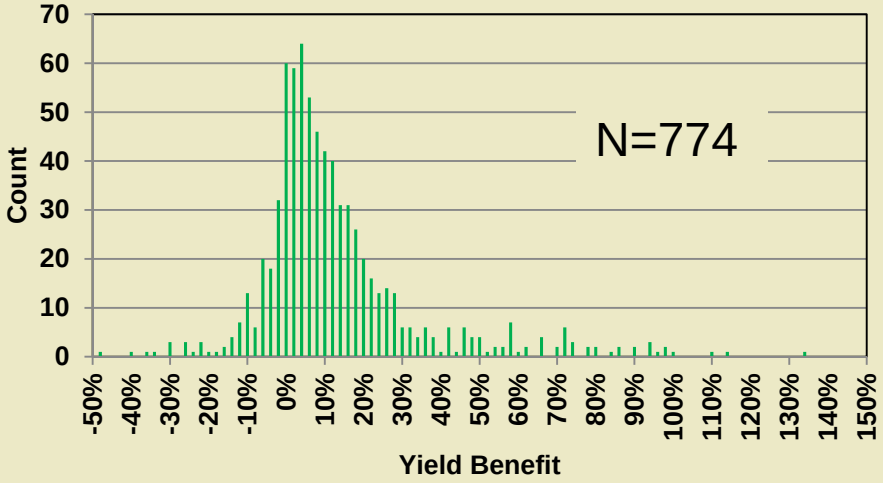
Neonicotinoid seed treatments are the most valued insect control method in North America

Yield Meta-Analysis (Mitchell)

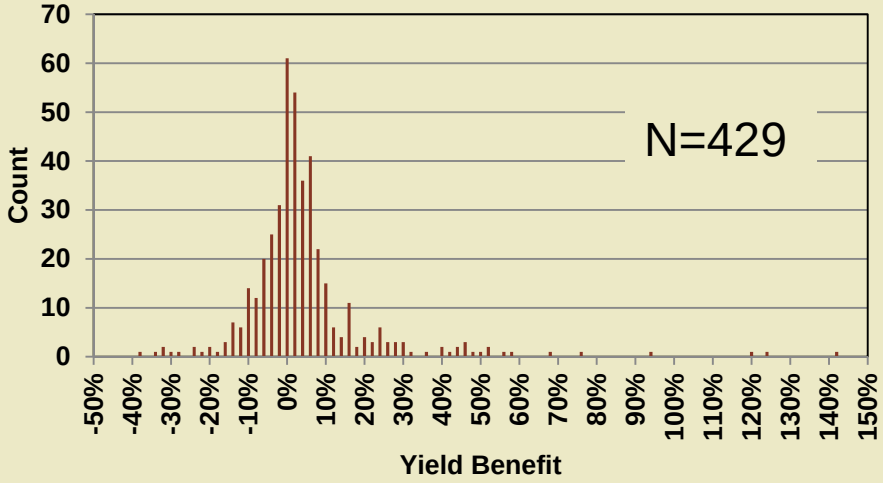
- Data from replicated small plot field experiments
- 1,500+ site-years generating 3,300+ observations of yield with and without neonicotinoid
- ~1,000 site-years generating 1,600+ observations of yield with neonicotinoid versus an insecticide alternative
- An observation is a paired comparison of average yield by treatment: NNi vs UTC or NNi vs non-NNi
- Corn, soybean, wheat, cotton, sorghum, potato, tomato
- Source: Journals, AMT, online extension/research reports, registrant studies by universities & outside researchers

Yield Impacts for NNi

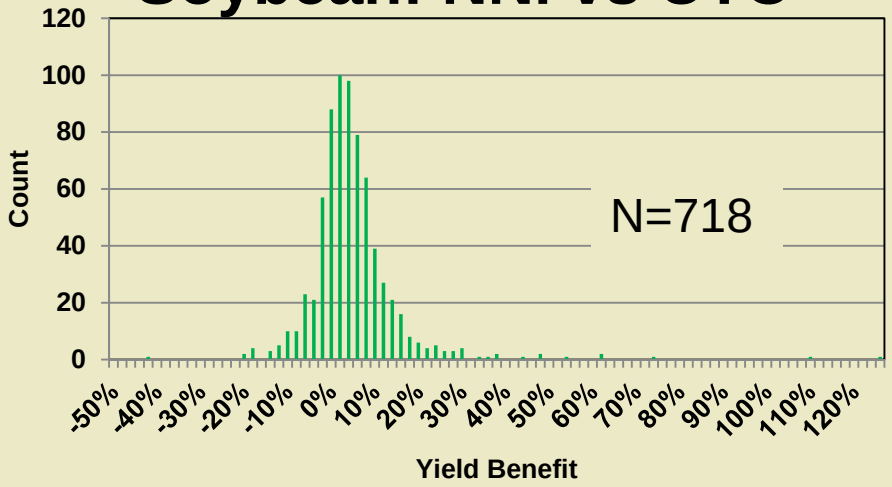
Corn: NNi vs UTC



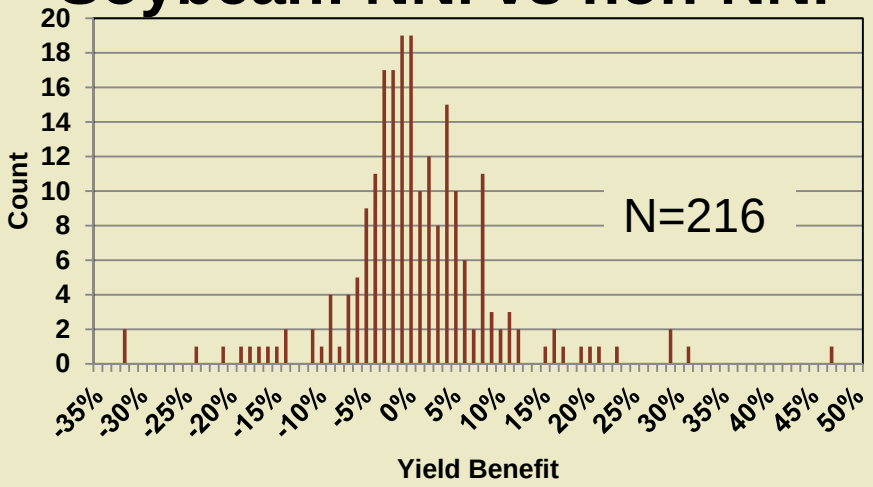
Corn: NNi vs non-NNi

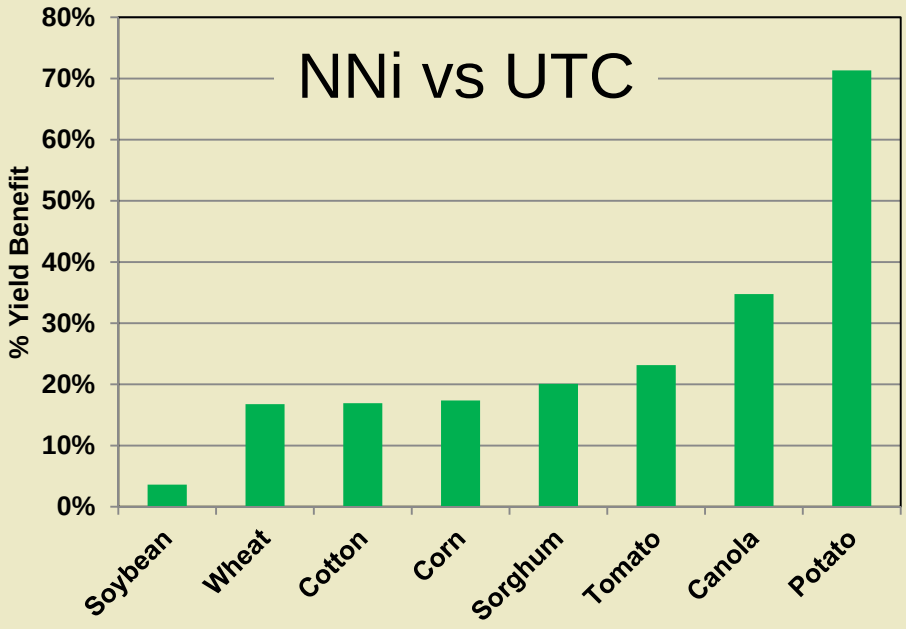


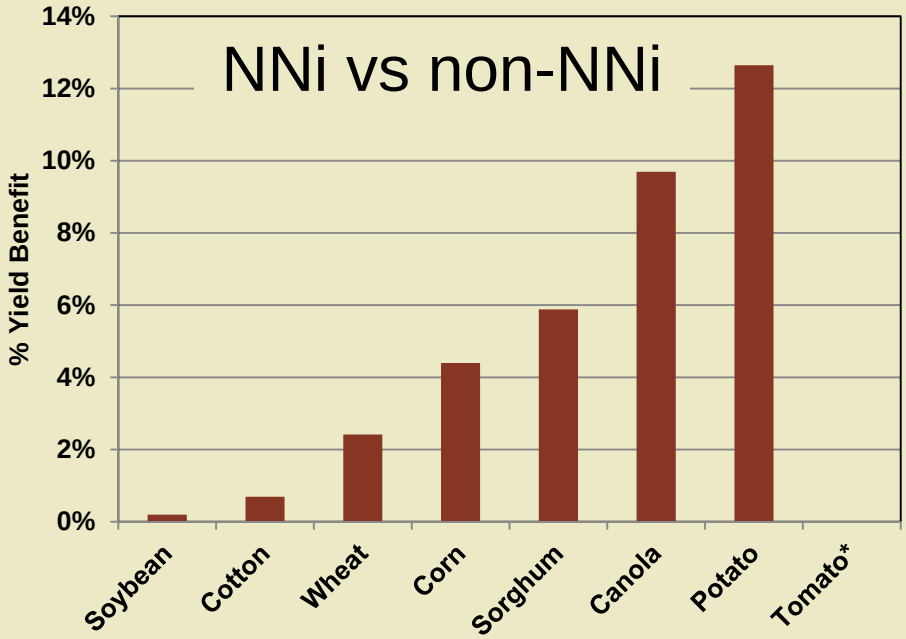
Soybean: NNi vs UTC



Soybean: NNi vs non-NNi



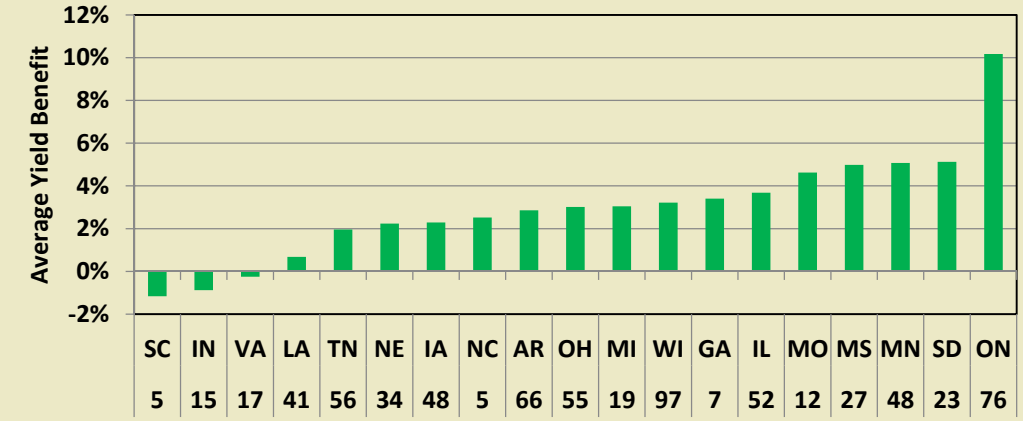




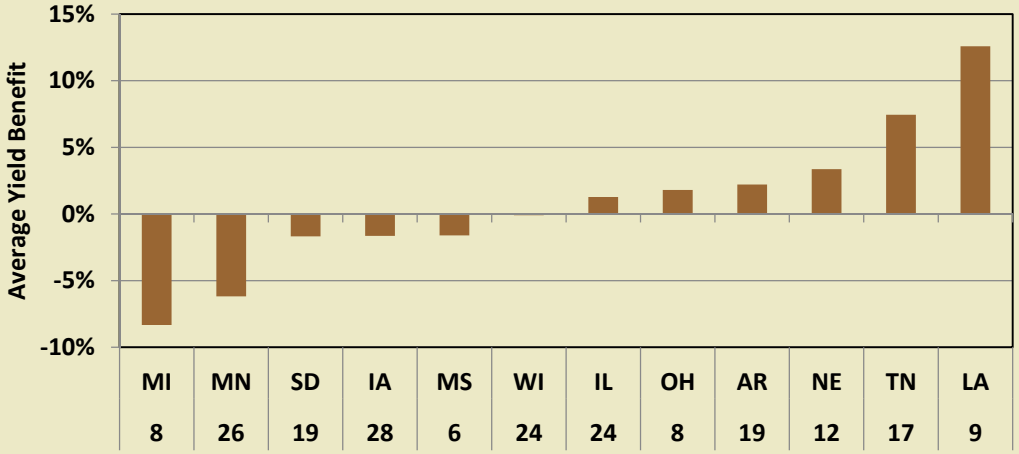
Average Yield Benefit by Crop

Crop	NNi vs UTC	NNi vs non-NNi
Corn	17.4%	4.4%
Soybean	3.6%	0.2%
Wheat	16.8%	2.4%
Cotton	16.9%	0.7%
Sorghum	20.1%	5.9%
Canola	34.8%	9.7%
Potato	71.3%	12.6%
Tomato	23.2%	---

Example of Geographic Yield Variation - Soybeans



Average soybean yield benefit for neonicotinoid treatments relative to untreated control treatments by state/province



Average soybean yield benefit for neonicotinoid treatments relative to non-neonicotinoid insecticide treatments by state

Significance of a 2.8% Yield Benefit in Soybeans

- The Context
  - ✓ 2013 U.S. average soybean yield = 44bu/A
  - ✓ 2013 U.S. average marketing price = $13 bu
- Quick Calculation
  - ✓ 2.8% X 44 bu X $13 = $16.02/A
  - ✓ Minus average seed treatment cost = $7.67
- Based on soybean yield histogram and these yield and price assumptions
  - on average a farmer would earn $16.02 – $7.76 = $8.26/A
  - a farmer would earn back at least the $7.67/A cost of the seed treatment 59% of the time

Market Level Analysis (Mitchell and Dong)

- Aggregate these yield & cost impacts to market level
- Allow crop prices & acreage to equilibrate to the new supply & profitability conditions & estimate “surplus”
- Value of neonicotinoids in U.S. ranges **$4.0 to $4.3 Billion** per year, mostly for corn
- Value of neonicotinoids in Canada ranges **US$150-$275 Million** per year, mostly for canola
- Without neonicotinoids:
  - Corn price increase $0.25/bu, wheat $0.22/bu
  - 350,000-400,000 acres move into crop production from non-crop uses, 225,000-250,000 from CRP

Surplus changes (US$ M) without neonicotinoids

Market	Surplus	Low	High
US Grains	Consumer Surplus	-$4,245	-$4,596
	Farm Income	$351	$426
	Net Surplus	-$3,894	-$4,170
US Specialty	Consumer Surplus	-$102	-$116
	Farm Income	-$33	-$45
	Net Surplus	-$135	-$161
US Total	**Consumer Surplus**	**-$4,347**	**-$4,712**
	Farm Income	**$318**	**$381**
	Net Surplus	**-$4,029**	**-$4,331**
Canada Grains	Consumer Surplus	-$284	-$568
	Farm Income	$135	$291
	Net Surplus	-$149	-$276

Quick Summary: Neonicotinoid seed treatments

- Most popular class of insecticides – effective, reduced-risk, safe, convenient
- Farmers target 70% of neonicotinoids at soil-dwelling pests: wireworm, seed maggots, rootworm and white grubs
- Soybean and wheat farmers do not have non-neonicotinoid alternatives for soil-dwelling pests
- Without neonicotinoids, acres treated with pyrethroids and organophosphates would roughly triple
  - Resistance concerns, non-target effects, spray drift

Quick Summary

- Highly valued by corn, soy, canola farmers, with stated values of $12-$14.50/ac
- Most valued insecticide treatment by North American farmers, with a stated value of $1.4 Billion per year
- 75%-80% of farmers who use neonicotinoid seed treatments say they would continue to do so even if untreated seeds were available
- Meta-analysis finds substantial yield benefits for neonicotinoids, even relative to alternatives
- Market-level analysis finds that the value of neonicotinoids ranges $4.0 to $4.3 Billion in the U.S. and $150-$275 Million in Canada

Thanks for Your Attention!

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