

# Pesticide-Treated Seed Public Workshop

Jennifer Teerlink, PhD, Environmental Program Manager, Environmental Monitoring Branch

Bryan George, Sr. Environmental Scientist Supervisor, Evaluation Branch

Anson Main, PhD, Sr. Environmental Scientist Supervisor, Environmental Monitoring Branch



California Department of Pesticide Regulation  
November 15, 2021

# Attendees

- For technical issues, use '**Chat**' box
- For asking questions and public comment, use one of the following options:



- Use '**Q&A**' box and enter your question.



- '**Raise Hand**' and the technical host will grant you access to speak. You will need to unmute your microphone.



# Agenda

- 1) Introduction and Overview – **Jennifer Teerlink**
- 2) Current Regulatory Framework for Pesticide-Treated Seeds – **Bryan George**
- 3) What We Know About Pesticide-Treated Seeds Planted in California – **Anson Main**
- 4) Environmental Overview of Offsite Transport of Pesticide-Treated Seeds – **Anson Main**
- 5) Meeting Wrap-Up and Overview of Key Questions for Stakeholders – **Jennifer Teerlink**
- 6) Public Comment

# Next steps

Workshop information and Questions for Stakeholders will be posted here:

[www.cdpr.ca.gov/docs/registration/canot/camenu.htm](http://www.cdpr.ca.gov/docs/registration/canot/camenu.htm)

Comments due February 15th, 2022

Submit to:

[TreatedSeeds@cdpr.ca.gov](mailto:TreatedSeeds@cdpr.ca.gov)

Or via hard copy to:  
Jennifer Teerlink  
1001 I Street, P.O. Box 4015  
Sacramento, California 95812-4015

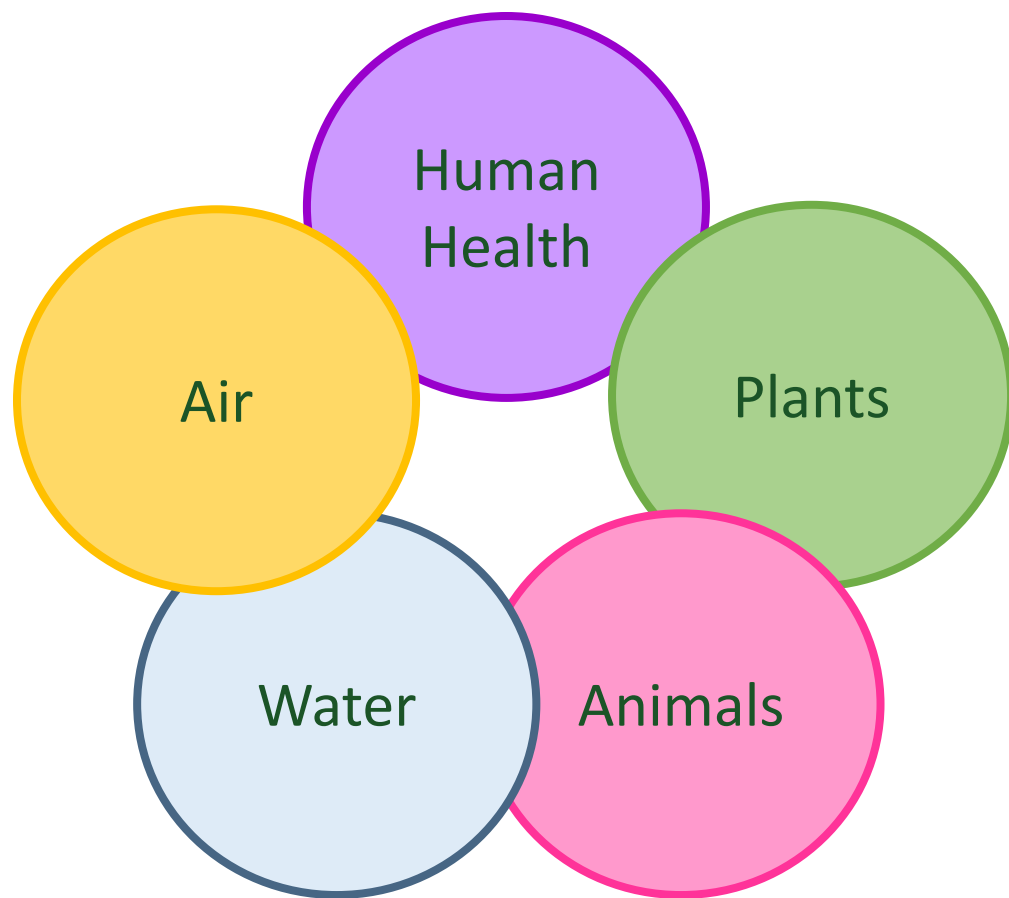




# Workshop objectives

- Share information on pesticide-treated seeds.
- Current regulatory framework surrounding seed treatment products.
- Characterize potential for off-site movement of seed coatings.
- Gather additional information on current use and potential impacts of pesticide-treated seeds. (**By February 15<sup>th</sup>, 2022**)

**DPR's mission** is to protect human health and the environment by regulating pesticide sales and use and by fostering reduced-risk pest management.



# What are pesticide-treated seeds?

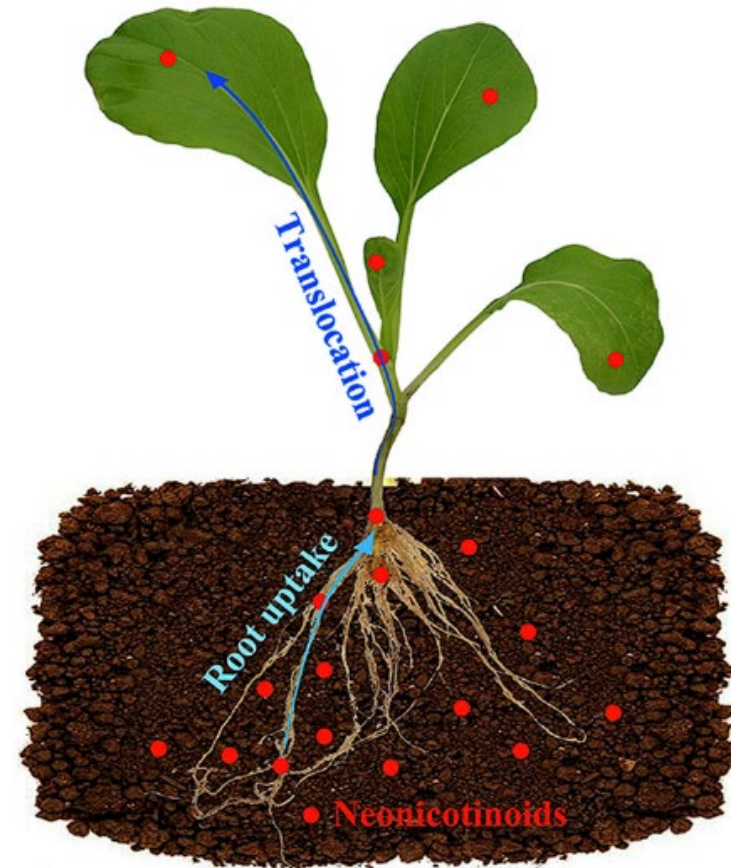
- Seed Treatment Products are applied to seeds to introduce pest protection at the time of planting.
- Many active ingredients in pesticide-treated seeds (e.g., fungicides, insecticides, bactericides).



credit: Syngenta

# Why are pesticide-treated seeds used?

- Localized plant protection.
- Can protect against soil and aboveground pests.
- Some active ingredients described as systemic pesticides are able to absorb into the plant and distribute throughout its tissues.
- Majority of pesticide-treated seed environmental fate research conducted on neonicotinoids.

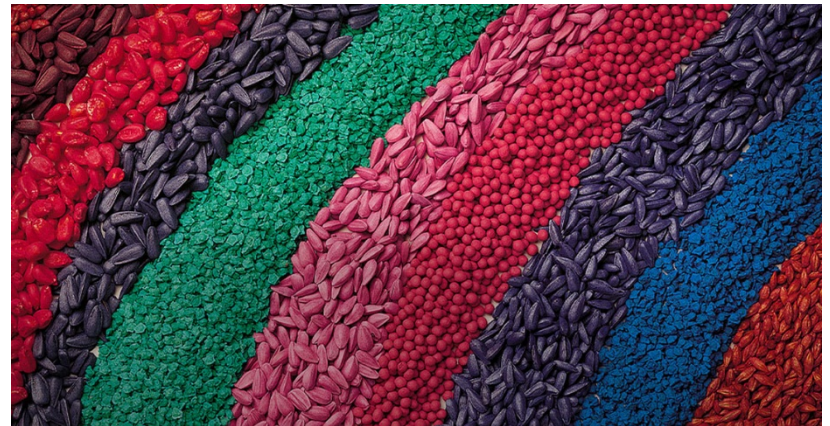


Li et al., 2018. *Chemosphere*.

# Nomenclature



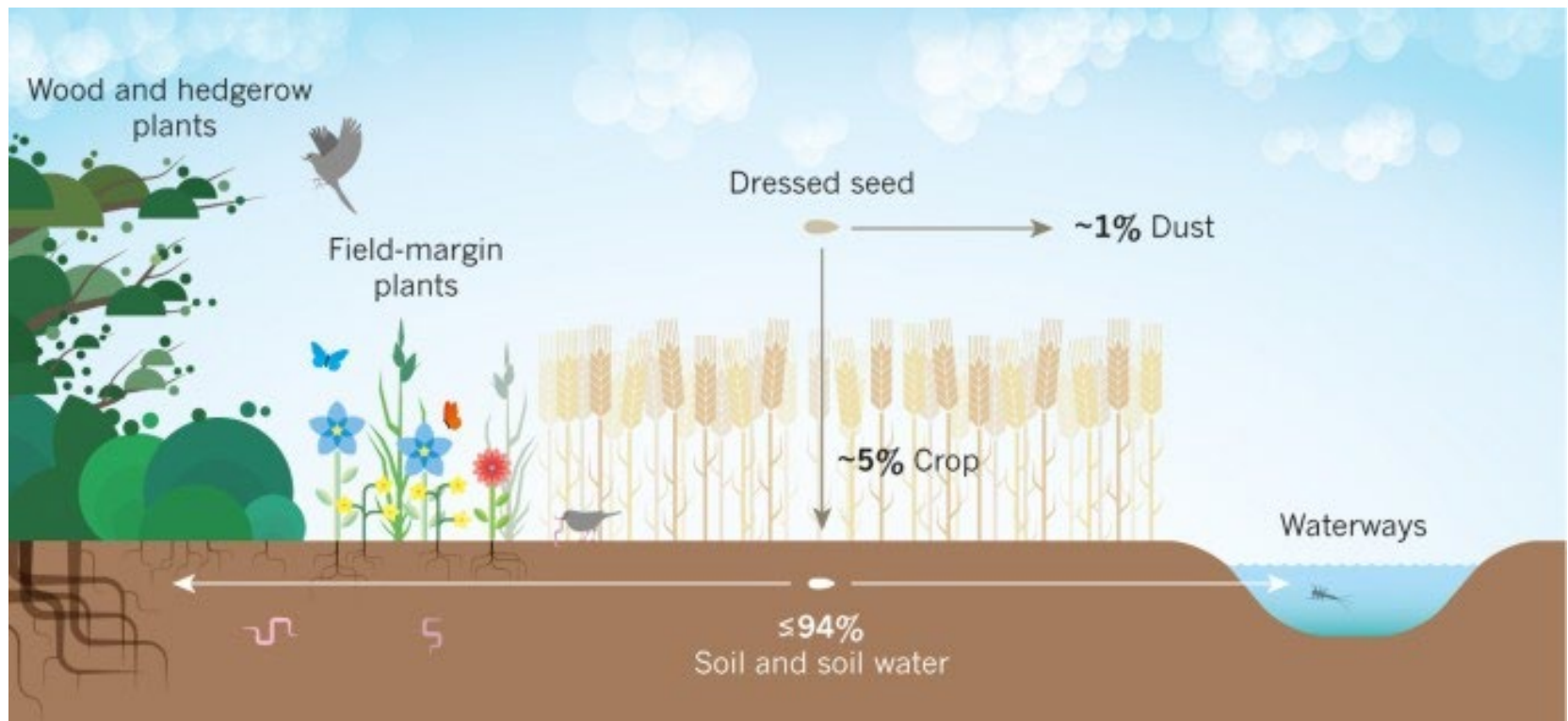
**Seed Treatment Product**



credit: Bayer

**Pesticide-Treated Seeds**

# Why are we interested in pesticide-treated seeds?



\*Figure percentages reflect distribution for neonicotinoids

Goulson, D. Pesticides linked to bird declines. *Nature* **511**, 295–296 (2014).  
<https://doi.org/10.1038/nature13642>



# Environmental Monitoring

- Conducting monitor in Surface Water impacted by agriculture since ~1990
- Characterizing pesticide residues supports continuous evaluation
- Analyses include active ingredients common in pesticide-treated seeds





**Are pesticide-treated seeds planted in CA  
coated with seed treatment products  
registered in CA?**



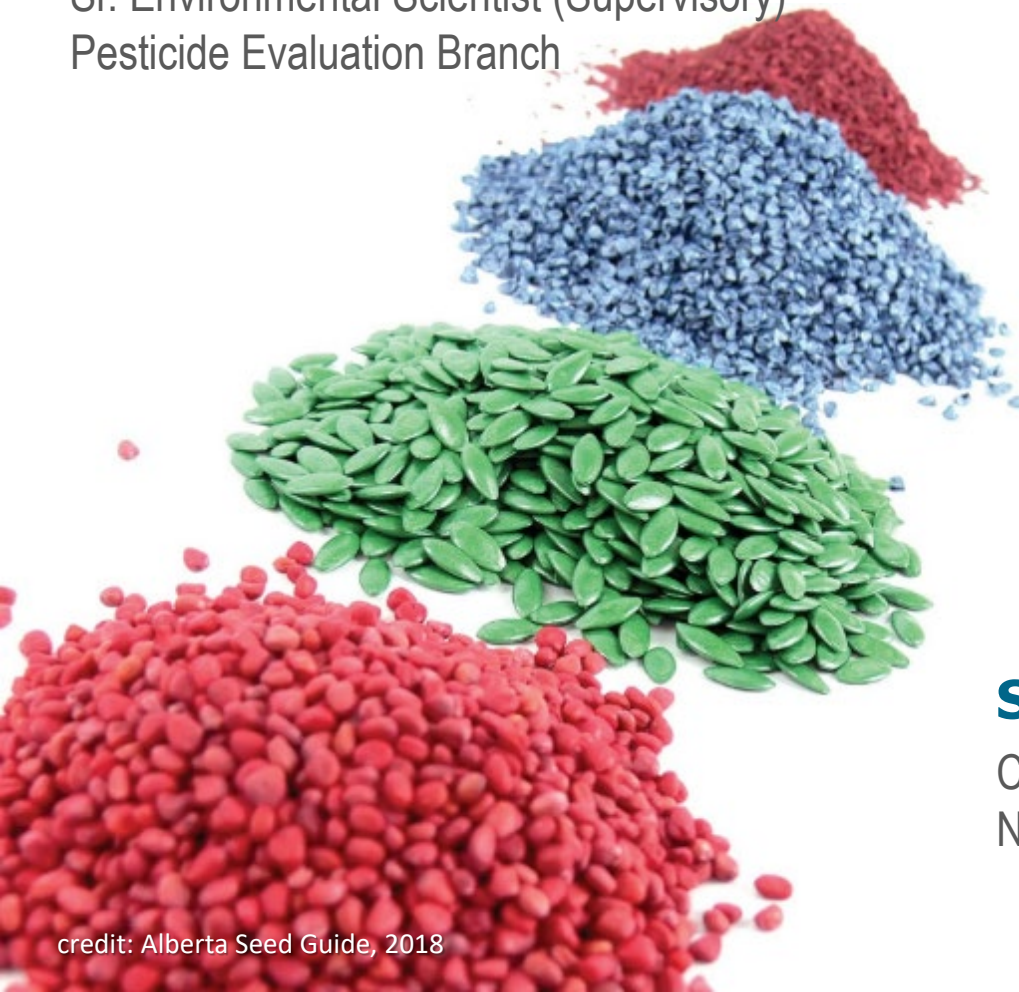
# What commodities use pesticide-treated seeds?



# Regulatory Framework:

Pesticide-treated seed/seed treatment product regulation, CDPR evaluation process, registered products and active ingredients

Bryan George  
Sr. Environmental Scientist (Supervisory)  
Pesticide Evaluation Branch



## Seed Treatment Workshop

California Department of Pesticide Regulation  
November 15, 2021





# Regulatory Framework

## Seed Treatment Products



Registered under FIFRA

## Pesticide-Treated Seeds



Exempt from registration as  
“treated article”

Registered under FIFRA and  
California FAC

Does not fall under state  
definition of “pesticide”

FIFRA = Federal Insecticide, and Rodenticide Act  
FAC = Food and Agriculture Code



# Treated Article Exemption

## 40 CFR §152.25 Exemptions for pesticides of a character not requiring FIFRA regulation

(a) Treated articles or substances. An article or substance treated with, or containing, a pesticide to protect the article or substance itself (for example, paint treated with a pesticide to protect the paint coating, or wood products treated to protect the wood against insect or fungus infestation), if the pesticide is registered for such use.



# Pesticide Definition

## FOOD AND AGRICULTURAL CODE - FAC

**12753.** “Pesticide” includes any of the following:

(a) Any spray adjuvant.

(b) Any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, as defined in Section 12754.5, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever.

# U.S. EPA Registered Seed Treatment Products

## Pesticide Product Information System (12/14/20):

- Registration Status: Active Section 3
- Site Description: Contains “Seed Treatment”

**Total Products: 629**



# CDPR Registered Seed Treatment Products

## CDPR Product/Label Internal Database (10/19/21):

- Registration Status: Active
- Application Type: Coating (i.e. Seed Coatings)

**Total Products: 210**

**Unique Active Ingredients: 68**

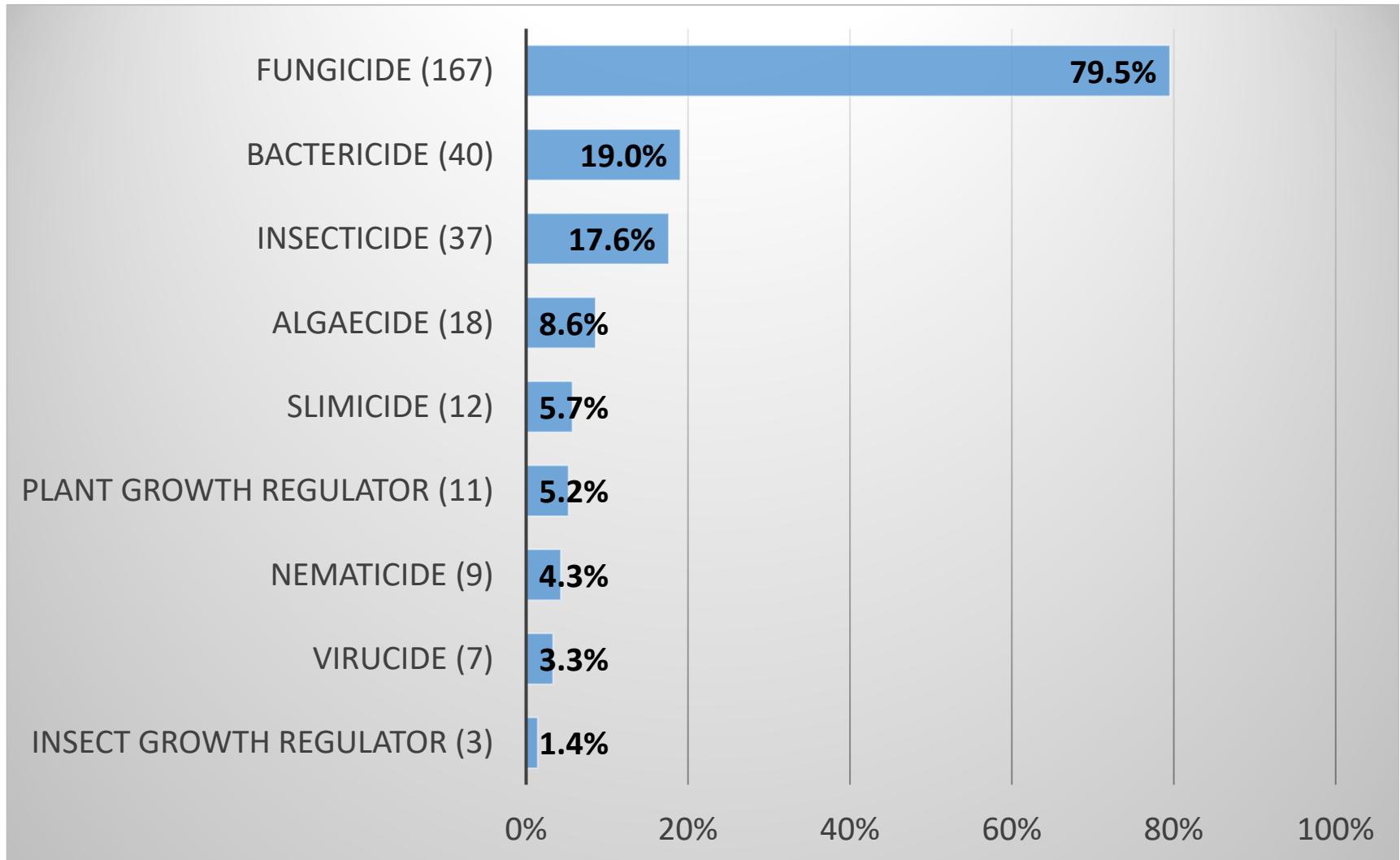
**Active Ingredients per Product (Average): 1.3**

**Seed Treatment Only Active Ingredients: 5**

- Sedaxane
- Penflufen
- Ethaboxam
- Salicylic Acid
- 2-Cyclopenten-1-one, 3-methyl-2-(2Z)-2-pentenyl-



# CA-registered Seed Treatment Product Types





# Most Commonly Used Seed Treatment Active Ingredients registered in California

Active Ingredient	Number of CA-registered Products	Product Type
Fludioxonil	18	Fungicide
Metalaxyl	17	Fungicide
Mancozeb	15	Fungicide
Tebuconazole	13	Fungicide
Mefenoxam	12	Fungicide
Hydrogen Peroxide / Peroxyacetic Acid	12	Algaecide / Bactericide Slimicide / Fungicide
Imidacloprid	10	Insecticide
Bacillus Subtilis Strain IAB/BS03	9	Fungicide / Bactericide Plant Growth Regulator
Thiamethoxam	9	Insecticide

Note: All of these active ingredients have additional registered uses beyond seed treatment.



# Pesticide Evaluation at CDPR

Data Requirement	Authority
Human Health Toxicology	40 CFR Part 158.500-158.510; FAC §§13121-13135
Human Exposure (if applicable)	40 CFR Part 158.1000-158.1070; 3 CCR §6176, §6177, §6183
Product Chemistry	40 CFR Part 158.300-158.355; 3 CCR §6188
Environmental Fate (if applicable)	40 CFR Part 158.1300; FAC §13143
Spray Drift (if applicable)	40 CFR Part 158.1100; 3 CCR §6192
Product Performance	40 CFR Part 158.400; 3 CCR §6186
Phytotoxicity (if applicable)	40 CFR Part 158.660; 3 CCR §6192
Ecotoxicology (if applicable)	40 CFR Part 158.630; 3 CCR §6187, §6192

# Seed Treatment Product Evaluation at CDPR

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Phytotoxicity (if applicable)	40 CFR Part 158.660; 3 CCR §6192
Ecotoxicology (if applicable)	40 CFR Part 158.630; 3 CCR §6187, §6192

# Regulatory Framework Summary

- Pesticide-treated seeds are exempted from review by US EPA under FIFRA as “treated articles”.
- To the extent that a seed is treated to protect the seed, the seed does not fall under the state definition of “pesticide” and is excluded from review by CDPR.
- Seed treatment products must be registered by U.S. EPA and CDPR when the coating process is conducted in California.
- Seed treatment products are evaluated according to their use directions (seed treatment process).
- There are few active ingredients found only in CA-registered seed treatment products.
- CDPR is looking at ways to improve our current evaluation of seed treatment products to streamline the process and improve consistency.

# Environmental Overview:

## Fate, transport, and movement of pesticide-treated seeds

Anson Main, PhD.

Sr. Environmental Scientist (Supervisory)

Surface Water Protection Program



## Seed Treatment Workshop

California Department of Pesticide Regulation

November 15, 2021



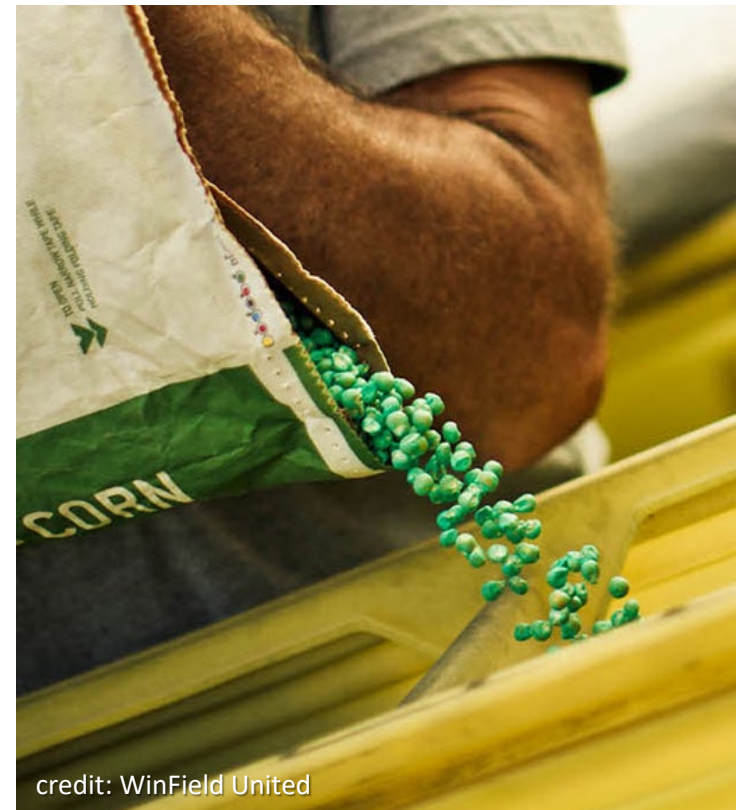
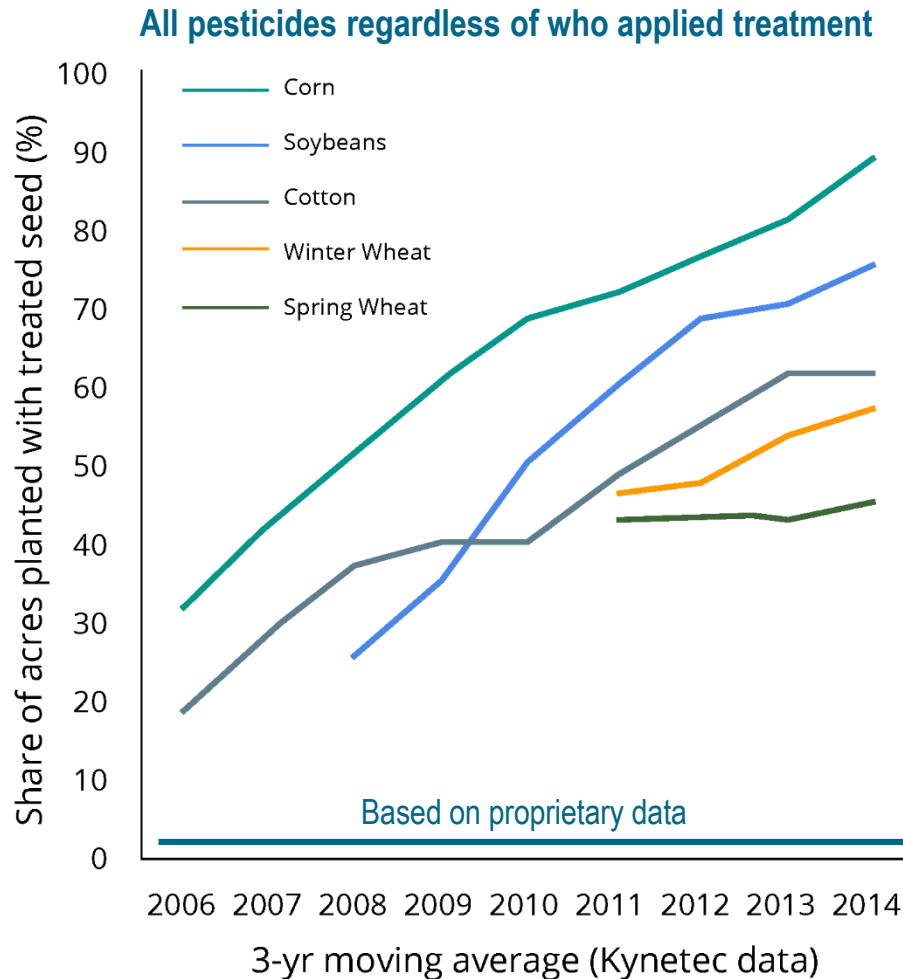


**What do we know about the use of pesticide-treated seeds in the United States?**



# Pesticide-treated seed use increased in 1990s to 2000s

- Insecticides typically used in conjunction with one or more seed-applied fungicides (Munkvold, 2009)



credit: WinField United

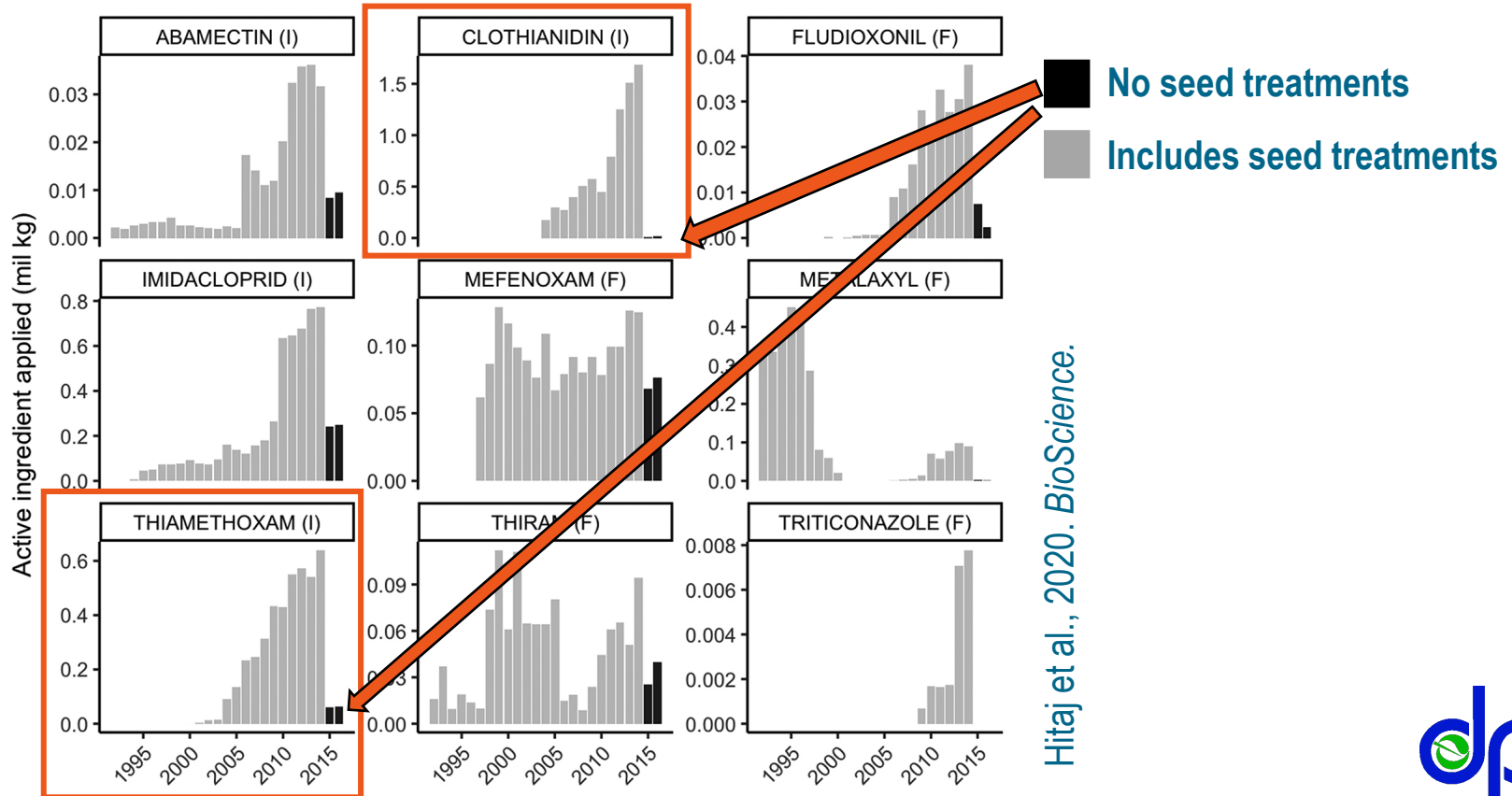
Adapted from Hitaj et al., 2020. *BioScience*.

# What mass of AI is introduced to the environment through planting pesticide-treated seeds?

- United States Geological Survey (USGS) Pesticide Synthesis Project:

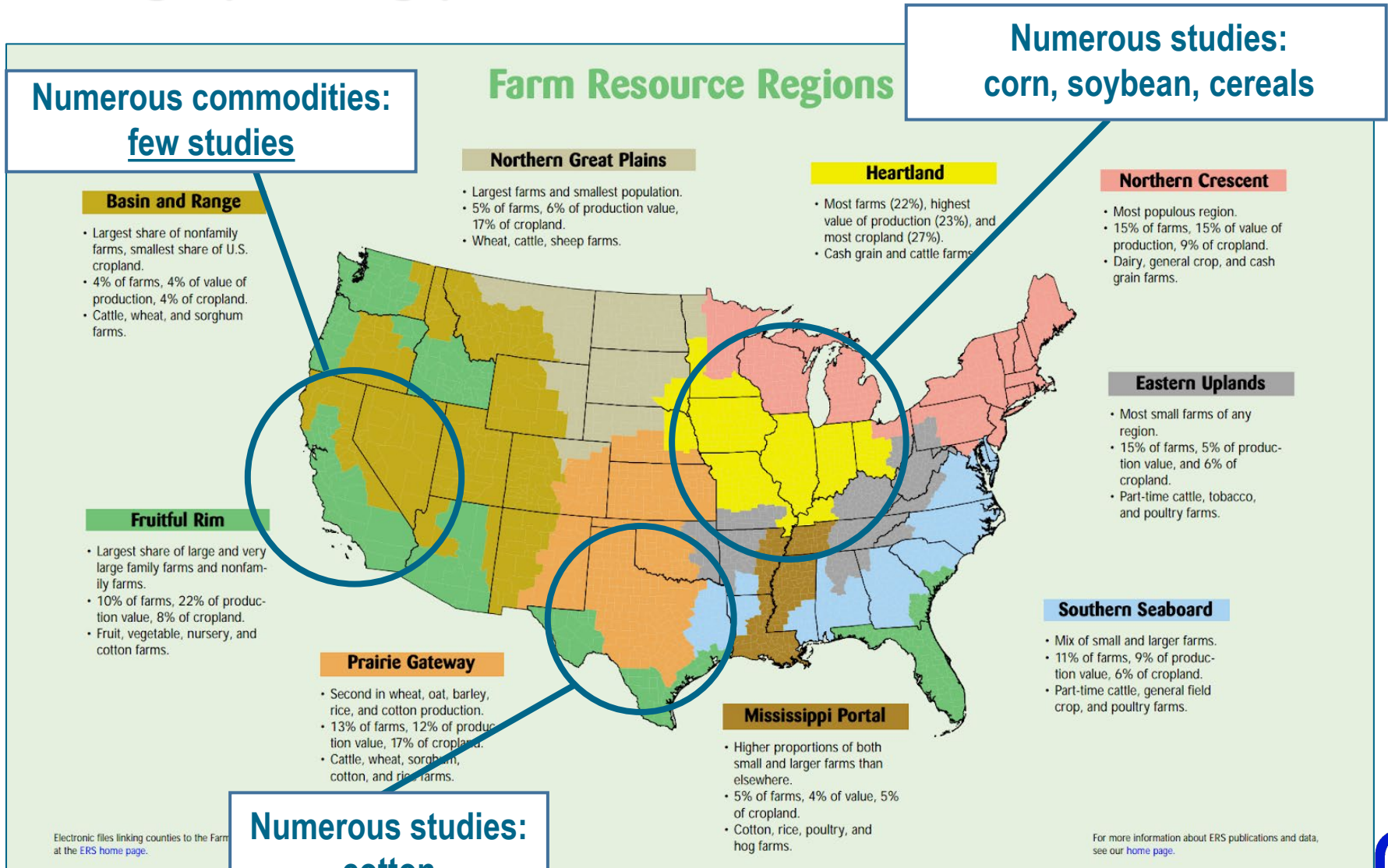
**National Data:** no longer included seed treatment use data after 2014

- Reported clothianidin use dropped: 1.5 million kg/year (2014) to 100,000 kg/year (2015) (Hitaj, 2020)

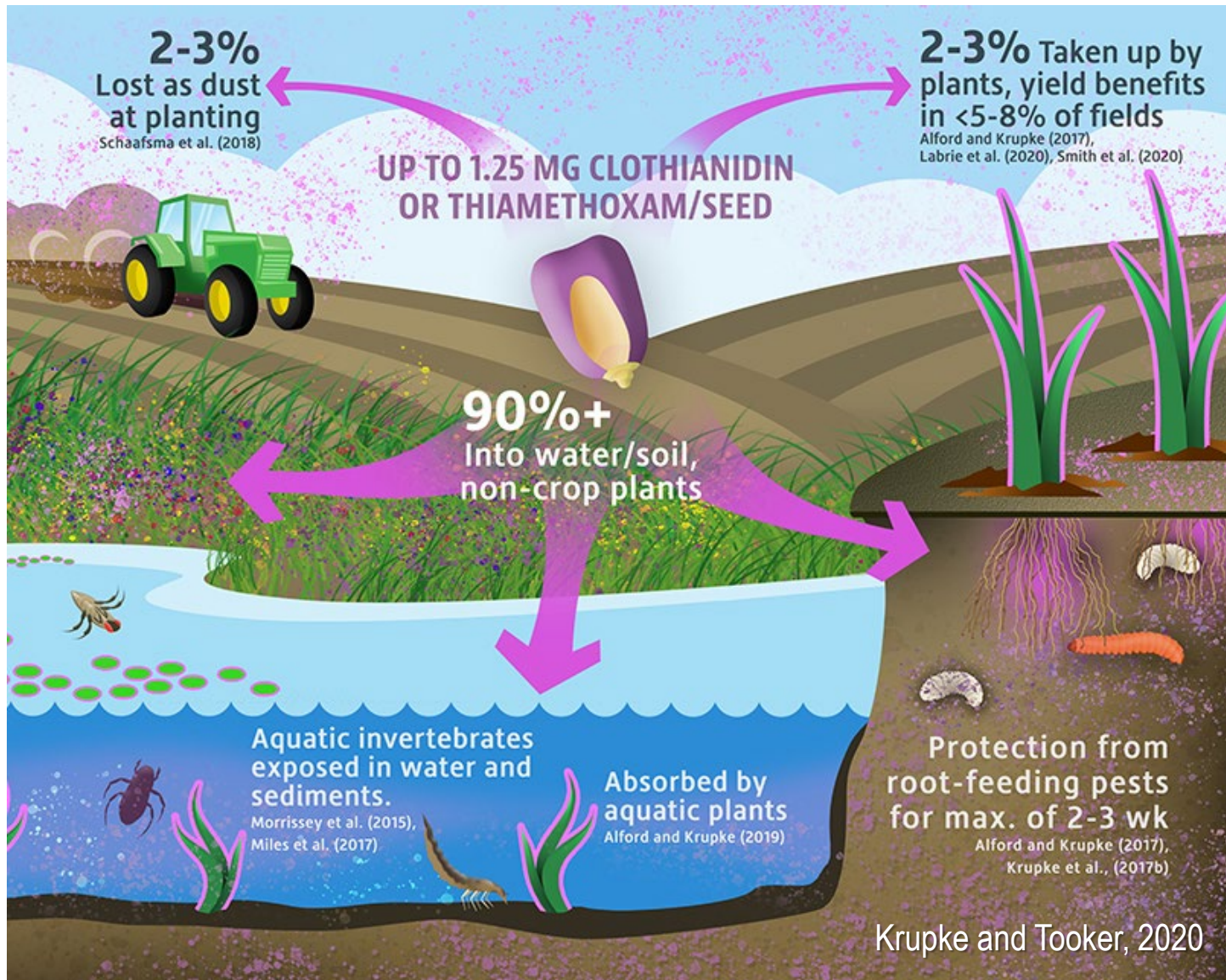




# What mass of AI is introduced to the environment through planting pesticide-treated seeds in California?



# Fate of pesticide-treated seeds in the environment





# Potential routes of exposure for non-target biota



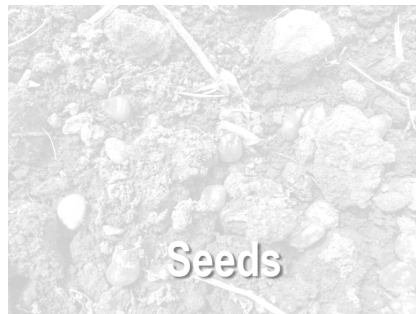
Managed pollinators



Wild pollinators



Avian species



Aquatic invertebrates

# Potential routes of exposure for non-target biota



Managed pollinators



Wild pollinators



Avian species



Aquatic invertebrates



# Potential routes of exposure for non-target biota



Managed pollinators



Dust



Wild pollinators



Agricultural soil



Wildflowers



Water



Avian species



Crop flowers



Aquatic invertebrates



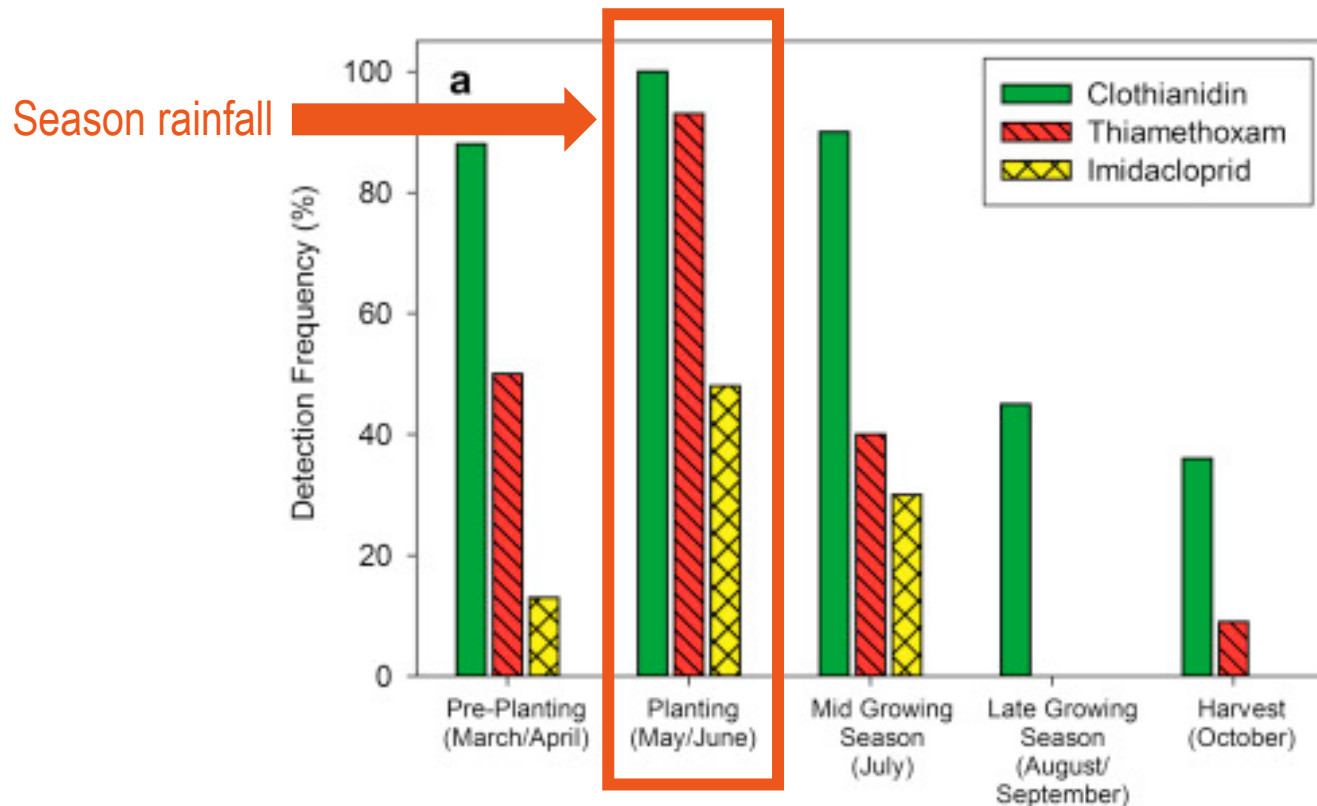
Seeds



# Seed coatings are transported into surface waters

Iowa Corn and soybean fields: Neonicotinoids frequently detected in Iowa streams associated with early planting of pesticide-treated seed (Hladik et al., 2014)

>80% of corn planted in the USA is grown using pesticide-treated seed (Hladik et al., 2018)



Hladik et al., 2014



**What California commodities currently use seed treatment products and with which active ingredients?**

# CDFA Seed Inspection Data

## Seed Services Program

- Enforcement branch of CDFA to protect seed consumers
- Tests for seed purity and germination through sampling
- Verifies accuracy of seed label statements/contents
- Required by State of California
- *Not a pesticide monitoring program*



**AgriShield<sup>®</sup> PLUS**  
**TREATED SEED**  
 FUNGICIDE + INSECTICIDE

The active ingredient contains 25% Diflufenican, 10% Prothioconazole, and 10% Imidacloprid. Roundup Ready 2 Xtend Soybeans are not tolerant to Roundup Ready 2 Xtend herbicide. Roundup Ready 2 Xtend Soybeans are not tolerant to Roundup Ready 2 Xtend herbicide. Roundup Ready 2 Xtend Soybeans are not tolerant to Roundup Ready 2 Xtend herbicide.

Seed Treatment	AgriShield <sup>®</sup> PLUS	AgriShield <sup>®</sup> PLUS	AgriShield <sup>®</sup> PLUS
Pure Seed	98.8%	98.8%	98.8%
Moisture	12.0%	12.0%	12.0%
Other Crop Seed	0.0%	0.0%	0.0%
Weight Seed	1.40%	1.40%	1.40%
Weight Seed (per Pound)	30.00	30.00	30.00
NET WT.	50.00	50.00	50.00

SEED TREATMENT INFORMATION  
 REGISTERED BY SEED TREATMENT SERVICE

SEEDS ARE FOR PLANTING IN THE U.S. ONLY  
 FOR SALE AND PLANTING IN THE U.S. ONLY

SOYBEANS  
**G3520RX**  
 LOT: **426113**  
 Contains: **40** Units @ 140,000 SEEDS UNIT  
 SEEDS PER LB.: **2491**  
 NET WT. 2348.08 lbs. / 1019.73 kg



credit: Sacramento County

**\*DPR does not endorse any product**





# CDFA Seed Inspection Data\*

## Which data are recorded?

- Enforcement data from 2010 to 2021, **25%** of all records included a seed treatment product
- **Data is not comprehensive for all pesticide-treated seeds available**
- Indicates the seed type, county, label, and treatment(s) or product name
- **Qualitative since no chemical testing is performed** – visual inspection only

**\*Data are not specifically focused on pesticide-treated seeds:** No info on EPA Registration number, AI % or seeding rate to convert to mass of pesticide per acre.



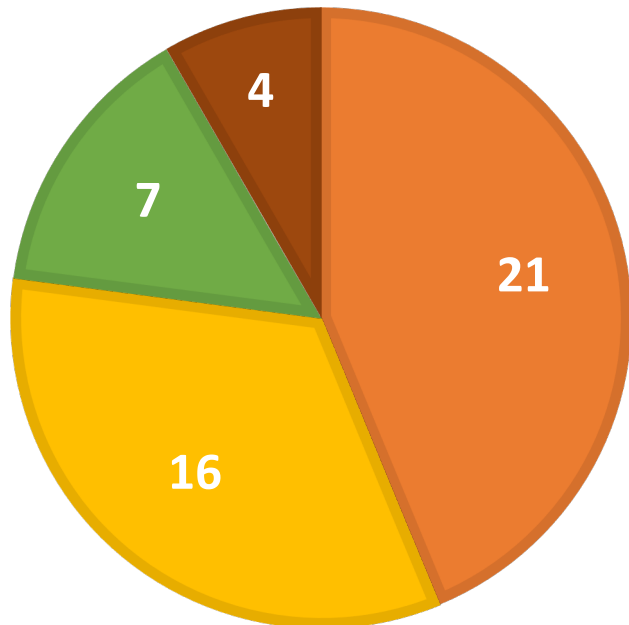
# Registration Status: Seed treatment products

## CDFA Seed Inspection Data: 2010 - 2021

- Majority of seed treatment products not registered in the state of California
- Some seed treatment products registered to be used in USA outside of California

### SEED TREATMENT PRODUCTS

N = 48



- California registered **210 registered by CA**
- US EPA registered **629 registered by US EPA**
- Registration not found (seed treatment)
- Currently canceled (US EPA)

# Registration Status: Seed treatment products

## Concerns raised through CDFA data:

1. Non-California registered seed treatment products are planted
2. Seed treatment registration not found:  
**Tsunami** – AI: Diquat dibromide\*; (herbicide);  
\*sold online as liquid formulation for eradication of pond weed
3. US EPA registered product:  
**Storcide II** – AI: Chlorpyrifos-methyl; Deltamethrin (insecticide);  
these active ingredients are not registered for seed treatment in California

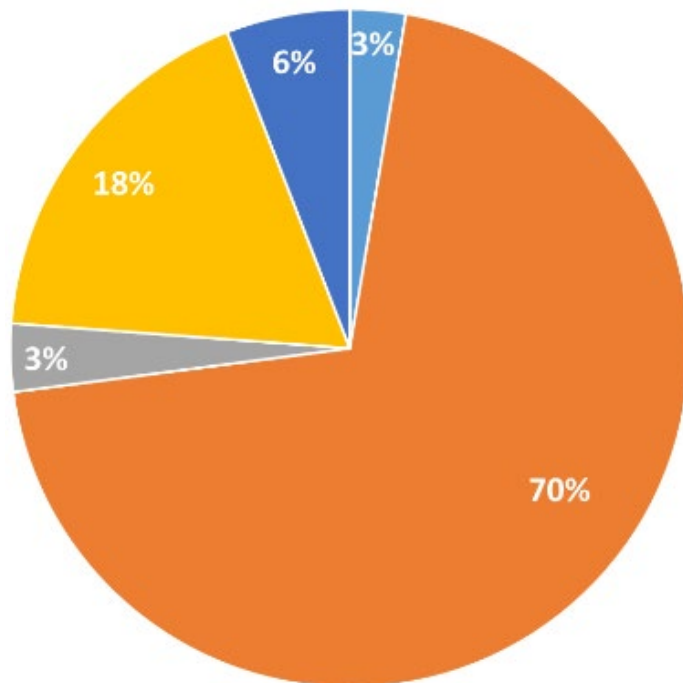


# What pesticides are used on pesticide-treated seeds planted in California?

## CDFA Seed Inspection Data: 2010-2021

- 58 active ingredients represented
- 17 active ingredients not registered for seed treatment products in California

Number of records by category ( $n = 341$ )



■ Biological ■ Fungicide ■ Herbicide ■ Insecticide ■ Other

## Seed treatment products not registered:

### Examples

Pyrethroids (e.g., cypermethrin, cyfluthrin)

Herbicides (e.g., glyphosate, diquat dibromide)

## Examples of noteworthy products (registered):

Organophosphates (e.g., chlorpyrifos, acephate)

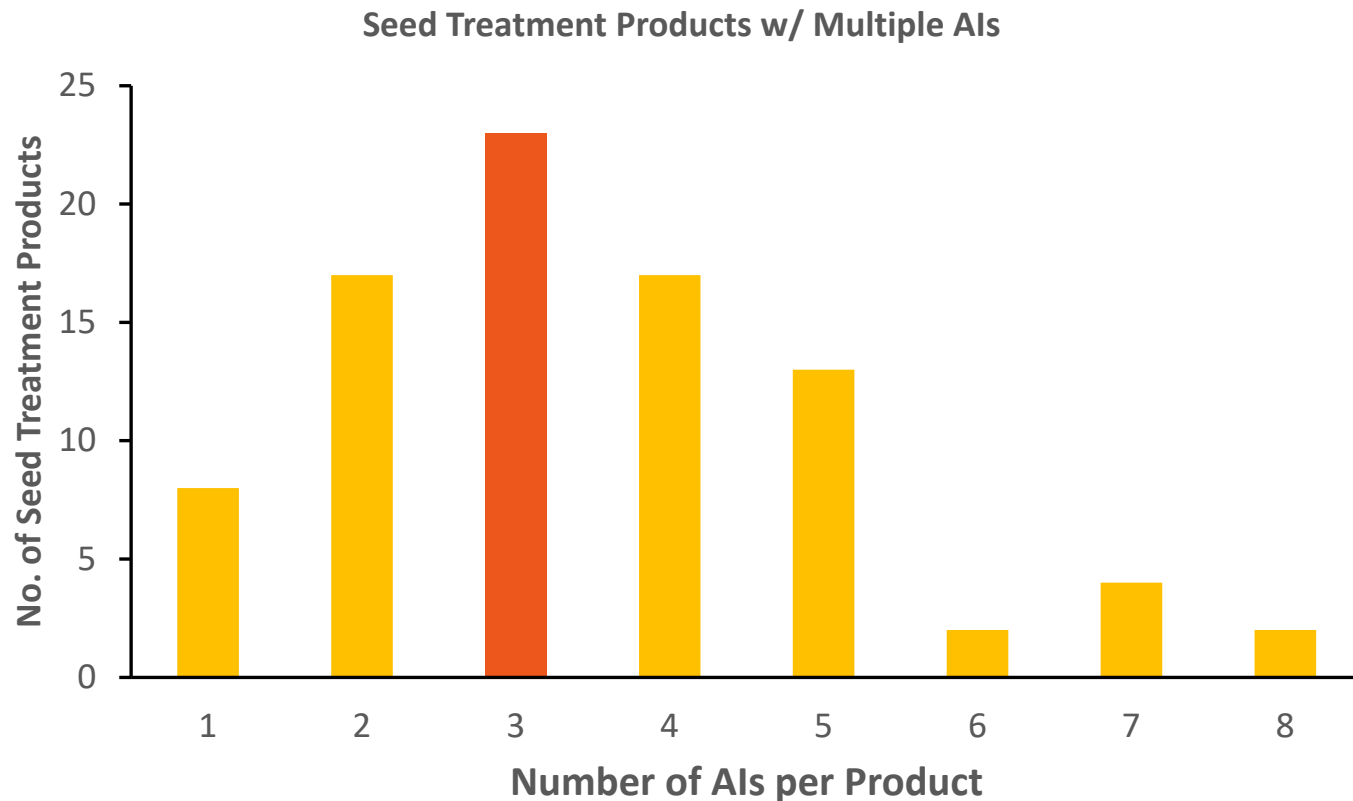
Neonicotinoids (e.g., clothianidin, thiamethoxam)



# What pesticide mixtures are on pesticide-treated seeds?

## Majority of products: Multiple active ingredients

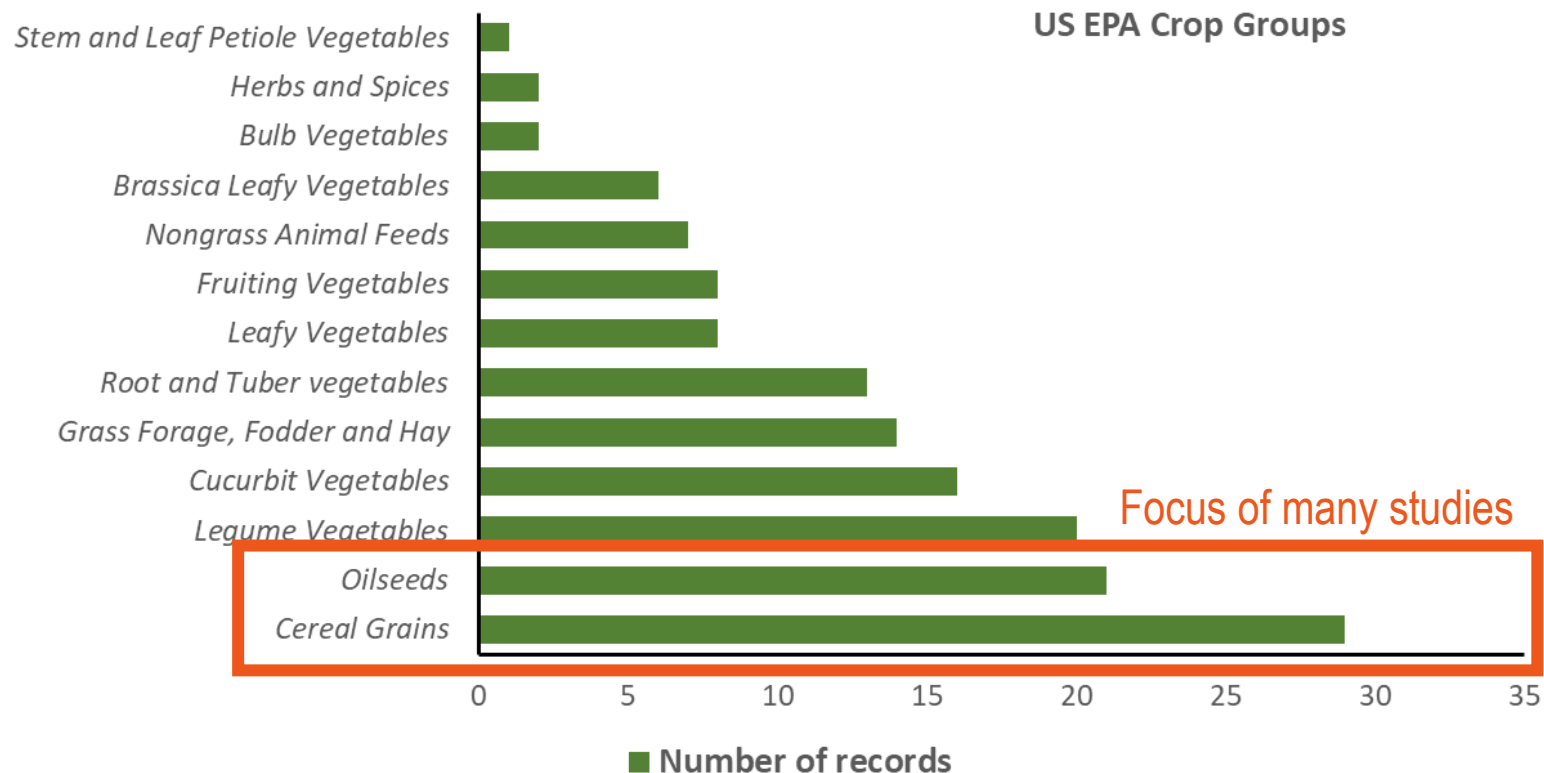
- Number of active ingredients range from 1 to 8
- Most products contain three active ingredients ( $n = 26$ ) – typically multiple fungicides



# What commodities utilize pesticide-treated seeds?

## CDFA Seed Inspection Data

- Pesticide-treated seeds are used for at least 13 of 26 US EPA crop groups
- Greatest number of products for cereal grains, oilseeds, legumes, cucurbits
- Groups not represented by seed treatments (e.g., citrus fruits, grapes/berries, tree nuts)



# Current knowledge and gaps

**Are some of CDPR's questions on seed treatment products answered?**

Other than neonicotinoids, what other pesticides are used in pesticide-treated seeds?

**Many! A range of active ingredients and pesticide types.**

What crops utilize pesticide-treated seeds?

**Cereals, oilseeds, fruiting vegetables, root vegetables, leafy greens...etc.**

Are non-CA registered pesticide-treated seeds coming into CA?

**Yes. CDFA data indicate this is occurring.**

Are there estimates of seed treatment mass applied or acres treated?

**Remains unknown.**

What proportion of the CA market uses pesticide-treated seed?

**Unknown.**



credit: incotec

# A California Case Study





# Transport from seed coatings used to grow vegetables

**Experimental Goal:** Investigate the potential runoff of imidacloprid and clothianidin under irrigation conditions

Two year study conducted at USDA Spence Farm (Salinas): 2019 (pilot year) to 2020

**Crop:** Romaine lettuce

**Experimental setup:** 16 plots in a randomized block design

Four Treatments (no. of fields):

(4) Imidacloprid seed: 39.1 g AI/acre (Admire Pro)

(4) Imidacloprid drench: 165.5 g AI/acre (Admire Pro)

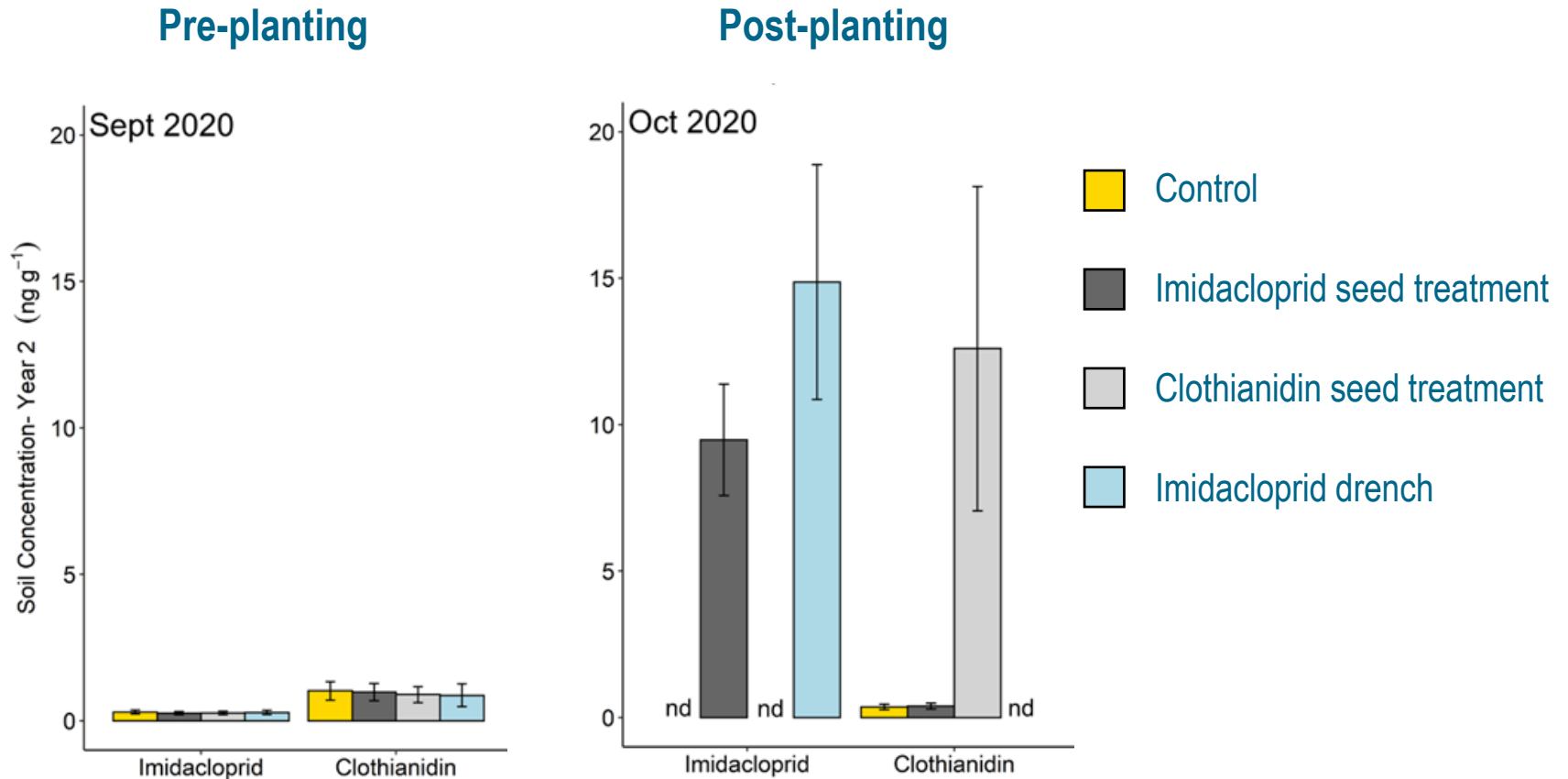
(4) Clothianidin seed: 55.8 g AI/acre (NipsIt)

(4) Control: no pesticides applied



**> 4 x the rate of application**

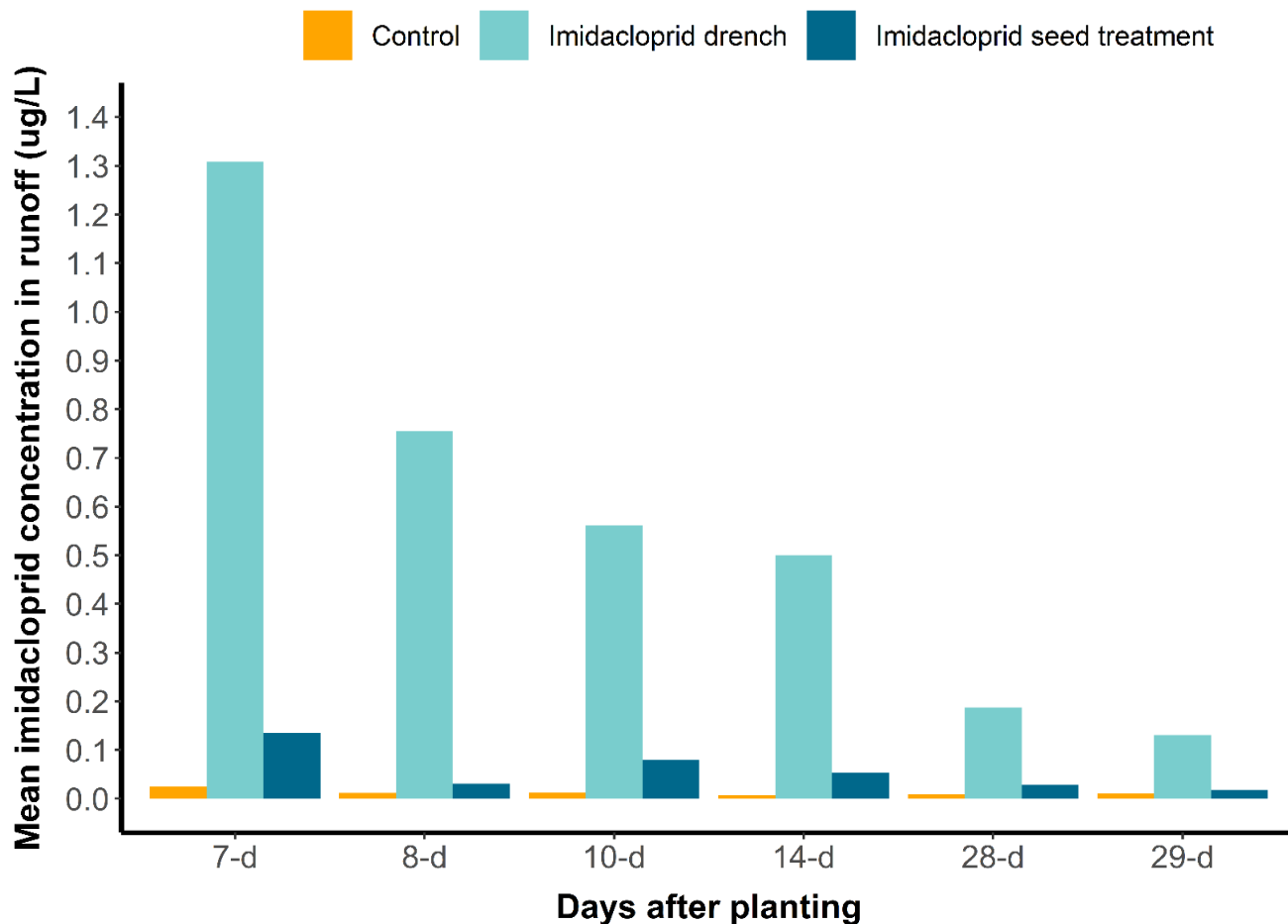
# Concentrations increased after planting



Woodward et al., 2021 (*In prep*)

# Neonicotinoids **can** move off-site into surface water

- Highest concentrations of imidacloprid in the drench treatment
- Seed treatments resulted in lower concentration of imidacloprid compared to drenching at planting



Woodward et al., 2021 (In prep)



A wide-angle photograph of a vast agricultural field filled with rows of vibrant green leafy vegetables, likely lettuce, stretching towards the horizon. The plants are densely packed and show signs of being well-maintained. In the background, there are rolling hills with a mix of green and golden-brown vegetation, suggesting a rural or semi-rural setting. A small, dark-colored tractor or farm vehicle is visible on the left side of the field, near the edge. The sky is a clear, pale blue, indicating a bright, sunny day. The overall scene conveys a sense of a healthy and productive agricultural landscape.

What are the potential mass contributions  
from pesticide-treated seeds?  
Monterey County: A case study



# Pesticide Use Reporting (PUR)

CDPR requires reporting of all agricultural pesticide use

Reporting includes pesticide applied, amount applied, area treated, and application method

Pesticide-treated seeds do not fall under State definition of a pesticide and are **exempt** from PUR reporting

Seed treatment products are considered industrial use and do not have the same reporting requirements





# Calculating potential mass from pesticide-treated seeds

~75% of US lettuce and leafy greens are grown in California; Monterey Co. is the largest producer

PUR data indicate neonicotinoids applied to lettuce as ground/aerial applications (e.g., spray, shank)

***Lettuce growers do not use imidacloprid as a pesticide-seed treatment***

***Calculations focused on clothianidin and thiamethoxam***

credit: progressive crop consultant



How does the relative mass contribution from pesticide-treated seeds compare to other application types?

# Max. potential mass applied via pesticide-treated seeds

## Calculated the individual mass for clothianidin and thiamethoxam separately

### Assumptions for estimates

1. All lettuce hectares being grown in Monterey Co. treated with clothianidin or thiamethoxam seed treatment
2. Maximum seeding rate per hectare followed label recommendations or published planting rates
3. Recommended maximum application rates were described on seed treatment labels
4. Estimates were based on the following equation:

**Mass** = maximum kilograms of AI per hectare X total lettuce hectares planted per year

AI	mg AI/seed	max. seeding rate/ha <sup>1</sup>	max kg AI/ha
clothianidin <sup>2</sup>	0.75	296,520	0.22
thiamethoxam <sup>3</sup>	0.90	308,875	0.28

<sup>1</sup>Based on seed treatment label OR recommended seeding rate in UCANR Publication 7216

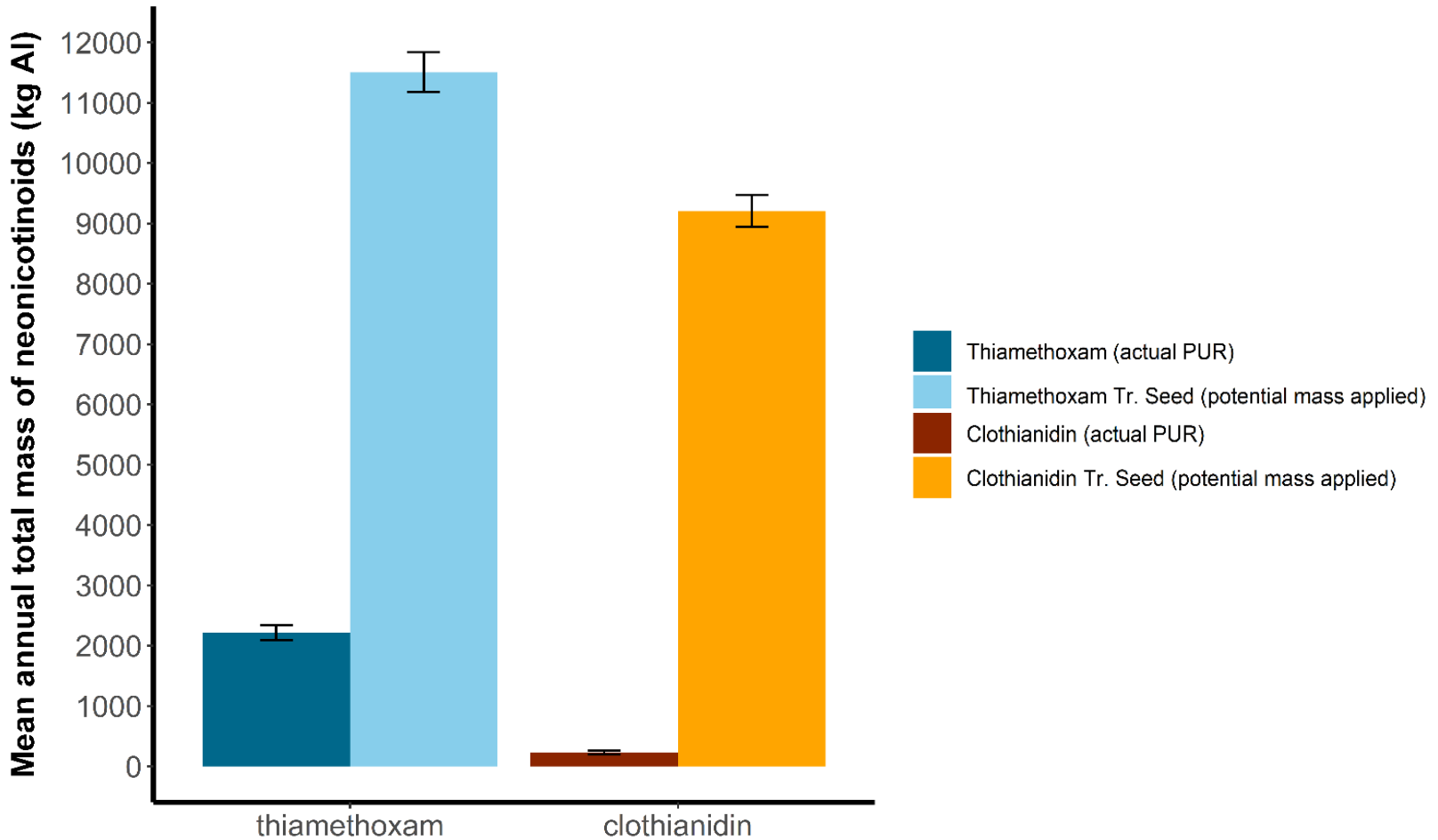
<sup>2</sup>Rate taken from *NipsIt Vegetables* seed treatment label

<sup>3</sup>Rate taken from *Cruiser 70 WS* seed treatment label



# Reported use vs. potential mass from pesticide-treated seeds

Represents mean annual total mass (kg AI) from 2016 to 2019 on head and leaf lettuce hectares



Pesticides applied to head and leaf lettuce crops (Monterey Co.)



Our estimates demonstrate that pesticide-treated seeds may introduce a significant contribution of pesticide mass that remains unreported in PUR.





# What is the relative contribution of pesticide-treated seeds?

- Environmental Monitoring uses PUR data to understand the relative contribution from different application types
- We do not know the contribution from pesticide-treated seeds





# Major questions remain...

- How do we accurately consider the relative contribution introduced through pesticide-treated seeds measured in California's surface waters?
- What is the runoff potential for pesticide-treated seeds associated with different commodities?
- Are there regional differences throughout the state of California?
- How do other active ingredients associated with pesticide-treated seeds, particularly non-systemics, move in the environment?



# Next steps

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Comments due February 15th, 2022

Submit to:

[TreatedSeeds@cdpr.ca.gov](mailto:TreatedSeeds@cdpr.ca.gov)

Or via hard copy to:

Jennifer Teerlink

1001 I Street, P.O. Box 4015

Sacramento, California 95812-4015





# Questions for public comment (1 of 3)

- What California crops are typically grown from pesticide-treated seeds? Is there any industry tracking of what portion of those crops rely on pesticide-treated seeds?
- Is there any tracking of how much (e.g., acres treated, pounds applied) total pesticide-treated seed is planted in California?
- What kind of insect or other pest pressures do seeds face?

## Questions for public comment (2 of 3)

- For crops that use pesticide-treated seeds, are these primarily imported, treated in California at a treatment facility or seed retailer, or treated on site?
- Is there any industry tracking or documentation that details how much pesticide treated seed is imported into California for use in California?
- What information is available on the mass of pesticide on the seed at the time of planting and how does that compare to rates stated on the seed treatment product label?

# Questions for public comment (3 of 3)

- The peer-review literature heavily focuses on environmental impacts from neonicotinoid-treated seeds. Is there information focused on other active ingredients utilized in pesticide-treated seeds?
- Is there any information on the relative environmental impact of pesticide-treated seeds versus other application methods?

**Thank You!**





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