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## Cover Crops & Herbicide Carryover

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## Cover crops

- Reduce erosion
- Decrease nutrient loss
- Build organic matter
- Improve infiltration
- Suppress weeds




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## How cover crops suppress weeds

- Physical suppression
  - Mulch layer hinders germination & growth
- Competition
  - Light, nutrients, water, space
- Allelopathy
  - Chemical compounds inhibit germination & growth
- Termination
  - Spraying, mowing, tilling cover crop
- Alter seed environment
  - Soil moisture, temperature, light, pests



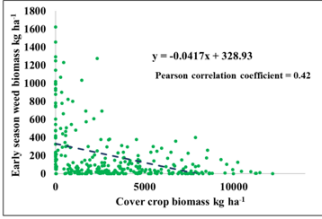
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## How cover crops suppress weeds

- Two main drivers
  - Biomass (lb/A)



$y = -0.0417x + 328.93$   
Pearson correlation coefficient = 0.42

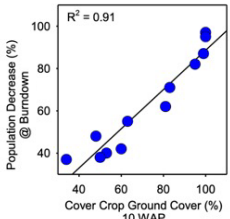
4 Hodgskiss et al. 2020 THE OHIO STATE UNIVERSITY COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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## How cover crops suppress weeds

- Two main drivers
  - Biomass (lb/A)
  - Ground cover (%)



$R^2 = 0.91$

5 Wallace et al. 2019 THE OHIO STATE UNIVERSITY COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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## How cover crops suppress weeds

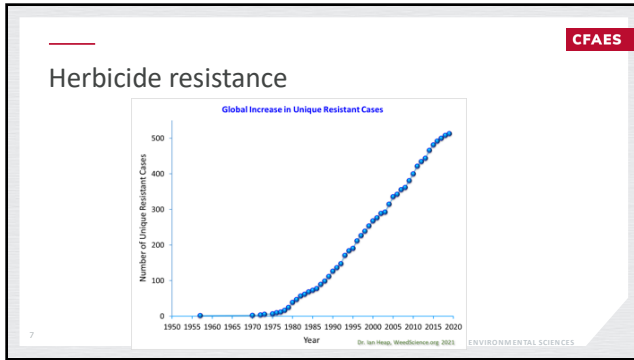
- Reduction in number and size of weeds
- Herbicide-resistance management
  - Lower weed density = less weeds exposed to herbicides
  - Smaller weeds = longer window of control
  - Potential to reduce herbicide inputs



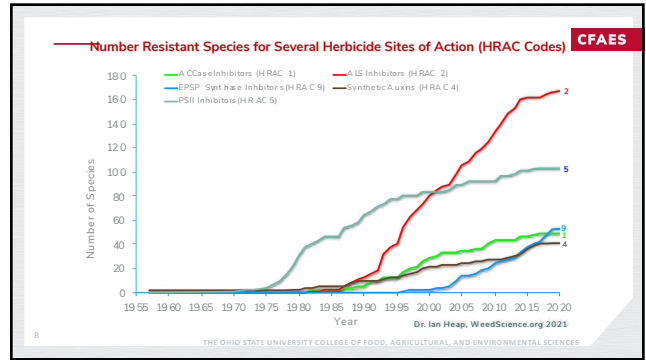
No cover crop vs. cereal rye

6 Hodgskiss et al. 2020; Wallace et al. 2019 THE OHIO STATE UNIVERSITY COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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### Herbicide resistance

- Repeated use of same herbicide
  - Selection pressure
- Lack of crop rotation
  - Narrows herbicide options
- Limited sites of action (SOA)
- Reduced rates

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### Residual herbicides are going to be more important than ever

Especially for weeds like waterhemp

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### Herbicide resistance in Ohio

Species	Common Name	Site of Action
<i>Chenopodium album</i>	Common lambsquarters	2, 5
<i>Daucus carota</i>	Wild carrot	4
<i>Amaranthus tuberculatus/rudis</i>	Tall waterhemp	2, 9
<i>Amaranthus powellii</i>	Powell amaranth	2
<i>Ambrosia artemisiifolia</i>	Common ragweed	2, 2 & 9, 2 & 14
<i>Ambrosia trifida</i>	Giant ragweed	2, 9, 2 & 9
<i>Xanthium strumarium</i>	Common cocklebur	2
<i>Sorghum bicolor</i>	Shattercane	2
<i>Conyza canadensis</i>	Horseweed	2, 9, 2 & 9
<i>Amaranthus hybridus/quitensis</i>	Smooth Pigweed	2
<i>Amaranthus palmeri</i>	Palmer amaranth	9, 14

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### DEALING WITH HERBICIDE RESISTANCE

*Proactive vs reactive*

How do we combat the current situation and prevent future instances of resistance?

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## Integrated pest management

- "Many small hammers"
  - Biological control
  - Cultural controls
  - Mechanical controls
  - Chemical control
- Cover crops
  - One of many small hammers needed in fighting herbicide resistant weeds



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## Cover crop establishment

- Planting date
- Seeding rate
- Planting method
- Carryover**



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## Herbicide carryover issues

- Herbicide carryover in cover crops will depend largely on **cover crop species selection** and **residual herbicides**
- **Rainfall** and **application timing** also play a role in carryover
  - Large variations year to year
- Studies out of Missouri highlight the most vulnerable species and damaging herbicides

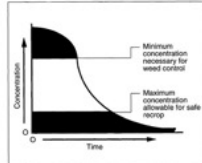
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## Factors that effect carryover

- Herbicides
  - High water solubility
  - Soil half-life
- Soil
  - High OM and clay content
  - High CEC levels increase risk
- Weather
  - Warm temperatures and rainfall increase degradation
  - Cool temperatures and drought increase carryover



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## Factors that effect carryover

- Application
  - Residuals at plant less risky than with POST
  - Incorporation increases persistence
- Tillage
  - Increases microbial degradation, reduces volatilization and photodecomposition
- Species selection
  - Herbicides more effective on small seeded weeds → and cover crops
  - Rye tends to be least problematic


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## Herbicide carryover issues

- The general order of sensitivity of cover crops to herbicide carryover, from greatest to least sensitive
  - Tillage radish > Austrian winter pea > crimson clover = annual ryegrass > winter wheat = winter oats > hairy vetch = cereal rye



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### Herbicide carryover issues

- Soybean herbicide treatments that were most injurious to cover crops
  - Fomesafen (Flexstar/Prefix), pyroxasulfone (Zidua), imazethapyr (Pursuit), acetochlor (Warrant), sulfentrazone (Authority products)
- Corn herbicide treatments that were most injurious to cover crops
  - Topramezone (Impact), mesotrione (Callisto, Halex GT, etc.) clopyralid (Stinger, SureStart), isoxaflutole (Balance Flexx), pyroxasulfone (Zidua, etc.), nicosulfuron (Accent Q, etc.)

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### Herbicide carryover issues

Carryover of post soybean treatments to tillage radish

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### Herbicide carryover issues

Carryover of post soybean treatments to cereal rye

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Legend: No reduction in any year (Green), Reduction in 1 of 3 years (Yellow), Reduction in 2 of 3 years (Red)

Herbicide Treatment	Rate	Cover Crop Species							
		Winter Wheat	Tillage Radish	Cereal Rye	Crimson Clover	Winter Oat	Austrian Pea	Annual Ryegrass	Hairy Vetch
Atrazine	2 qts	Green	Green	Green	Green	Green	Green	Green	Green
Callisto	3 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green
Laudis	3 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green
Impact	3/4 fl oz	Green	Green	Green	Green	Green	Green	Green	Green
Balance Flexx	5 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green
Stinger	1/2 pt	Green	Green	Green	Green	Green	Green	Green	Green
Python	1 oz	Green	Green	Green	Green	Green	Green	Green	Green
Resolve	1 oz	Green	Green	Green	Green	Green	Green	Green	Green
Accent Q	0.9 oz	Green	Green	Green	Green	Green	Green	Green	Green
Surestart + Atra	1.25 pt + 1 qt	Green	Green	Green	Green	Green	Green	Green	Green
Halex GT + Atra	4 pt + 1 qt	Green	Green	Green	Green	Green	Green	Green	Green
Capreno	3 fl ozs	Green	Green	Green	Green	Green	Green	Green	Green
Zidua	3 ozs	Green	Green	Green	Green	Green	Green	Green	Green

Cornelius and Bradley, 2017. Carryover of common corn and soybean herbicides to various cover crop species. Weed Tech 31:21-31.

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### Cover Crop Groundcover Reduction in Response to Residual Herbicides Applied in the Previous Soybean Crop (2016/17)

Whalen et al. 2019. Evaluation of cover crop sensitivity to residual herbicides applied in the previous soybean crop. Weed Technology 33:312-320.

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### Herbicide carryover issues

In general, residual herbicides with grass activity can interfere with establishment of some grass cover crop species, especially smaller seeded ryegrass species

Group 2 (ALS), group 5 (triazine), group 14 (PPO), or group 27 (bleacher) residual herbicides can interfere with the establishment of some broadleaf cover crop species

Purdue University

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Not sure what to expect?  
 Conduct a field bioassay

- Collect soil from treated areas ~ August - Sep
- Plant desired species in treated and untreated soils
- Water the soil and keep track of emergence and growth
- Will help indicate whether or not there will be issues

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Carry over from in-season herbicides – what about fall applied residuals?


Coming soon...

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Cover crop fact sheet series



<https://iwilltakeaction.com/news/cover-crop-fact-sheet-series>

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Weed Management Resources

- OSU C.O.R.N. Newsletter  
<http://corn.osu.edu/>
- OSU Weed Science Website  
<http://u.osu.edu/osuweeds>
- Weed Control Guide for OH/IN/IL/MO  
 OSU Extension ANR-789, OSU Extension eStore
- Ohio Agronomy Guide  
<https://extensionpubs.osu.edu/ohio-agronomy-guide-15th-edition/>

OSU Weed Science Website

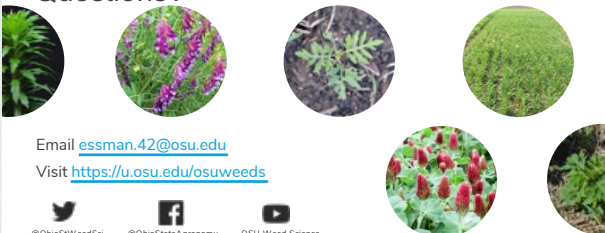


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Questions?



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