

# Cover Crops for Integrated Weed Management in Soybean

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## What is integrated weed management?

- Using multiple, complementary weed control practices

### Herbicides

- Sequential
- Residual
- Multiple sites of action
- Well-timed

### Cultural practices

- Crop rotation
- Cover crops
- Seeding date
- Row spacing
- Plant populations
- Good agronomic practices

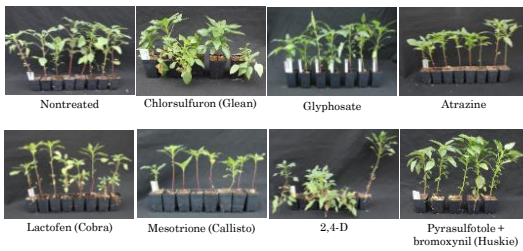


## Why integrated weed management?

- Herbicide resistance
- Sustainability?
- Herbicide resistance



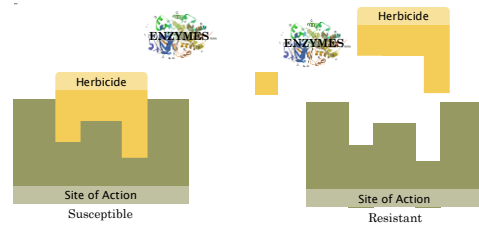
## Multiple resistant Palmer amaranth



Slyam et al., 2019



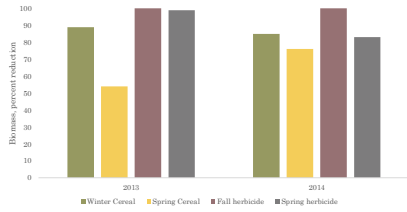
## Non-target-site resistance (Metabolic resistance)



Cytoschrome P450 structure: Oryepka et al 2011



## Cover crops and herbicides control horseweed similarly



Christenson et al., 2015



## Comparison

	Marestail control	Cost per acre
Fall herbicide	100%	\$34.09
Winter cereal rye	91-100%	\$49.87
Winter cereal rye with incentive		\$13.54

Fall herbicide: 4 oz ValorXLT plus 0.5 pt dicamba  
 Winter cereal rye: 90 lbs, 2.25 pt glyphosate  
 Incentive: EQUIP, practice 310



## How cover crops control weeds

- Competition
- Allelopathy?
- Alter soil conditions



## Allelopathic effect is inconsistent

	Large crabgrass height (inches)		
	Fresh residue	Leached residue	Leachate
Summer 2018	6.7	8.3	22
Fall 2019	1.1	0.9	1.6



Hilgema, 2017  
 Decker and Lancaster, 2019



## Palmer amaranth germination

- Warmer soils increase germination
- Fluctuating temperatures increase germination
- Light exposure increases germination



Ba et al., 2010



## Weed suppression is related to cover crop biomass accumulation



Chen et al., 2019



## Postemergence Palmer amaranth control

Herbicide	Active ingredient	Site of action (WSSA group)	Max. labeled height (in.)
Cobra	lactofen	PPO inhibitor (14)	2
Engenia	dicamba	Synthetic auxin (4)	4
Liberty	glufosinate	Glutamine synthetase inhibitor (10)	5
Reflex	fomesafen	PPO inhibitor (14)	4'
Resource	flumiclorac	PPO inhibitor (14)	4'
Ultra Blazer	acifluorfen	PPO inhibitor (14)	4

\*Label reads "6 true leaves"



## Integrated pigweed management in soybean

- 2 years, 3 locations
- Row-width, cultivation, cover crop, herbicides



Hay et al., 2019



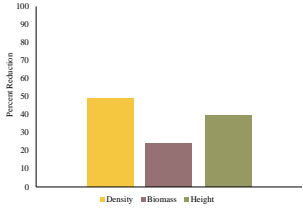
# Integrated pigweed management in soybean

- Herbicide program provided excellent weed control
- Row width had limited affect on pigweed
- Cover crop generally reduced Palmer amaranth growth



Hay et al., 2019

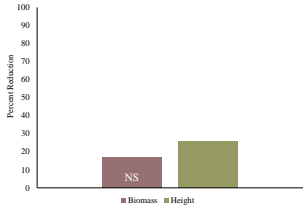
# Palmer Amaranth Growth Reduction 8 WAP by Winter Wheat - Manhattan



Hay et al., 2019



# Palmer Amaranth Growth Reduction 8WAP by Winter Wheat - Hutchinson



Hay et al., 2019



# Waterhemp Growth Reduction 8 WAP by Winter Wheat - Ottawa



Hay et al., 2019



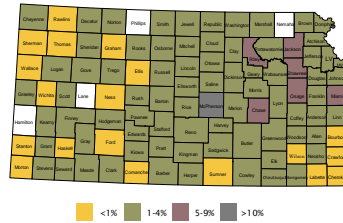
## Comparison

	Pigweed control	Cost per acre
Herbicide	97+%	\$124.64
Winter wheat	0-62%	\$99.09
Winter wheat with incentive		\$62.73
Winter wheat with grazing		\$77.59
WW with incentive and grazing		\$41.26

**Herbicide:** 2.25 oz Zidua SC, 20 oz Authority MTZ, 2 pt Prefix, 36 oz Liberty, 3 lb AMS  
**Winter wheat:** 120 lbs, 50 lbs urea, 27 oz Roundup PowerMax  
**Incentive:** EQUIP, practice 340  
**Grazing:** pasture rental rate



## Cover Crop Use Percent of cropland



2017 Census of Agriculture



## Conclusions

- Herbicide resistance is changing the way we manage weeds
- Cover crops alone may be effective for some winter annual weeds, but do not adequately control key summer annual weeds
- Cover crops may enhance weed control by herbicides
  - Reduce density/biomass, slow emergence/growth



## Things we don't know:

- How do cover crops affect season-long pigweed management compared to fall-applied herbicides?
- How do cover crops impact efficacy of residual herbicides?
- How will new herbicide resistant soybean systems affect economics of integrated pigweed management?





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