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Strategies to Use Cover Crops for Weed Suppression

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Introduction

- ✓ **Farmers are demanding information about using cover crops for weed suppression (among other uses)**
- ✓ **Cropping systems are diverse from west to east:**
  - ✓ **Winter wheat-fallow**
  - ✓ **Winter wheat-grain sorghum-fallow**
  - ✓ **Grain sorghum or corn-soybean-winter wheat**
  - ✓ **Corn-winter wheat/DC soybean**
- ✓ **Length of fallow period becomes shorter from west to east**

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Overview

1. What is your targeted weed species?
2. What will precede and what will follow the cover crop in your rotation?
3. How will you terminate your cover crop and when?

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Introduction

- ✓ Key 'driver' weed species, may have single or multiple resistance to herbicides:
  - ✓ kochia
  - ✓ Palmer amaranth
  - ✓ waterhemp
  - ✓ horseweed (marestail)

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Key considerations

1. **What is your targeted weed species?**
   1. **What cover crop will you plant and when?**
   2. **Knowing when your <u>key weed species</u> germinates and emerges in the field, dictates the best time for cover crop sowing and establishment:**
      - ❑ **Late summer and fall/winter cover crops for**
        - ✓ **Horseweed and kochia**
      - ❑ **Early spring cover crops for**
        - ✓ **Palmer amaranth and waterhemp**

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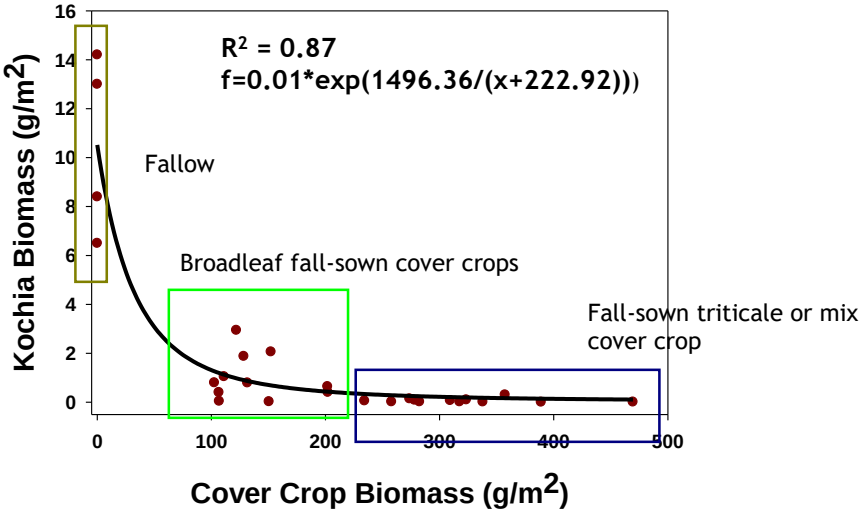
Kochia Response to Fall Cover Crops



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Petrosino et al. 2015, Crop, Forage & Turfgrass Mgmt 1

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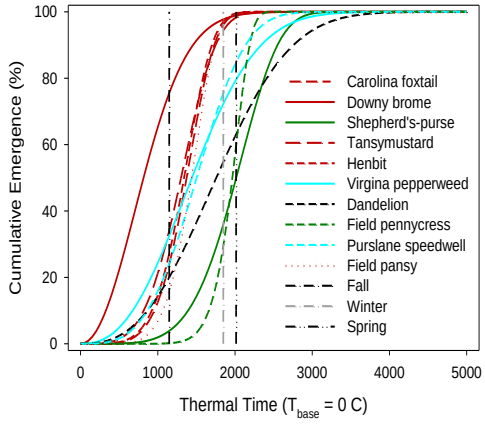
Observations of winter annual weed emergence in Nebraska, 2010 and 2011



Werle et al. 2014
Weed Sci. 62:83-96.

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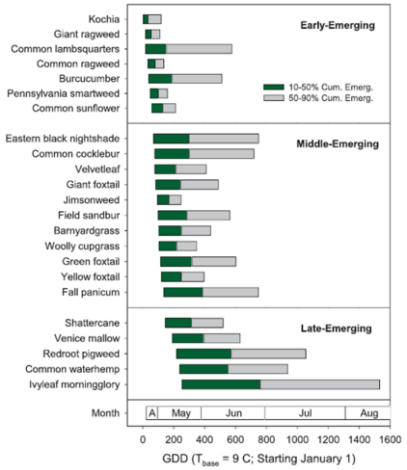
Fig 3. Emergence sequence and duration (10 to 90% of total emergence) of 23 summer annual weeds in Iowa.



Werle et al. 2014
Weed Sci. 62:267-279.

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Locations

Chelsea McCall, 2018
MS Research Project

Highland

Topeka

Ottawa

Iola

Parsons

Oswego

★ 2014-2015

★ 2015-2016

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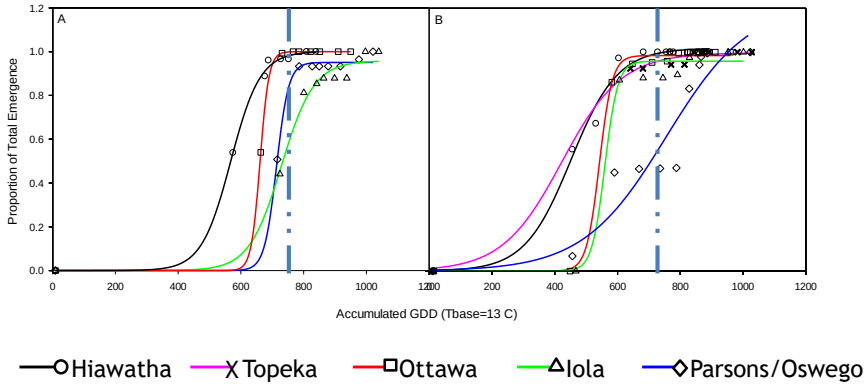
Horseweed emergence patterns

Cumulative proportion of total horseweed emergence in the absence of competition in (A) 2014-2015 and (B) 2015-2016



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Weed control vs. Cover crops

	Horseweed Suppression	
Treatment	2013	2014
	%	
Untreated Control	0 d	0 d
Annual ryegrass	21 cd	59 c
Winter wheat	20 cd	93 ab
Winter barley	35 c	90 ab
Winter rye	94 ab	96 a
Spring oats	14 cd	-
Spring rye	-	89 ab
Winter rye/spring no residual	100 a	100 a
Fall residual	100 a	99 a
Fall no residual	94 ab	75 bc
Spring residual	98 a	85 ab
Spring no residual	97 ab	100 a

Andi Marie Christenson. 2015. Cover crops for horseweed [*Conyza canadensis* (L.)] control before and during a soybean crop. MS Thesis. Kansas State University.

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Overview

1. What is your targeted weed species?
2. What will precede and what will follow the cover crop in your rotation?
3. How will you terminate your cover crop and when?

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Key considerations

II. What cover crop will you plant and when?

- ✓ Consider your crop rotation sequence and where a cover crop can fit
  - ✓ Change the crop rotation
  - ✓ Change time of crop planting
- ✓ Establish the cover crop prior to that key point in lifecycle of weed species for greatest weed suppression impact?
  - ✓ Residue or living mulch reduce sunlight reaching soil surface
  - ✓ Alter microenvironment (moisture, temperature) during weed seed germination
  - ✓ Release of chemicals from roots or decaying residue to inhibit weed seed germination (allelopathy)

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Cover crop impacts on Palmer amaranth

May 13, 2015

July 13, 2015

No cover

Terminated Winter wheat Cover crop

Chelsea McCall, 2018, MS research project

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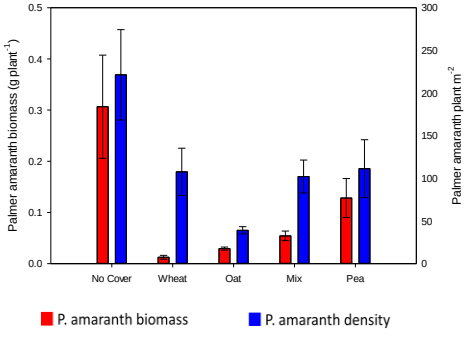
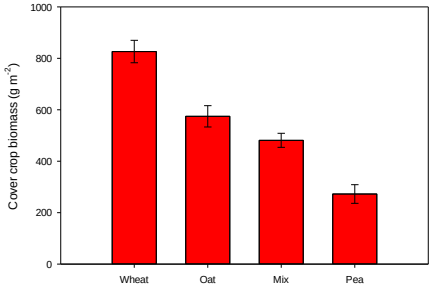
Cover crop impacts on Palmer amaranth

Chelsea McCall, 2018, MS research project

Palmer amaranth biomass and density prior to cover crop termination, May 18, 2015.



Aboveground cover crop biomass at termination, May 18, 2015



1000 g/m^2 = 4.46 ton/ac

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Cover crop impacts on Palmer amaranth

Chelsea McCall, 2018 MS research project

	May 13, 2015	July 13, 2015
Spring pea		
Spring oat		

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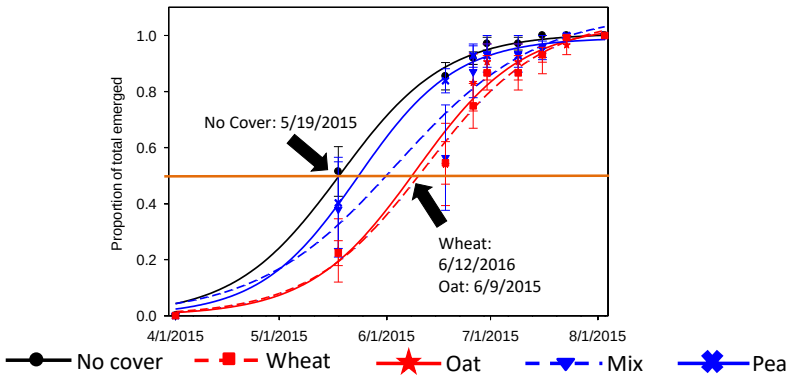
Season-long Palmer Amaranth Emergence



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Chelsea McCall, 2018, MS research project

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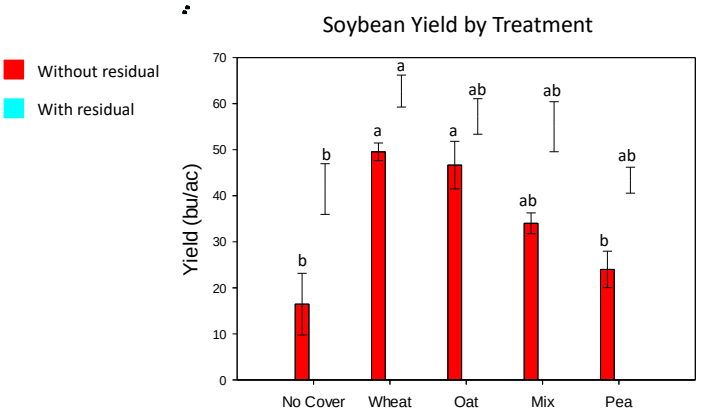

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Cover crops for early season weed suppression in corn

Malynda Smith, MS

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Materials and Methods
Experimental Design

- Locations
  - Manhattan (Ashland Bottoms)
  - Ottawa (ECK experiment station)
- RCBD with split-split plot arrangement
  - Whole plot: Cover crop
    - Triticale (*triticosecale*)
    - Pea (*Pisum sativum*)
    - Triticale + Pea
    - No cover
  - Subplot: Termination time
    - 3 weeks before corn planting (3WBP)
    - At corn planting (AP)
  - Sub- subplot: Nitrogen fertilizer rate
    - 100 kg N ha^{-1}
    - 168 kg N ha^{-1}

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Cover Crop Biomass

Manhattan 2019

	Cover crop biomass (kg ha^{-1})	
Cover crop	3WBP	AP
No cover	0 (0) e	0 (0) e
Pea	380 (35) de	2347 (246) cd
Full mix	3737 (667) bc	6746 (204) a
Triticale	5520 (737) ab	No data

Manhattan 2020

	Cover crop biomass (kg ha^{-1})	
Cover crop	3WBP	AP
No cover	613 (98) DE	0 (0) E
Partial mix	1557 (135) CD	5733 (370) B
Full mix	2152 (249) C	7962 (311) A
Triticale	1608 (50) CD	6110 (458) B

Mean cover crop biomass values for each year followed by same letter are not different at α = 0.05.

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Manhattan, KS
at corn planting
June 5, 2019

Manhattan, KS
at corn planting
May 20, 2020

Pea
AP termination
~2300 kg ha^{-1}

Triticale
AP termination
~ 6100 kg ha^{-1}

Triticale + pea
Terminated 3WBP
~ 2500 kg ha^{-1}

No cover
AP burndown

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Weed Density

1 week before planting
Manhattan 2019

	Weed density	
Cover crop	3WBP	AP
	Plants m^{-2}	
No cover	19 (8) c	98 (15) a
Pea	39 (12) bc	72 (12) ab
Full mix	0 (0) c	8 (7) c
Triticale	0 (0) c	No data

Mean weed density values followed by same letter are not different at α = 0.05 level.

* Cover crops in treatments to be terminated AP were live at the time of this count.

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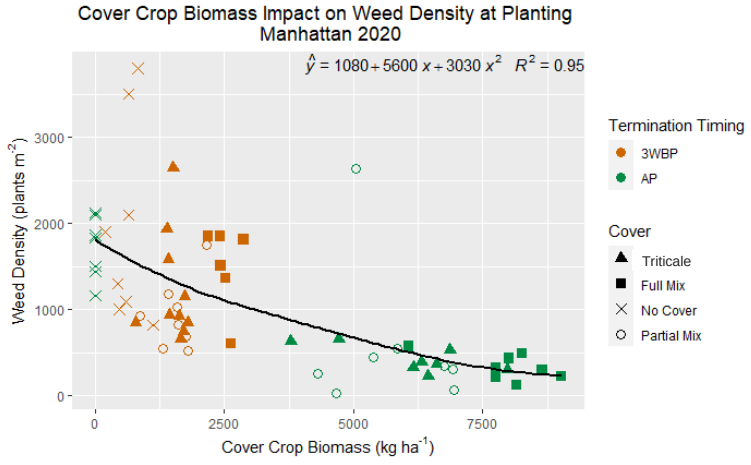

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Overview

1. **What is your targeted weed species?**
2. **What will precede and what will follow the cover crop in your rotation?**
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Termination timing and method

- ✓ **Consider both the cover crop and potential weed species present or will yet emerge**
  - ✓ **Some will freeze out**
  - ✓ **Some require specific timing and methods**
  - ✓ **Include a residual herbicide in termination / burndown application mixture**
- ✓ **Standard recommendation is at least 2 weeks prior to planting summer row crop**
- ✓ **Check with insurance providers, USDA-FSA, or NRCS for local rules on termination timing**

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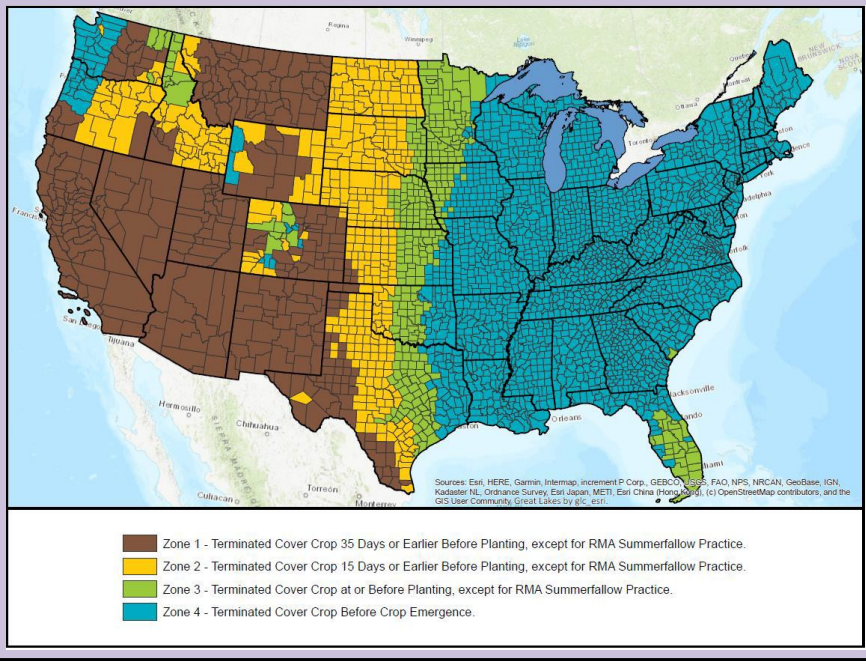
USDA-NRCS cover crop termination guidelines (v4: June 2019)



Efficacy of Pre-Emergence Herbicides on Palmer amaranth Control as Affected by Cover Crop Termination Timings (Ednaldo Borgato, PhD Candidate)

Cover Crop Treatments at Soybean Planting Date

NCC	DCC	GCC
		
No Cover Crop Terminated at CC emergence	**Dead Cover Crop** Terminated 2 weeks before soybean planting	**Green Cover Crop** Terminated at soybean planting date

- 2020: triticale + winter peas (100 + 67 kg ha^{-1}); 2021: spring oats (100 kg ha^{-1})
- glyphosate + dicamba (800 + 280 g ai ha^{-1}) back-pack sprayer calibrated to deliver 187 L ha^{-1}

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Herbicide Treatments* at Soybean Planting Date

Herbicide	Dose (g ai/ha)	Type of activity
Non-Treated Control	-	-
Flumioxazin (Valor)	28.9	Soil + leaves
Metribuzin	226.8	Soil + leaves
S-metolachlor (Dual II Magnum)	723.3	Soil
Saflufenacil (Sharpen)	10	Soil + leaves
Sulfentrazone (Authority)	113.4	Soil + leaves

*Glyphosate + dicamba (800 + 280 g ai ha^{-1}) were added

- Applied at soybean planting
- Back-pack sprayer calibrated to deliver 187 L ha^{-1}

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Greater CC biomass increases weed suppression

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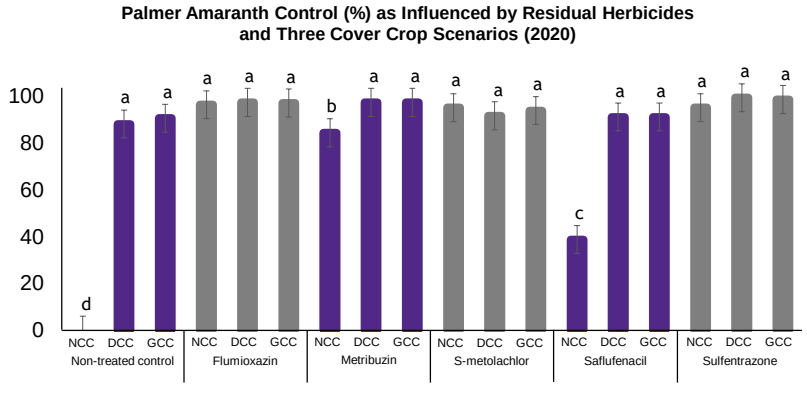
Saflufenacil+NCC provided the poorest control fb Metribuzin+NCC



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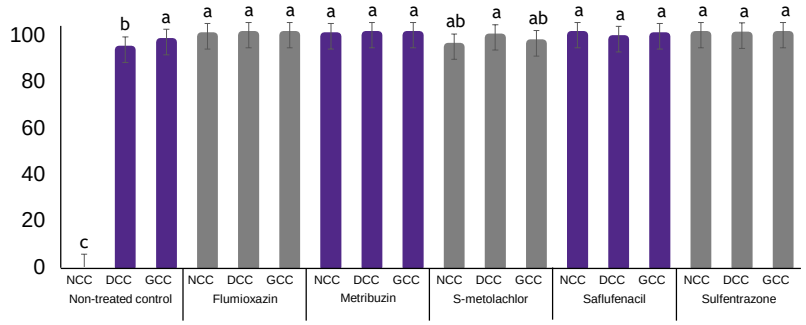
Herbicides were not affected by CC termination timing; GCC provided control similar to H, H+DCC and H+GCC

Palmer Amaranth Control (%) as Influenced by Residual Herbicides and Three Cover Crop Scenarios (2021)



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Future Research – impact on cash crop establishment

Effect of different CC termination timings on soybean (cash-crop) establishment (i.e., initial height, stand) needs to be investigated further

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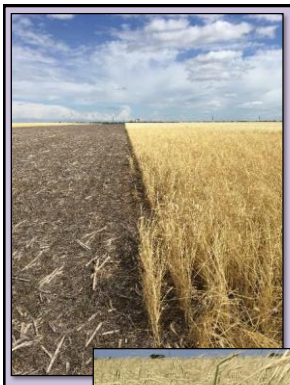



June 25/19 at Ashland Bottoms Experiment Field, Manhattan, KS

Termination time: 5 wk before planting

No cover crop
Residual (Acuron and RU)

Termination time: 3 wk before planting

Cover crop
No residual (RU only)

Termination time: 5 wk before planting

Cover crop
No residual (RU only)

Termination time: day of planting

Cover crop
No residual (RU only)

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Impact of termination timing on weed density

Luke Chism, MS student

Weed density (#/m^2 (SE)) on June 25, 2019 (20 d) after termination.			
		No Residual	Residual
Termination timing	5 wk before plant	185 (35)	20.5 (10)
	3 wk before plant	193 (28)	7 (4)
	1 wk before plant	141 (38)	0
	Day of plant	3.5 (2)	0.5 (0.5)
Cover crop	Cover crop	90 (21)	5.5 (2)
	No cover crop	171 (30)	8.5 (5)

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Impact of termination timing on corn yield

Luke Chism, MS student

Corn yield (bu/ac (SE)) in 2019 at Ashland Bottoms.			
		No Cover crop	Cover crop
Termination timing	5 wk before plant	136 (6)	144 (7)
	3 wk before plant	144 (3)	136 (5)
	1 wk before plant	144 (2)	137 (4)
	Day of plant	137 (5)	126 (5)
Residual	Residual	147 (2)	135 (3)
	No residual	136 (3)	138 (4)

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Termination timing

Observations of soybean and weeds on June 7, 2018 on Josh Lloyd's farm near Oak Hill, KS

Term. time re: soybean planting	Term. date	Growth stage of cereal rye	Observations on June 7, 2018			Mean soybean yield (SE)
			Soybean stage	Soybean (cm)	Weed counts (#/0.25 m^2)	Yield (kg ha^{-1})
1 wk prior	May 8	25 cm	V3	23	16	2935 (194)
At planting	May 15	boot	V3	23	6	3050 (81)
1 wk post	May 23	heading	V1	13	0	3000 (195)

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Cover crops before soybean

June 25, 2019, Luke Chism 2019 MS research

5 weeks before planting

3 weeks before planting

at planting

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Overview

1. **What is your targeted weed species?**
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Acknowledgements & Questions?

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