K-STATE
Research and Extension

Use of Cover Crops for Weed Suppression in Field Crops in Kansas

Anita Dille and Josh Lloyd

Knowledge for Life

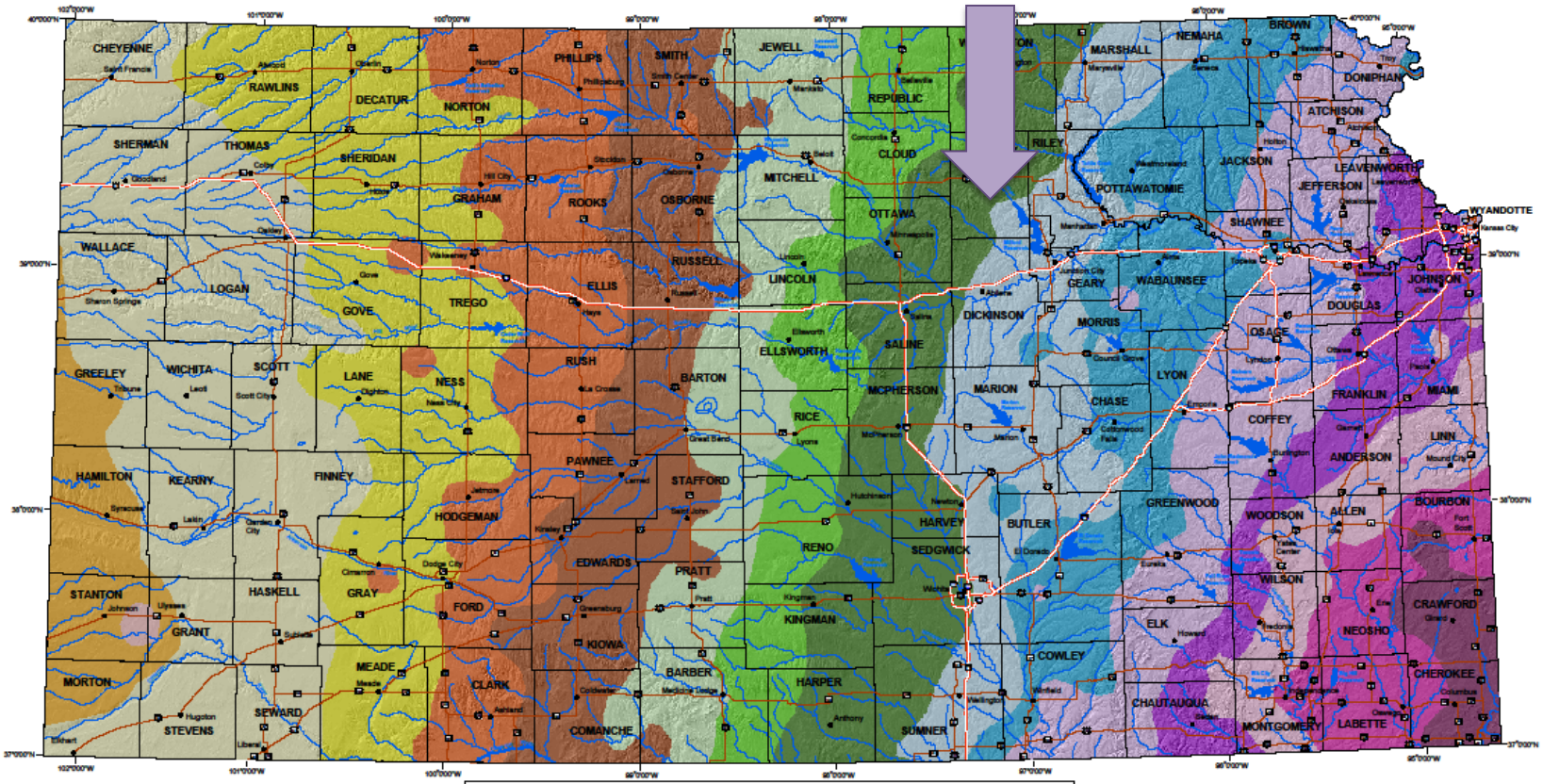
Introduction

- ✓ Kansas' farmers are demanding information about using cover crops for weed suppression
- ✓ Kansas cropping systems very diverse from west to east:
  - ✓ Winter wheat-fallow
  - ✓ Winter wheat-grain sorghum-fallow
  - ✓ Grain sorghum-soybean-winter wheat
  - ✓ Corn-soybean-winter wheat
- ✓ Length of fallow periods reduced from west to east

USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

KANSAS
ANNUAL PRECIPITATION



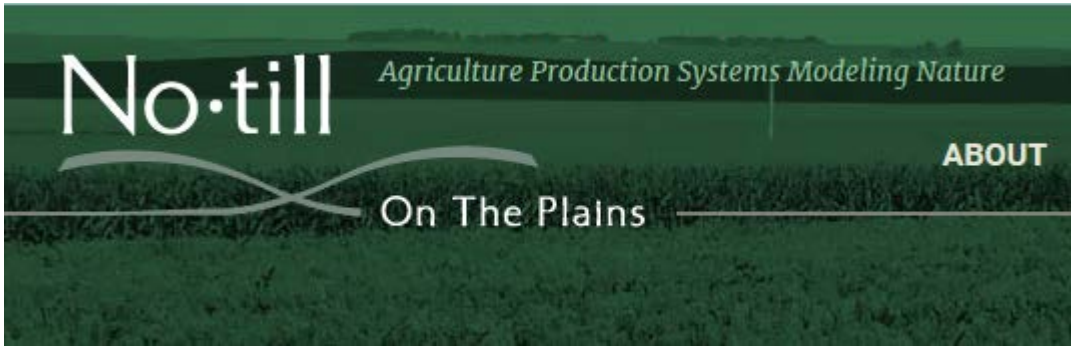
Knowledge for Life

Introduction

- ✓ **Key 'driver' weed species in Kansas, have single or multiple resistance to herbicides:**
  - ✓ **Horseweed**
  - ✓ **Kochia**
  - ✓ **Palmer amaranth**
  - ✓ **Waterhemp**

Objectives

- ✓ **In farmers' fields, to what extent are cover crops suppressing weeds before soybean planting**



KANSAS SOYBEAN COMMISSION

- ✓ **How are farmers' fitting cover crops into their Kansas' cropping system**

Josh Lloyd's Base Rotation

Year 1	Year 2	Year 3	Year 4	Year 5
[DC WW – DC SB or CC]	[WW – DC]	[Corn or Milo]	[SB]	[SB]

- **Opportunities for Cover Crops**
  - Summer after Winter Wheat
  - Winter after Corn, Soybeans, Grain sorghum

Fall vs Spring Planting

Fall

- Cover Crop Options Limited
- Over Winter Growth
- Less issue with Residue blowing
- Knock Down Snow Catch

Spring

- More Cover Crop Options
- More issues with Residue blowing
- Can burndown winter annuals and grasses

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Clay County Cover Crop Mix

Legumes		2%						
Clover -Balansa "FIXatioN"	1.0	2%	L165-15-972-C	OR	80.00%	52.90%	0.00%	47.10%
Grasses		90%						
Spring Oats - Rockford	18.0	34%	MISC.RF_DF_14.1	SD	99.00%	99.56%	0.24%	0.20%
Spring Forage Barley	15.0	29%	TM_NE_14.25	NE	95.00%	99.49%	0.50%	0.01%
Triticale - Spring 141	14.0	27%	Pf-2015	NE	91.00%	99.71%	0.10%	0.19%
Brassicas		4%						
Rapeseed - Trophy	1.1	2%	45033-CAN	ID	85.00%	98.00%	0.50%	1.00%
Other Broadleaves		4%						
Safflower- Finch	2.1	4%	BS-VP-14-01	MT	83.00%	99.96%	0.00%	0.04%

Green Cover Seed 918 Road X Bladen, NE 68928 402-469-67

eller warrants that this seed conforms to the label description as required by federal and state seed laws. We make no othe

April 19, 1 month after Planting

Surveyed June 1 for cover crop biomass and weed biomass and density prior to soybean planting

Weeds in:
bare strip
= 14.2 weeds/m^2 (3.3 g/m^2)

oat cover crop = 7.2 weeds/m^2

mixed cover crop = 1.2 weeds/m^2

June 7

August 2nd

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2016 Test Site Clay County

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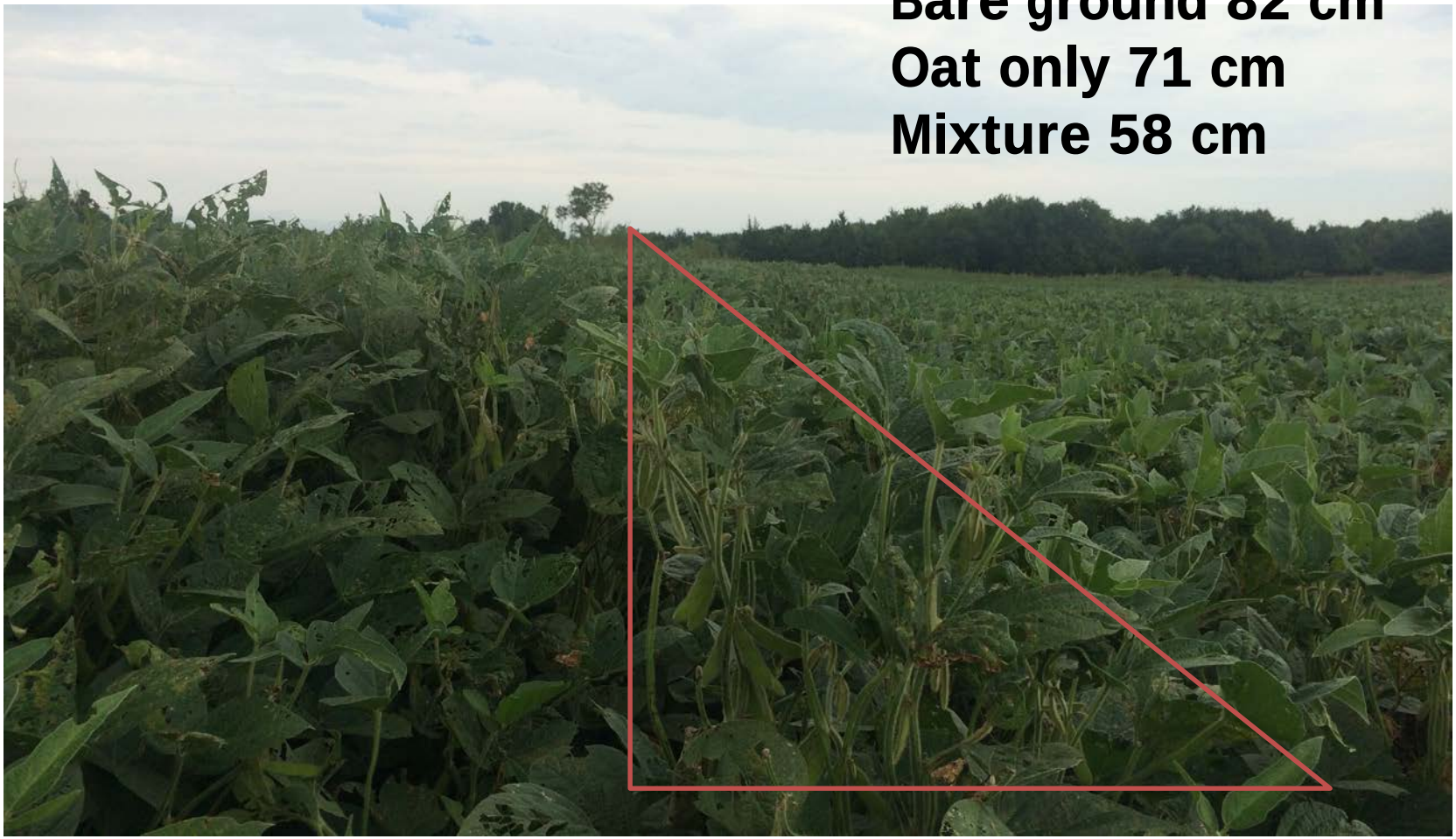
August 24th

Soybean heights:
Bare ground 82 cm
Oat only 71 cm
Mixture 58 cm



Osage City field site, 2016
Planted cover crops March 10
Surveyed June 3 for cover crop biomass and weed biomass and density

Weeds in:
bare strip
= 142 weeds/m^2 (3.3 g/m^2)

oat cover crop
= 76 weeds/m^2 (0 g/m^2)

August 30

Bare strip = downy brome

Oat cover strip = few weeds

Suppression on Farmer's Fields

- ✓ **Spring-sown cover crops (dominated by spring oat) provided:**
  - ✓ **50% or more reduction in individual weed plants**
  - ✓ **95% or more reduction in weed biomass**

- ✓ **Economics for Clay County farmer:**

Weed control costs, 2016

Field Activity	Date	Cover Crop		Bare Soil	
		$/ac	Products	$/ac	Products
Winter weed control	2/25			$11.16*	4 oz metribuzin 8 oz dicamba
	3/14	$36.34	Seed $18.34 Drill rent $18.00		
Burndown + PRE	6/1			$28.87*	3 oz Authority XL 1.5 oz Zidua 8 oz 2,4-D 24 oz glyphosate +1# AMS
Burndown	6/7	$7.89 *	24 oz glyphosate + 1# AMS		

* Includes application cost of $6.00 / acre

Weed control costs, 2016

Field Activity	Date	Cover Crop		Bare Soil	
		$/ac	Products	$/ac	Products
Early POST	7/8			$21.33*	24 oz U Blazer 24 oz glyphosate 16 oz COC + 1# AMS
	7/24	$16.77*	24 oz Ultra Blazer + 1# AMS		
Late POST	8/3	$23.65*	24 oz U Blazer 0.4 oz Cadet 24 oz glyphosate + 1# AMS + NIS	$20.53*	24 oz U Blazer 0.4 oz Cadet + 1# AMS + NIS
TOTALS		$84.65		$81.89	

* Includes application cost of $6.00 / acre

K-State HB Ranch,

Hays, KS 2016

Drilled cover crops mid-March

Surveyed June 13 for cover crop biomass and weed biomass and density

Weeds in:
Fallow = 258 weeds/m^2 (95.4 g/m^2)
Spring pea = 68 weeds/m^2 (3.2 g/m^2)
Triticale/oat = 28 weeds/m^2 (0.7 g/m^2)
Spring pea/triticale/oat mix
= 6 weeds/m^2 (0.2 g/m^2)

K-State Northwest Research Center, Colby, KS 2016

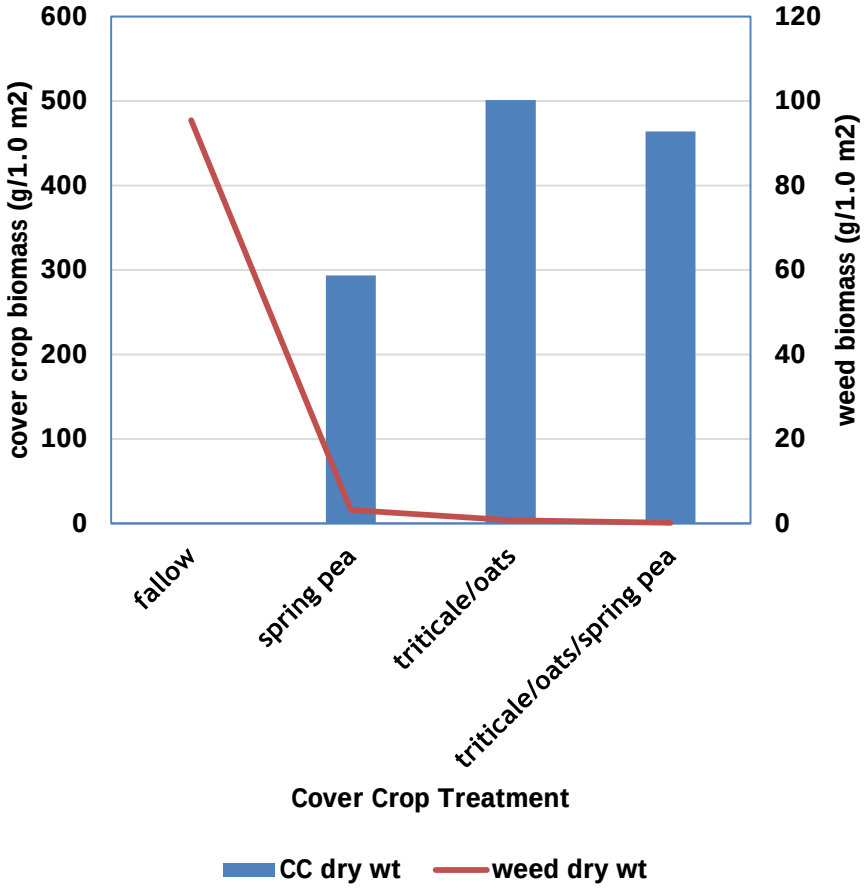
Drilled cover crops mid-March

Surveyed June 13 for cover crop biomass and weed biomass and density

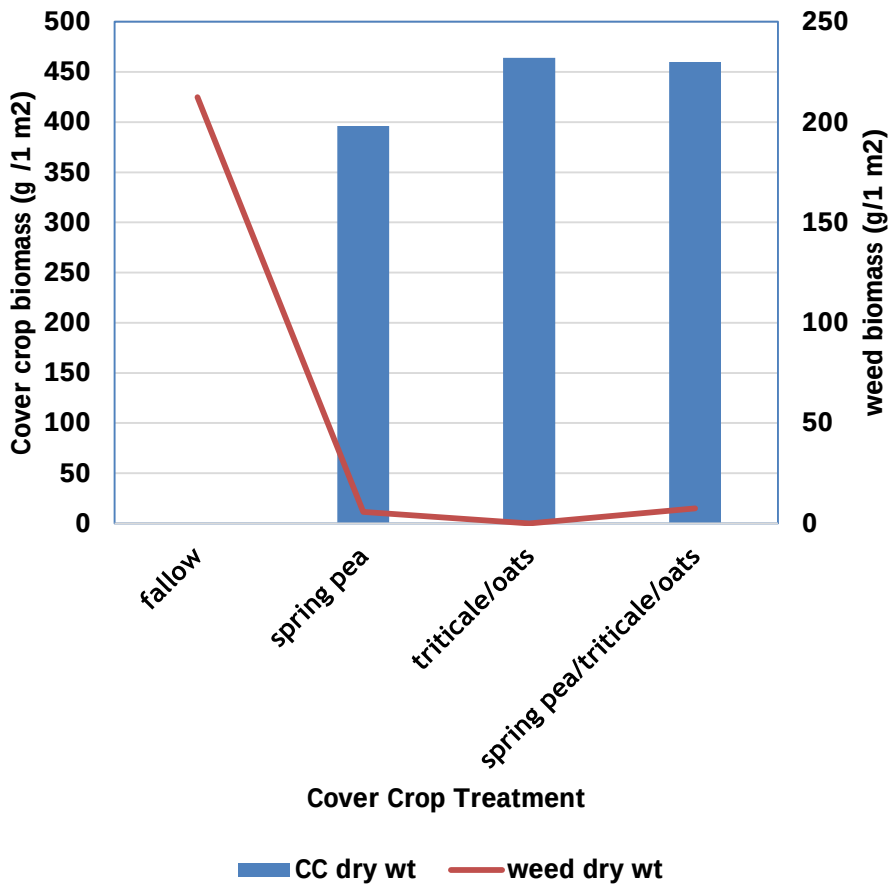
Weeds in:
Fallow = 153 weeds/m^2 (212 g/m^2)
Spring pea = 76 weeds/m^2 (5.8 g/m^2)
Triticale/oat = 0 weeds
Spring pea/triticale/oat mixed
= 32 weeds/m^2 (7.4 g/m^2)

June 13, 2016

HB Ranch, Hays, KS



NW Research Ctr, Colby, KS



Suppression at on-station fields

- ✓ **Spring-sown cover crops (dominated by cereals) provided:**
  - ✓ **50% or more reduction in individual weed plants**
  - ✓ **95% or more reduction in weed biomass**

Weed Suppression

- ✓ "Driver" weed species should dictate the recommended timing of cover crop sowing and establishment
  - ✓ Summer and winter cover crops for
    - ✓ Horseweed
    - ✓ Kochia
  - ✓ Early spring cover crops for
    - ✓ Palmer amaranth
    - ✓ Waterhemp

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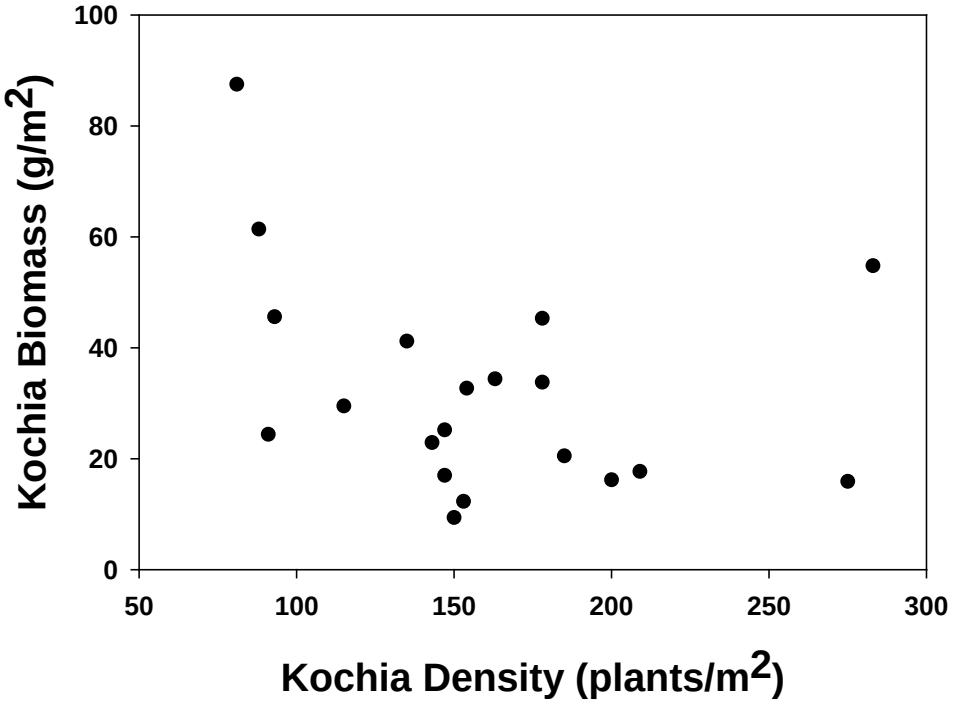
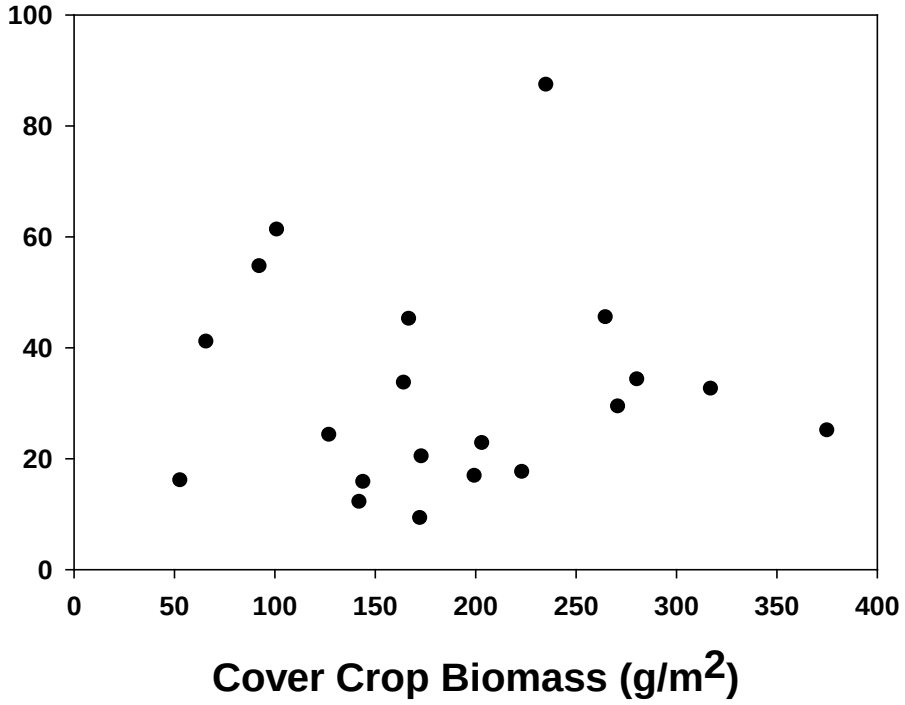
Kochia response to Spring Cover Crops

Kochia Density and Biomass



Spring Cover Crop Biomass and Kochia Biomass



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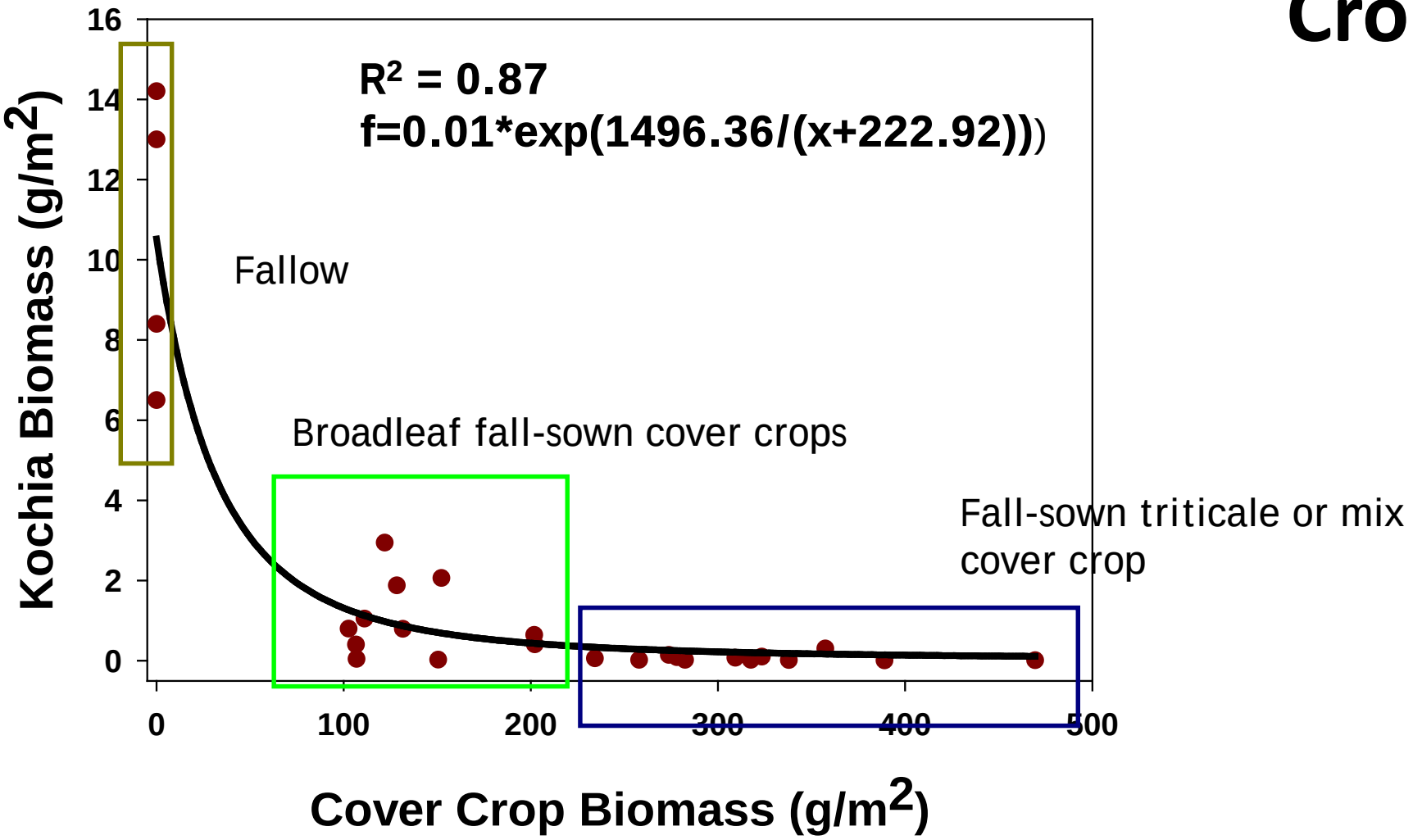
Petrosino et al. 2015, Crop, Forage & Turfgrass Mgmt 1

Kochia Response to Fall Cover Crops



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

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Horseweed Suppression

Treatment	Horseweed Suppression 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

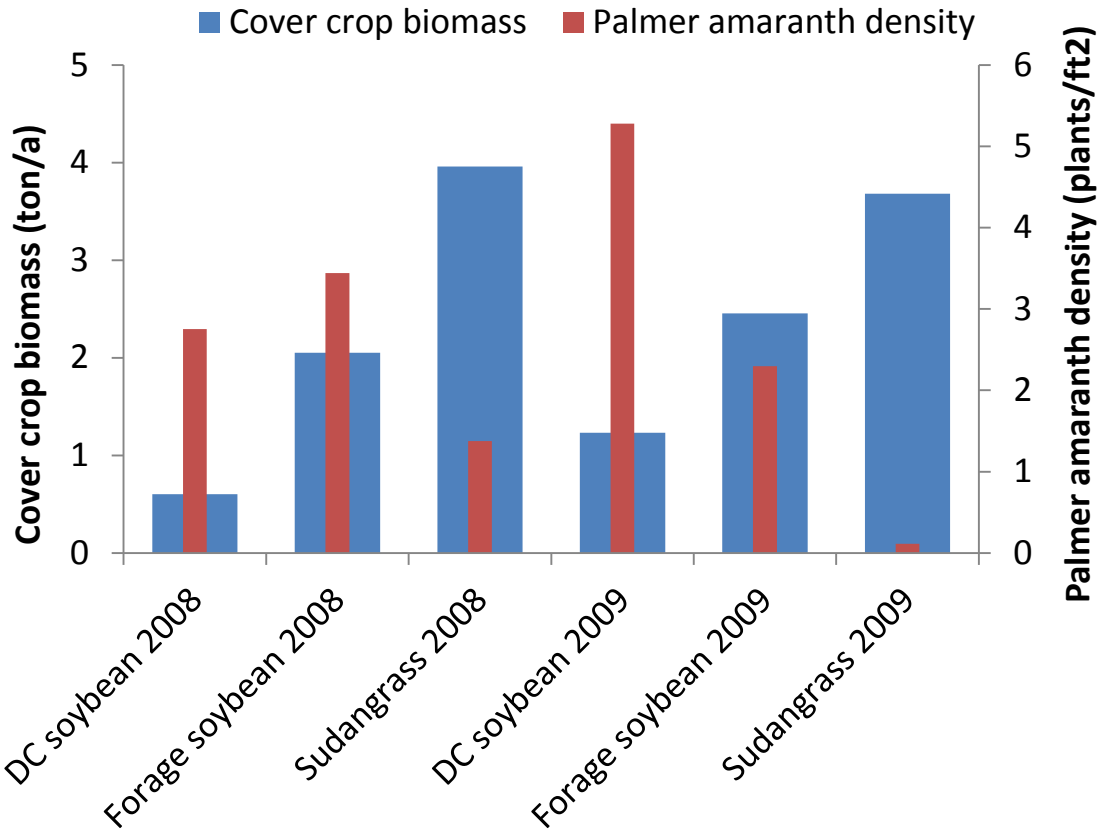
Knowledge for Life

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

Palmer amaranth in grain sorghum

Palmer amaranth suppression with summer cover crops

- **Cover crops after wheat harvest, before next year's grain sorghum**



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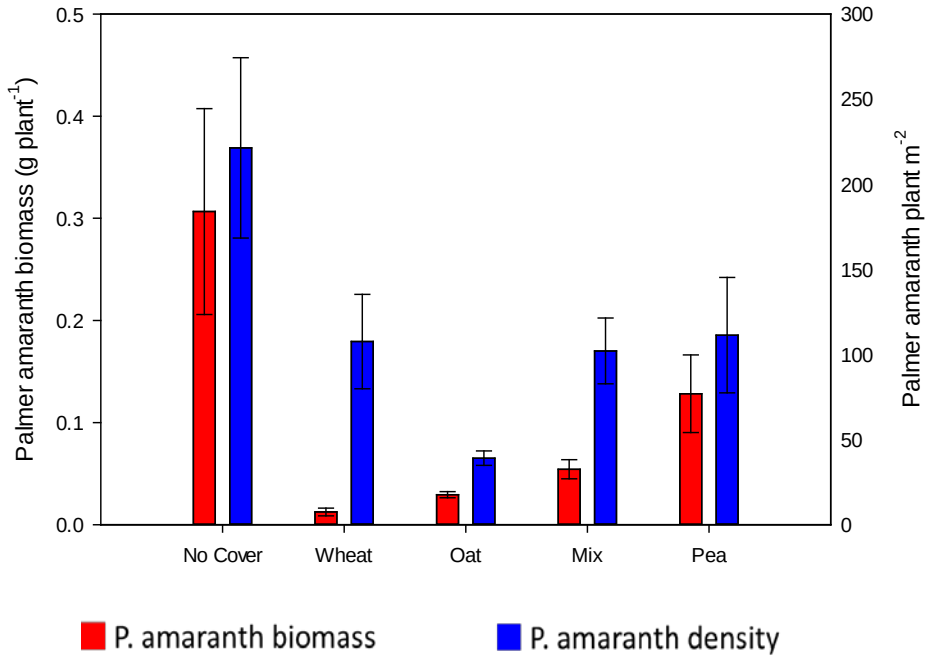
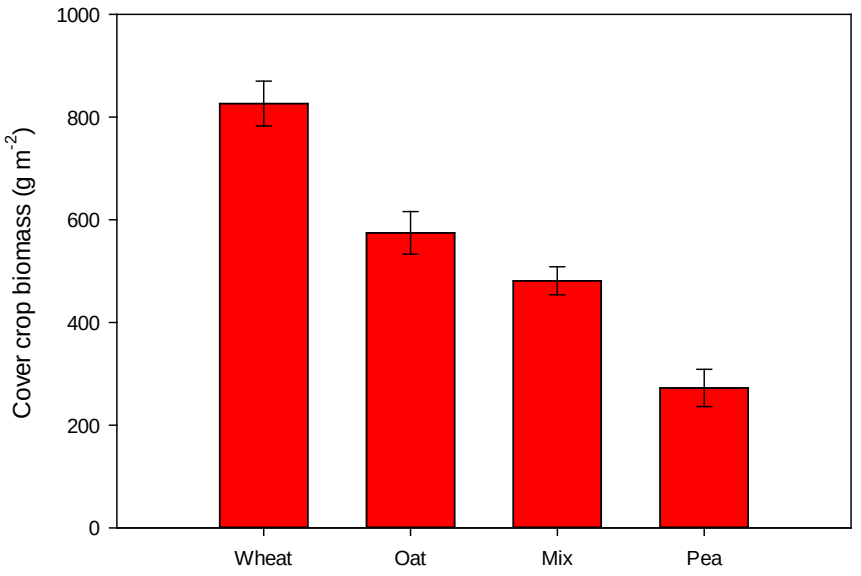
Palmer amaranth suppression with spring cover crops

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



Aboveground cover crop biomass at termination, May 18, 2015



Chelsea Ahlquist, MS research

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Cover crop impacts on Palmer amaranth

No cover, May 13, 2015

July 13, 2015

Terminated Winter wheat Cover crop

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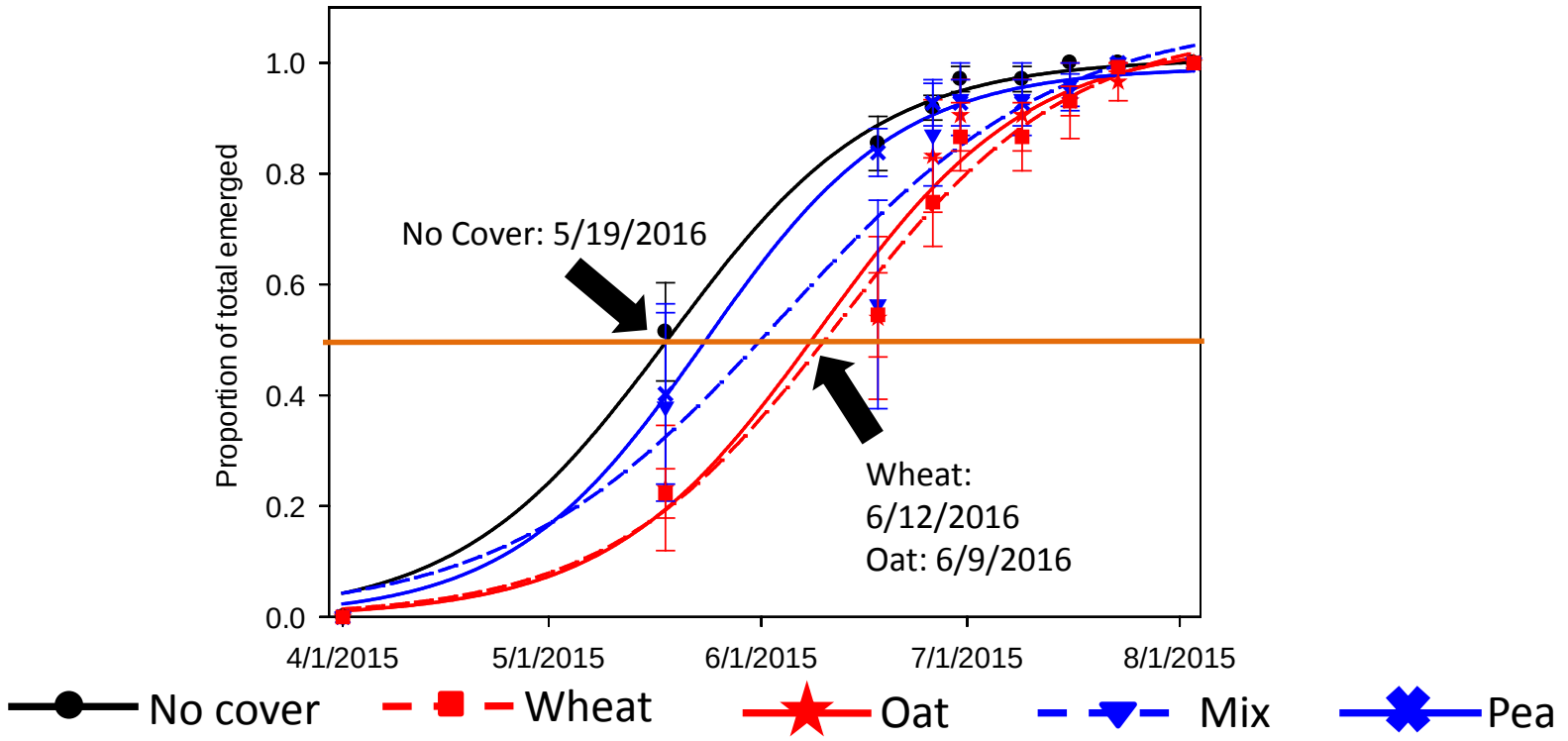
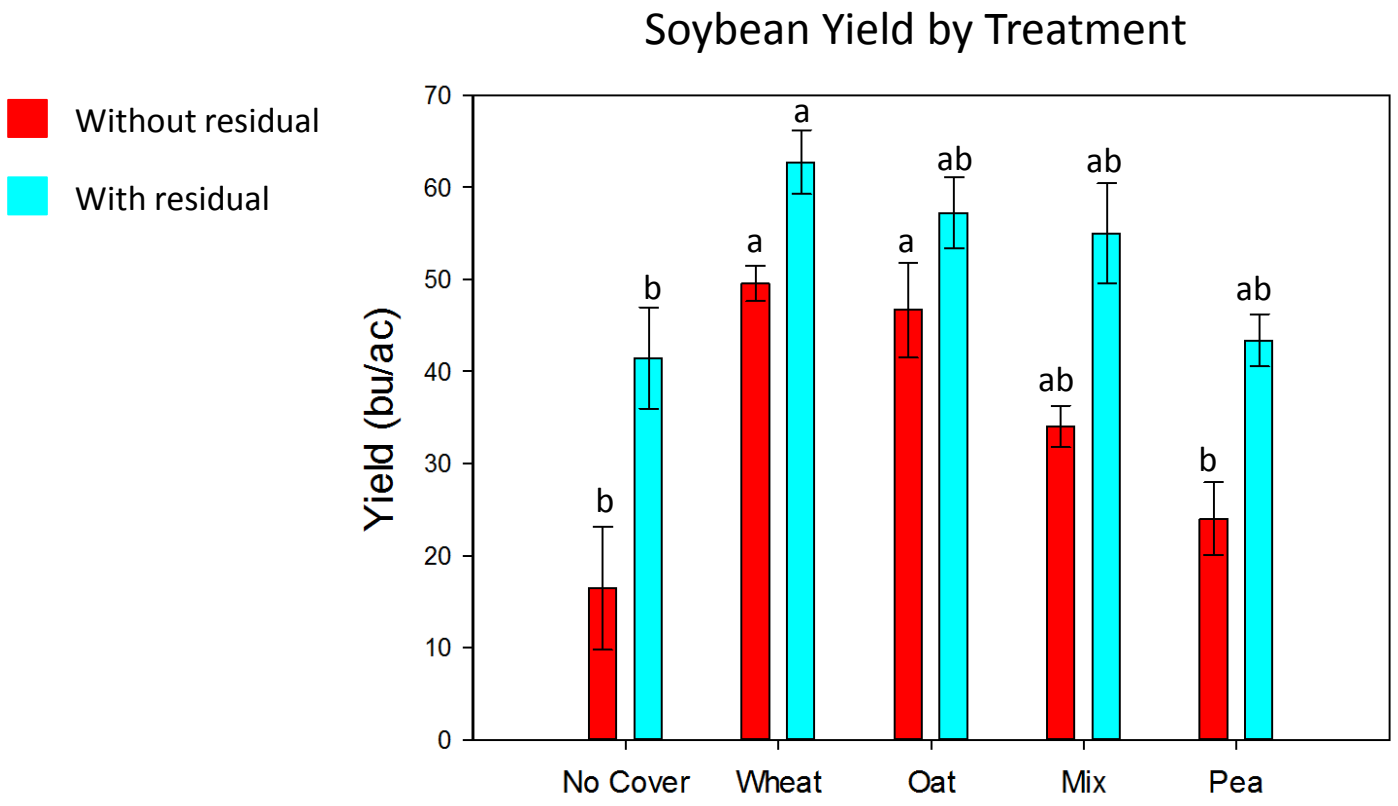
Season-long Palmer Amaranth Emergence



Chelsea Ahlquist, MS student research project



Chelsea Ahlquist, MS student research project

Cover Crop vs Herbicide

Cover Crop

- Costs similar to Herbicide
- Builds Soil
- Improves Water Infiltration
- Soil Armor
  - Temperature
  - Wind Erosion
  - Water Erosion
- Grazing Option

Herbicide

- Costs similar to Cover Crop
- Can leave target area
- Soil sits Fallow
- Soil is susceptible to
  - Temperature
  - Wind Erosion
  - Water Erosion

Wheat Cover Crop ahead of Corn

Cover Crop between Wheat Crops

Grazing Cover Crops

Summer

Winter

Erosion Control

Josh Lloyd - Building Top Soil

2005

2015

Conclusions and Implications

- ✓ **Cover crops in no-tillage systems on farmers' fields are suppressing weeds, reducing total numbers and biomass**
- ✓ **Alter cropping system to include cover crops (delay row crop planting until after June 1)**

- ✓ **Main suppressor is presence of cereal cover crop (wheat, oats, triticale)**
- ✓ **Need established cover crop prior to emergence of "driver" weed species**

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Thank you and Questions

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