

K-STATE
Research and Extension

Weed Suppression with Cover Crops

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Weed Ecology, Agronomy

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Key considerations


1. What do you want to accomplish with a cover crop?

- ✓ Match choice of a cover crop with your specific goal(s):
 - ✓ Provide weed management benefits
 - ✓ Protect water quality
 - ✓ Reduce or prevent soil erosion, reduce compaction
 - ✓ Conserve or use excess soil moisture
 - ✓ Reduce fertilizer inputs (scavenge or fix N)
 - ✓ Provide additional grazing resource
 - ✓ Add organic matter to soil
 - ✓ Other ...





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/m² (3.3 g/m²)
oat cover crop = 76 weeds/m² (0 g/m²)




August 30
Bare strip = downy brome
Oat cover strip = few weeds


Clay County field site, 2016
Planted cover crops March 10
Surveyed June 1 for cover crop biomass and weed biomass and density

Weeds in:
bare strip
= 14.2 weeds/m² (3.3 g/m²)
oat cover crop = 7.2 weeds/m²
mixed cover crop = 1.2 weeds/m²




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/m² (95.4 g/m²)
Spring pea = 68 weeds/m² (3.2 g/m²)
Triticale/oat = 28 weeds/m² (0.7 g/m²)
Spring pea/triticale/oat mix = 6 weeds/m² (0.2 g/m²)




K-State Northwest Research Center,
Colby, KS 2016

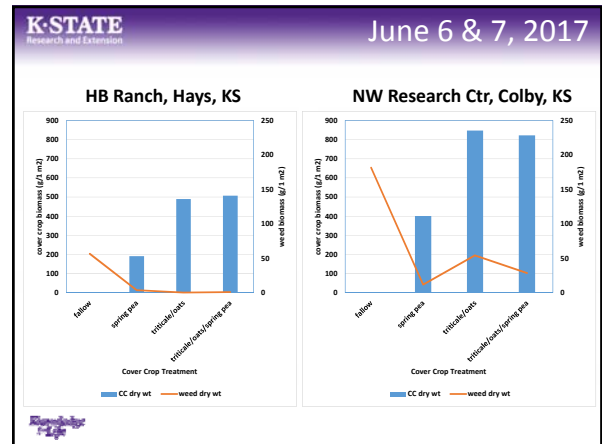
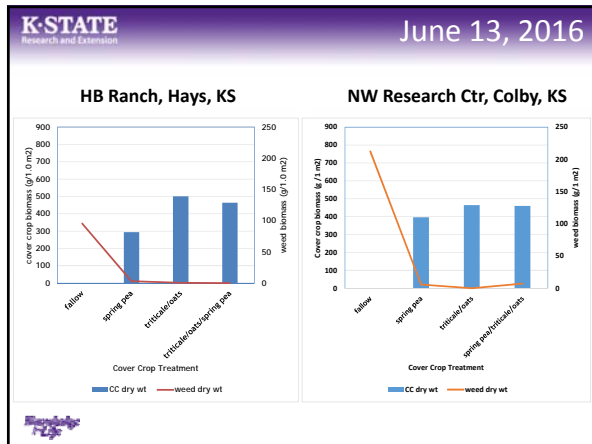
Drilled cover crops mid-March



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

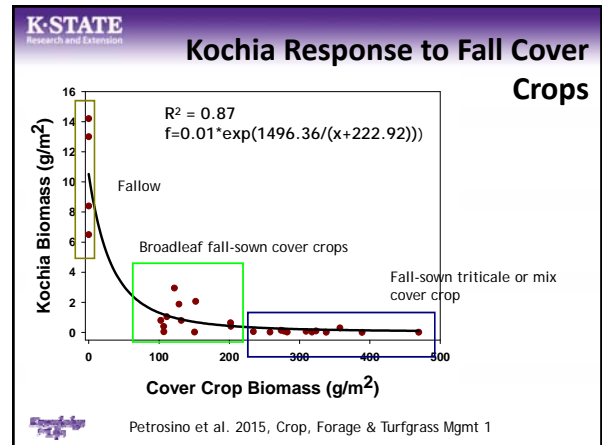
Weeds in:
Fallow = 153 weeds/m² (212 g/m²)
Spring pea = 76 weeds/m² (5.8 g/m²)
Triticale/oat = 0 weeds
Spring pea/triticale/oat mixed = 32 weeds/m² (7.4 g/m²)





K-STATE Research and Extension **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



K-STATE Research and Extension **Key considerations**

1. What do you want to accomplish with a cover crop?

- ✓ Be aware of costs associated with cover crops:
 - ✓ Cost of seed
 - ✓ Availability of equipment to plant cover crop
 - ✓ One or more additional passes through the field for planting, terminating
 - ✓ Use of soil moisture
 - ✓ Becomes a volunteer weed, volunteer wheat, or other pest problems
 - ✓ Timing and ability to terminate (mowing, tilling, rolling, spraying, etc).

K-STATE Research and Extension **Key considerations**

2. How will you plant it, and when?

- ✓ Consider your crop rotation sequence and where a cover crop can fit
 - ✓ Change the crop rotation
 - ✓ Change time of crop planting
- ✓ Know when your key weed species germinates and emerges in the field

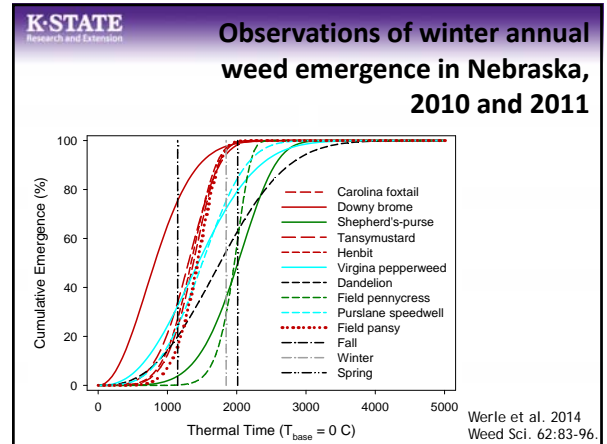
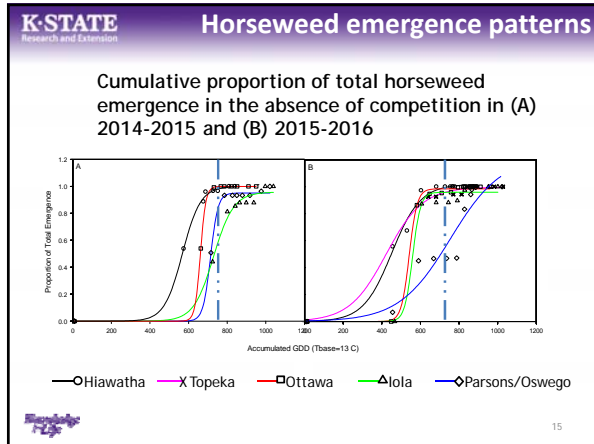


Table 2. Seeding timing of various cover crops.

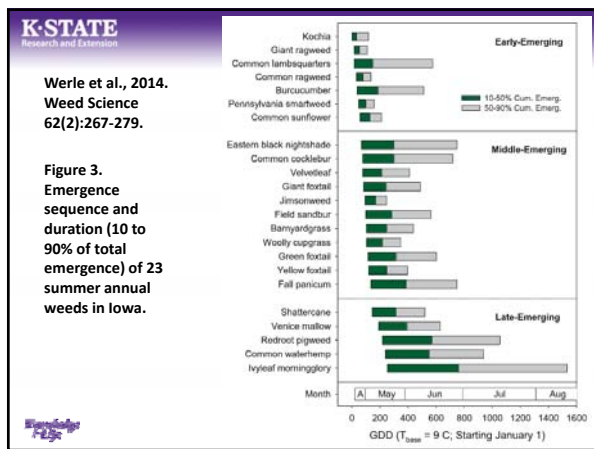
	April	May	June	July	Aug	Sept	Oct	Nov
Red clover								
Crimson clover								
Spring barley								
Oats								
Hairy vetch								
Chickling vetch								
Sweet clover								
Cowpeas								
Field peas ¹								
Turnips/Forage rape								
Oriental mustard								
Oilseed radish								
Buckwheat								
Cereal rye								
Winter wheat								
Winter barley								
Triticale								
Annual ryegrass								
White clover								
Sorghum-sudangrass								

¹Red clover is Austrian winter peas (black peas), Canadian field peas (spring peas).

Horseweed Suppression

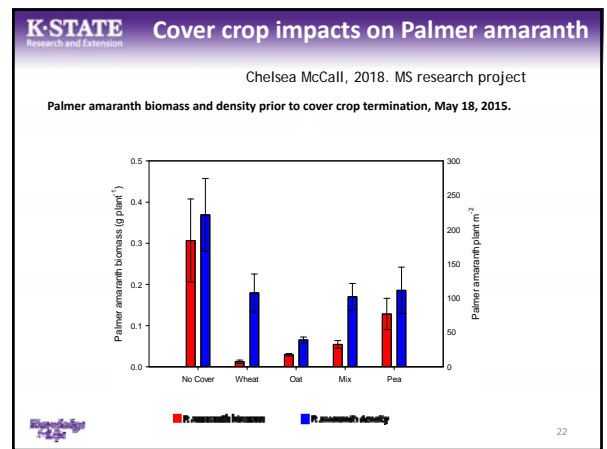
Treatment	2013		2014	
	%			
Untreated Control	0d	0d	0d	0d
Annual ryegrass	21cd	59c		
Winter wheat	20cd	93ab		
Winter barley	35c	90ab		
Winter rye	94ab	96a		
Spring oats	14cd	-		
Spring rye	-	89ab		
Winter rye/spring no residual	100a	100a		
Fall residual	100a	99a		
Fall no residual	94ab	75bc		
Spring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

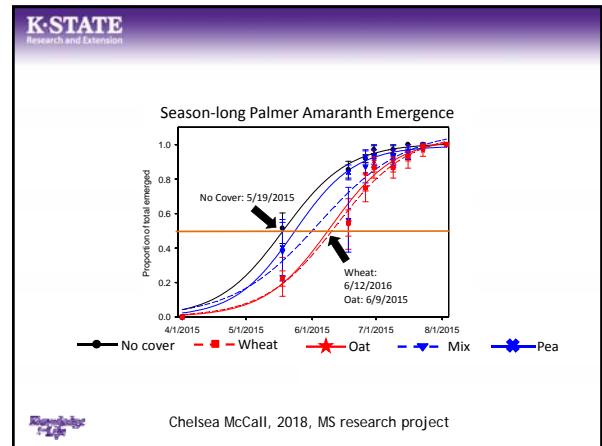
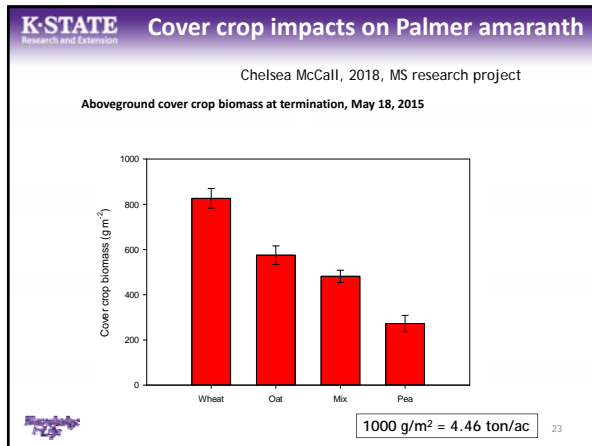
Andi Marie Christenson. 2015. Cover crops for horseweed [*Coryza canadensis* (L.) control before and during a soybean crop. MS Thesis, Kansas State University.



Werle et al., 2014. Weed Science 62(2):267-279.

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





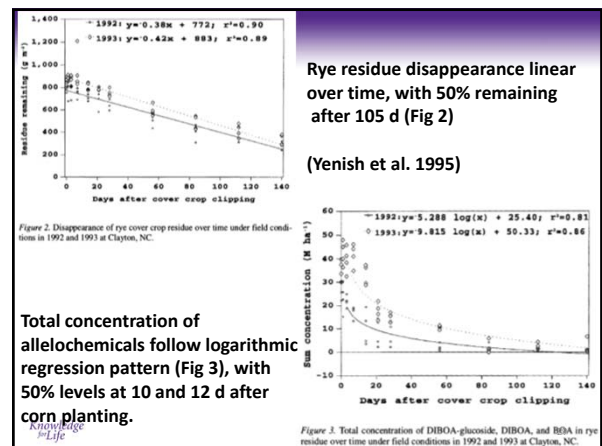
- ### K-STATE Research and Extension Key considerations
2. How will you plant it, and when?
- ✓ Establish the cover crop prior to that key point in lifecycle of weed species for greatest weed suppression impact; Why?
 - ✓ Reduce sunlight reaching soil surface; residue or living mulch to smother and outcompete emerging weeds for light, water, and nutrients
 - ✓ Alter microenvironment (moisture, temperature) during weed seed germination
 - ✓ Release of chemicals from roots or decaying residue to inhibit weed seed germination (allelopathy)

- ### K-STATE Research and Extension Allelopathy
- ✓ Many plant species have allelopathic characteristics, that is, can produce chemicals that affect other plant species
 - ✓ Weed suppression with cover crops?
 - ✓ Due to a physical barrier of residue, or
 - ✓ Due to allelopathy
 - ✓ DIBOA, allelochemical isolated from rye, suppresses growth of plants, insects, fungi.

K-STATE Research and Extension Allelopathy

- ✓ Cereal rye produces DIBOA:
 - ✓ Glucose molecule attached to DIBOA provides stability, prevents toxicity in plant
 - ✓ Toxic DIBOA is released when mixing DIBOA-glucoside with glucosidase upon plant wounding
 - ✓ As rye cover crops breakdown, toxic DIBOA or degradation products provide weed suppression (Yenish et al. 1995. Weed Sci 43:18-20)

May 2, 2018



Cereal rye shoot biomass and allelochemical concentration

Rye cultivar	Field study shoot biomass	DIBOA	Total allelochemical
	g m ⁻²	ug g ⁻¹	
Aroostok	589	367	443
Bates	820	167	191
Bonel	557	1,240	1,469
Elbon	741	299	339
Maron	820	329	390
Oklon	618	132	155
Pastar	422	112	137
Wintercross	688	205	232
LSD (0.05)	21	115	127

Burgos et al. 1999. Weed Sci 47:481-485

- ### Key considerations
- 3. What will precede and what will follow the cover crop in your rotation?**
- ✓ Consider carbon-to-nitrogen ratio of cover crops
 - ✓ Changes rate of residue breakdown, release of nutrients for subsequent crop
 - ✓ Consider preemergence herbicides applied in previous crop, persisting into late summer or fall, and impacting establishment of some cover crop species
 - ✓ Grazing restrictions

Response of fall-seeded cover crops to herbicide residues applied 3-mo prior.

Herbicide treatment	Herbicide Rate (g/ha)	Shoot dry weight (g/m ²)			
		Oat	Oilseed radish		Cereal rye
		8 WAE	8 WAE		37 WAE
untreated	0	406a	325a	342a	375a
Verdict	735	419a	320a	332a	376a
Verdict	1470	404a	323a	343a	372a
-Lumax	2280 + 140	397a	321a	344a	384a
-Lumax	5760 + 280	393a	313ab	345a	361a
Pursuit	100	447a	308ab	329a	379a
Pursuit	200	419a	213b	331a	374a

Yu et al. 2015. Crop Protection 75:11-17

- ### Key considerations
- 4. Which cover crop will you plant?**
- ✓ Resources available to help select:
 - ✓ Midwest Cover Crop Council
 - ✓ Cover Crop Decision Tool, data for Kansas available now
 - ✓ Integrating Cover Crops in Soybean Rotations publication
 - ✓ "Managing Cover Crops Profitably", 3rd Edition, SARE publication
 - ✓ Field days! See what grows in your area...

- ### Key considerations
- 5. How will you terminate your cover crop?**
- ✓ 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

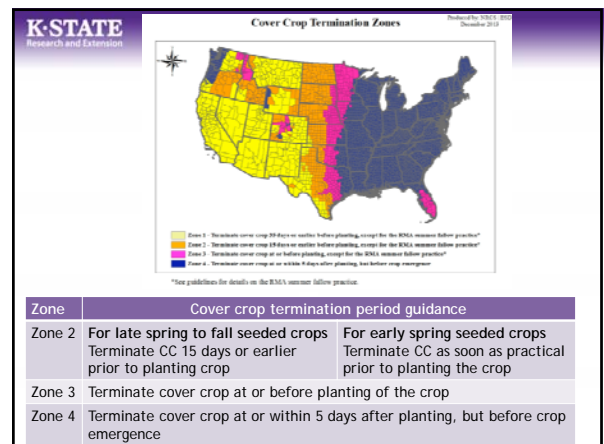



Table 3. Cover crop management strategies.				
Cover crop	Winter kill	Tillage – timing or size of cover crop	Herbicide	Roller/crimper
Red clover	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Crimson clover	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Alfalfa	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Hairy vetch	No	2 to 4 weeks before planting	2,4-D ester + Glyphosate	Not recommended
Oilseed radish	Yes	—	—	—
Oriental mustard	Yes	—	—	—
Buckwheat	Yes	—	—	—
Field pea (Austrian pea)	Yes	—	—	—
Cereal rye	No	9 to 12 inches	Glyphosate	Soft dough stage
Wheat	No	9 to 12 inches	Glyphosate	Soft dough stage
Oats	Yes	—	—	—

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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 (error)
			Soybean stage	Soybean (cm)	Weed counts (#/0.25 m ²)	
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)



Knowledge 