Cropping System Intensity, Fallow Efficiency and Evaluating Fallow Alternatives

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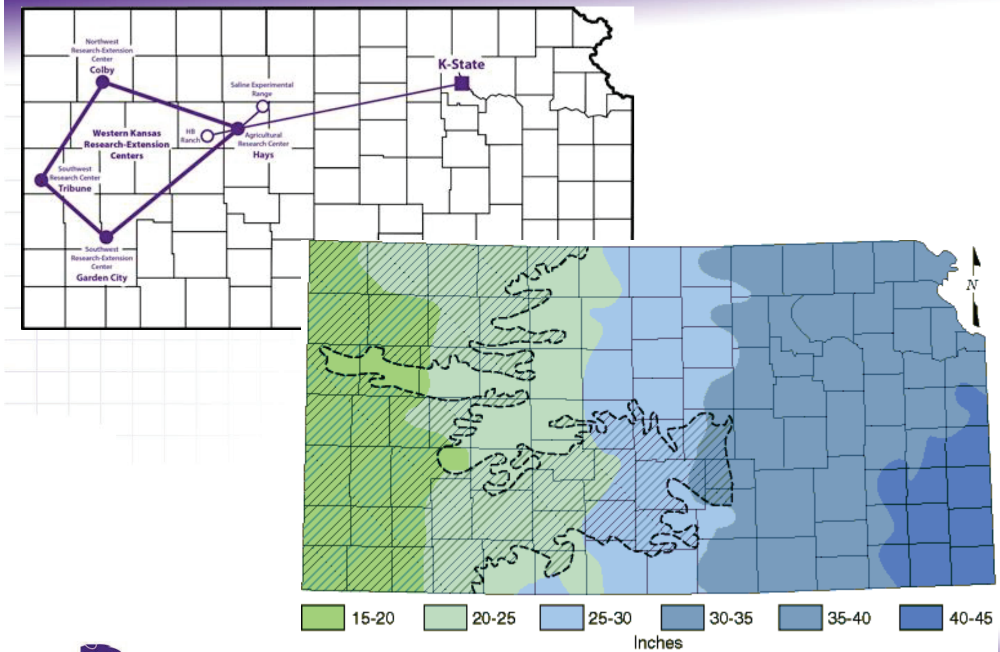
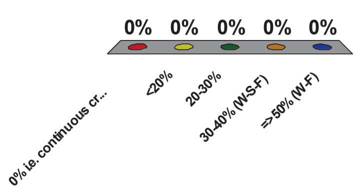


Under "normal" conditions, what percentage of your dryland acres are in fallow

A. 0% i.e. continuous cropping
B. <20%
C. 20-30%
D. 30-40% (W-S-F)
E. =>50% (W-F)



How much can I afford to spend on NT fallow?

Grain price sensitivity

Sorghum Price	Wheat Price $ 4.00	$ 4.50	$ 5.00	$ 5.50	$ 6.00	$ 6.50	$ 7.00	$ 7.50	$ 8.00	$ 8.50	$ 9.00
$ 3.00	$ 139	$ 141	$ 144	$ 147	$ 150	$ 153	$ 156	$ 159	$ 161	$ 164	$ 167
$ 3.50	$ 154	$ 157	$ 160	$ 162	$ 165	$ 168	$ 171	$ 174	$ 177	$ 180	$ 183
$ 4.00	$ 169	$ 172	$ 175	$ 178	$ 181	$ 183	$ 186	$ 189	$ 192	$ 195	$ 198
$ 4.50	$ 184	$ 187	$ 190	$ 193	$ 196	$ 199	$ 202	$ 204	$ 207	$ 210	$ 213
$ 5.00	$ 200	$ 203	$ 205	$ 208	$ 211	$ 214	$ 217	$ 220	$ 223	$ 225	$ 228
$ 5.50	$ 215	$ 218	$ 221	$ 224	$ 226	$ 229	$ 232	$ 235	$ 238	$ 241	$ 244
$ 6.00	$ 230	$ 233	$ 236	$ 239	$ 242	$ 245	$ 247	$ 250	$ 253	$ 256	$ 259
$ 6.50	$ 246	$ 248	$ 251	$ 254	$ 257	$ 260	$ 263	$ 266	$ 268	$ 271	$ 274
$ 7.00	$ 261	$ 264	$ 267	$ 269	$ 272	$ 275	$ 278	$ 281	$ 284	$ 287	$ 289
$ 7.50	$ 276	$ 279	$ 282	$ 285	$ 288	$ 290	$ 293	$ 296	$ 299	$ 302	$ 305
$ 8.00	$ 291	$ 294	$ 297	$ 300	$ 303	$ 306	$ 309	$ 311	$ 314	$ 317	$ 320
$ 8.50	$ 307	$ 310	$ 312	$ 315	$ 318	$ 321	$ 324	$ 327	$ 330	$ 332	$ 335

$4/bu wheat to $8 wheat only changes allowable fallow cost by $22/ac

$3.50/bu sorghum to $7 sorghum changes allowable fallow cost by $107/ac

NT returns over RT at varying yield reduction levels

Evaluated at 2024 NC Cash at Cornerstone Terminal, Colby on 1/16/2024
$6.26 wheat, $4.82 sorghum

NT/RT Assumption		No-Till Fallow Cost														
bu/bu		$ 50	$ 60	$ 70	$ 80	$ 90	$ 100	$ 110	$ 120	$ 130	$ 140	$ 150	$ 160	$ 170	$ 180	$ 190
83/83	0%	33	23	13	3	-7	-17	-27	-37	-47	-57	-67	-77	-87	-97	-107
83/80	10%	44	34	24	14	4	-6	-16	-26	-36	-46	-56	-66	-76	-86	-96
83/77	20%	54	44	34	24	14	4	-6	-16	-26	-36	-46	-56	-66	-76	-86
83/74	30%	65	55	45	35	25	15	5	-5	-15	-25	-35	-45	-55	-65	-75
83/71	40%	76	66	56	46	36	26	16	6	-4	-14	-24	-34	-44	-54	-64
83/68	50%	87	77	67	57	47	37	27	17	7	-3	-13	-23	-33	-43	-53
83/64	60%	98	88	78	68	58	48	38	28	18	8	-2	-12	-22	-32	-42
83/61	70%	109	99	89	79	69	59	49	39	29	19	9	-1	-11	-21	-31
83/58	80%	119	109	99	89	79	69	59	49	39	29	19	9	-1	-11	-21
83/55	90%	130	120	110	100	90	80	70	60	50	40	30	20	10	0	-10
83/52	100%	141	131	121	111	101	91	81	71	61	51	41	31	21	11	1

How did we get here?

- Fallow not originally part of cropping systems in the Great Plains
- Implementation of fallow stabilized crop yields in a wheat mono-culture vs. continuous cropping
- Mineralization of plant nutrients
- Opportunity to control weeds

PUE – Precipitation Use Efficiency

- The key to improved productivity and $$$ in your pocket
- How much grain did we raise with the precipitation we received in the entire cropping system?

(lbs of grain per inch of precipitation)

- Two ways to improve PUE
  - Grow a crop in place of fallow (W-F to W-S-F)
  - Improve fallow efficiency (No-Till, more residue)

Evaluation of Fallow Efficiency (Precipitation Storage Efficiency, PSE)

$$\text{Fallow Accumulation} = \Delta \text{ASW}$$

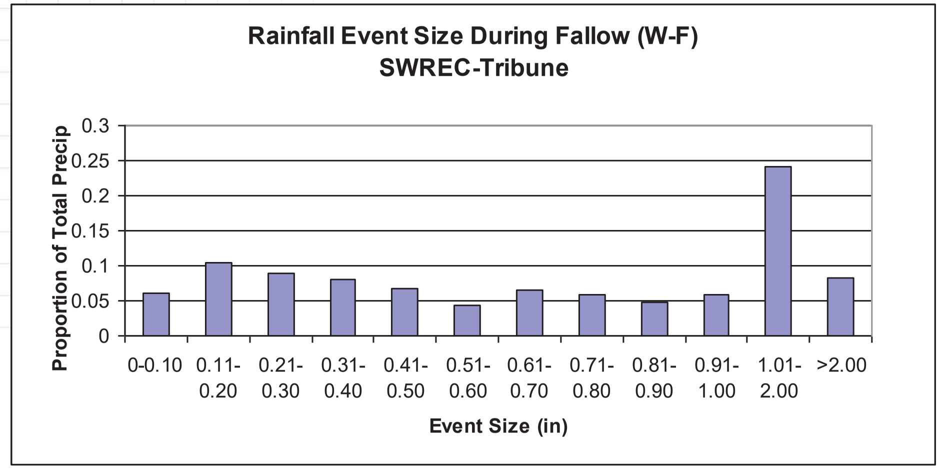
$$\text{Fallow Efficiency} = \frac{\Delta \text{ASW}}{\text{Fallow Precipitation}}$$

$$\text{Fallow Efficiency} = \frac{\text{Ending Soil Water} - \text{Beginning Soil Water}}{\text{Fallow Precipitation}}$$

Factors to Fallow Efficiency

Water is leaving the system in one of two ways

- ***Weed Control***
- **Evaporative Losses**
  - Size of precipitation events
  - Surface residue
  - Tillage



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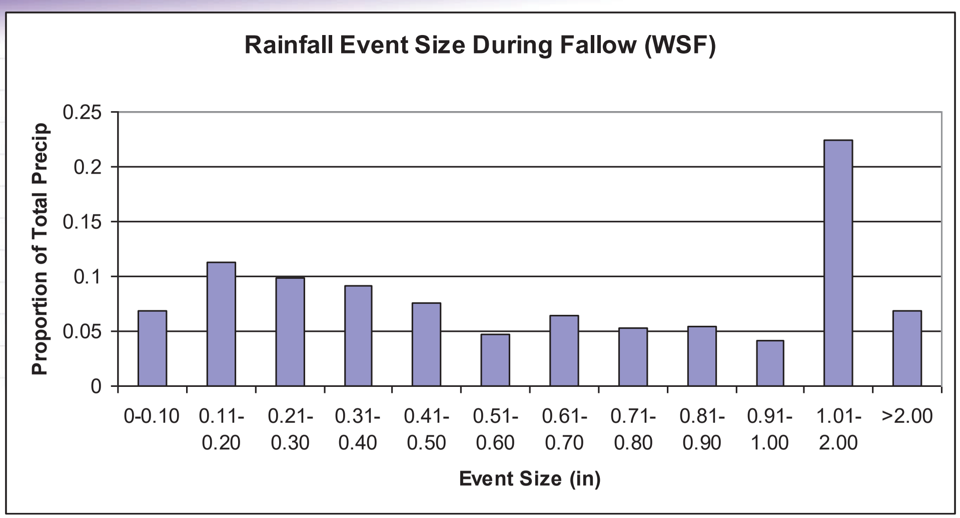

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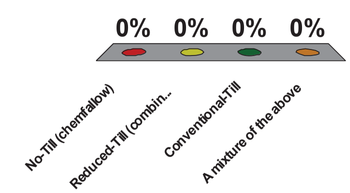
My fallow acres are:

A. No-Till (chemfallow)
B. Reduced-Till (combination of tillage and chem.)
C. Conventional-Till
D. A mixture of the above



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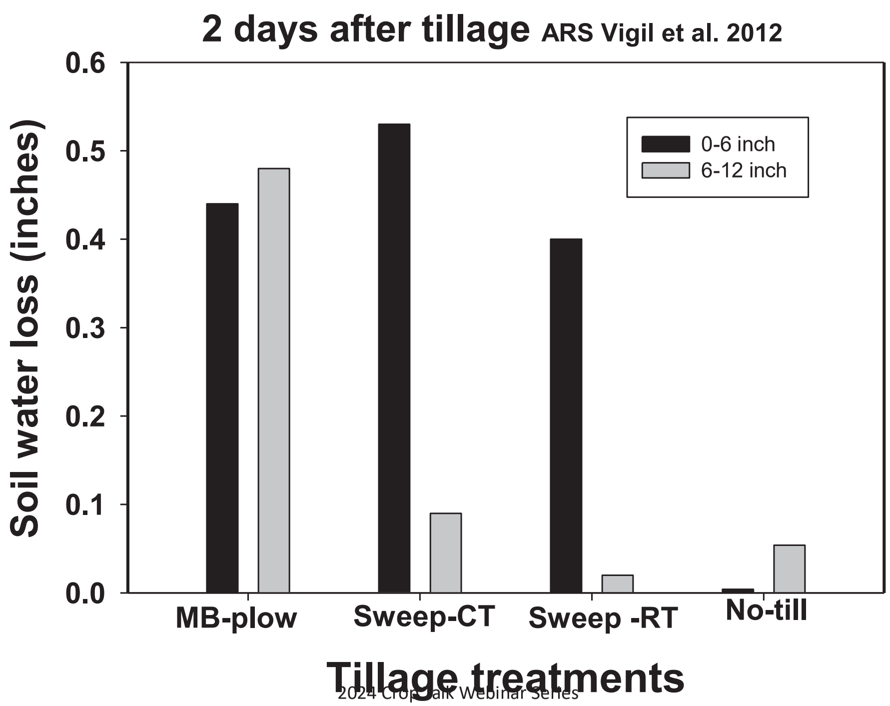
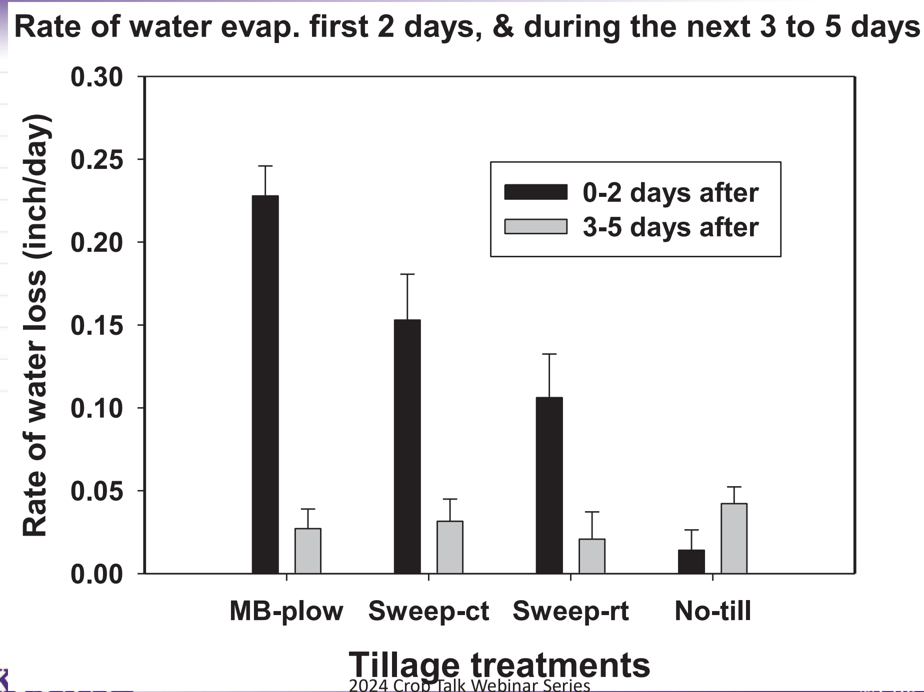
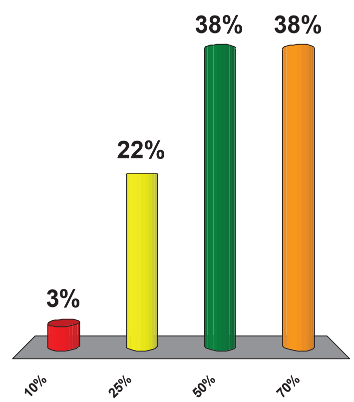




The use of tillage during summerfallow can reduce water accumulation compared to no-till by as much as:

A. 10%
B. 25%
C. 50%
D. 70%

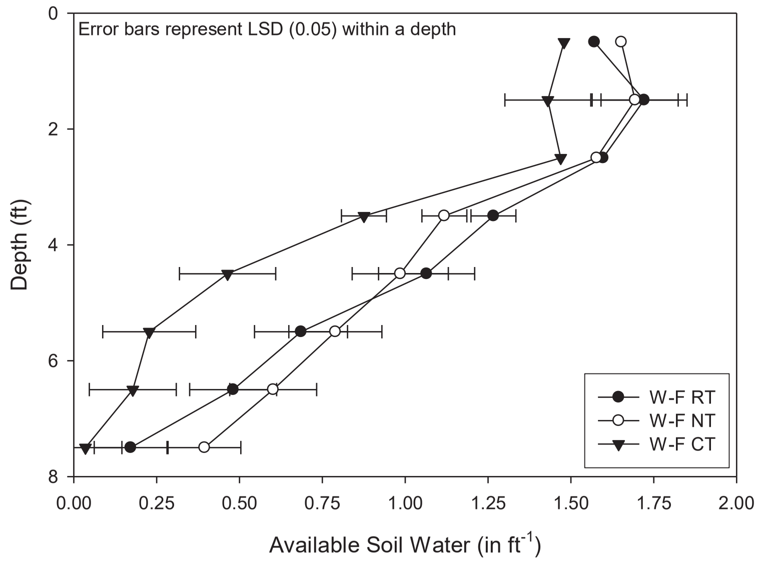


Effect of Tillage – W-F 1993-1998

Fallow Method	Fallow Accumulation		Fallow Efficiency	
	cm (in)		Percent	
No-Till	16.0 (6.30)	a	23.8	a
Reducted Till	14.0 (5.51)	b	20.9	a
Conventional Till	8.2 (3.23)	c	12.1	b
ANOVA P>F				
Source of Variation				
Fallow Method	0.011		0.0114	
LSD 0.05	1.6 1.7		0.07	

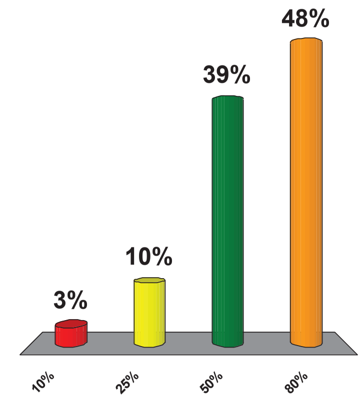
†Letters within a column represent differences at LSD (0.05)

Available Soil Water at Wheat Planting
Tribune, Kansas 1995-1998

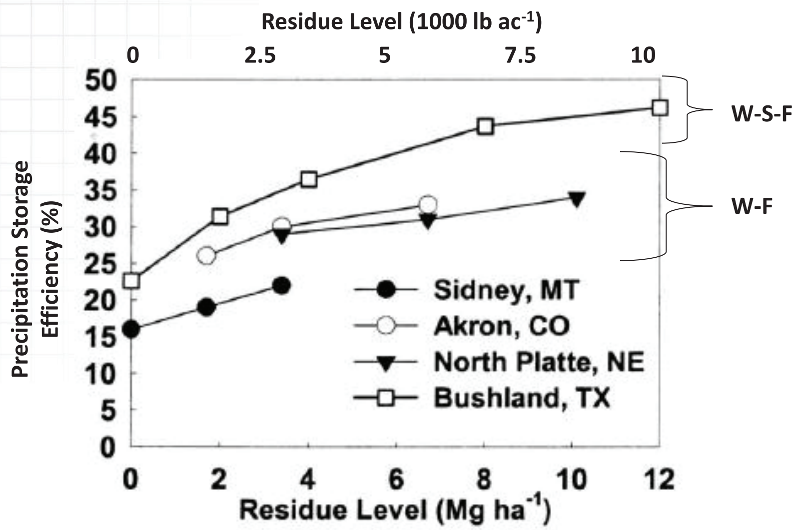


The level of surface residue can effect fallow efficiency by as much as?

A. 10%
B. 25%
C. 50%
D. 80%

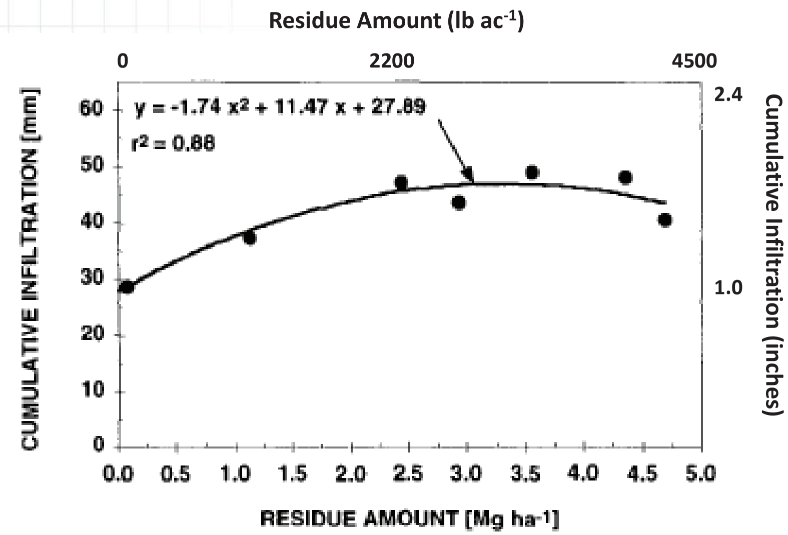


Residue Effects PSE



Adapted from Nielsen et al., 2005.

Residue Effects Infiltration



Adapted from Baumhardt and Lascano, 1996.

Crop Choice Effect on Surface Residues and Fallow Efficiency 1998-2008

Fallow Method	Fallow Accumulation		Fallow Efficiency	
	cm (in)		Percent	
W-S-F	8.3 (3.25)	a	20.1	a
W-SF-F	5.3 (2.08)	b	12.5	b
ANOVA P>F				
Source of Variation				
Fallow Method	0.0452		0.0346	
LSD 0.05	1.6 (1.14)		6.94	

†Letters within a column represent differences at LSD (0.05)

Effect of Crop Choice in Stacked Rotations on Fallow Efficiency 2001-2006

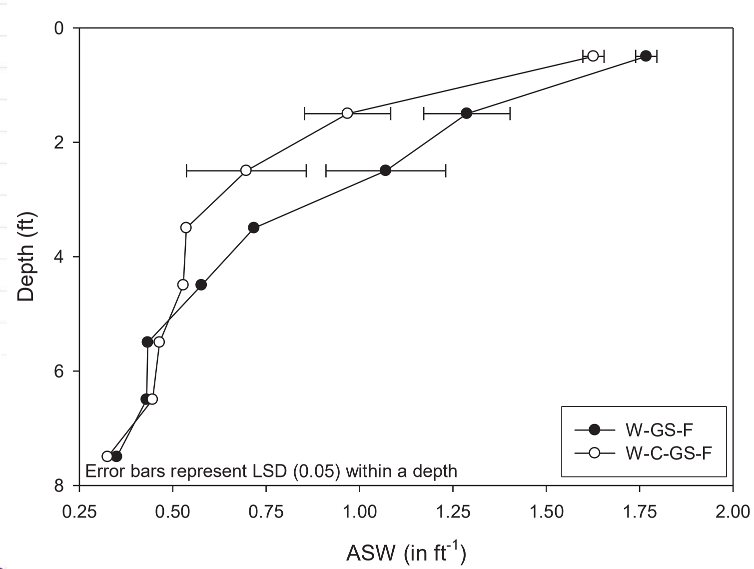
Fallow Method	Fallow Accumulation		Fallow Efficiency	
	cm (in)		Percent	
W-C-GS-F	8.3 (3.26)	a	20.4	a
W-C-SB-F	5.8 (2.27)	b	14.1	b
W-C-SF-F	4.2 (1.64)	c	10.0	c
ANOVA P>F				
Source of Variation				
Fallow Method	0.0002		<0.0001	
LSD 0.05	1.6 (0.54)		2.53	

†Letters within a column represent differences at LSD (0.05)

Effects of Crop Sequence in 3 and 4 year rotations – 2009-2011

Cropping System	Fallow Accumulation	Fallow Efficiency
	cm (in)	Percent
W-GS-C-F	8.3 (3.27)	17.7
W-C-GS-F	8.0 (3.13)	17.5
W-S-F	7.8 (3.07)	17.6
W-C-F	6.6 (2.61)	14.9
ANOVA P>F		
Source of Variation		
Fallow Method	0.6941	0.8018
LSD 0.05	- -	-

†Letters within a column represent differences at LSD (0.05)



Effects of Weed Control and Fallow Efficiency with Time (W-C-F)

Wheat Harvest to Row Crop Planting

Post Harvest Weed Control	Previous Harvest to August Fallow		August Fallow to October Fallow		October Fallow to Row-Crop Planting		Previous Harvest to Row-Crop Planting	
	Accumulation	Efficiency	Accumulation	Efficiency	Accumulation	Efficiency	Accumulation	Efficiency
	cm (in)	Percent	cm (in)	Percent	cm (in)	Percent	cm (in)	Percent
July	2.3 (0.91) a†	25.2	1.2 (0.49) a	19.4	5.7 (2.23)	41.3	8.8 (3.47) a	30.1
August	1.3 (0.53) b	14.7	1.0 (0.41) a	16.3	5.2 (2.03)	37.6	7.9 (3.09) b	26.9
Spring	1.3 (0.53) b	14.6	-1.5 -(0.60) b	-24.0	5.0 (1.95)	36.2	4.8 (1.89) c	16.4
			ANOVA P>F					
Source of Variation								
Weed Control	0.0012	-	<0.0001	-	0.1282 -		<0.0001	-
LSD 0.05	0.6 (0.23)	-	0.6 (0.22)	-	- -	-	0.8 0.30	-

†Letters within a column represent differences at LSD (0.05)

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Effects of Weed Control Timing During Fallow on Efficiency and Profile Water (W-C-F)

Wheat Harvest to Row Crop Planting

Table x. Effect of post wheat harvest weed control timing on profoile available water. SWREC-Tribune 2001-2006

Post Harvest Weed Control	Plant Available Soil Water at Sampling				
	August Fallow	October Fallow	Corn Planting	July In-Season	Corn Harvest
	cm (in)				
July	10.4 (4.1) a†	10.8 (4.2) a	15.9 (6.3) a	13.8 (5.4) a	8.6 (3.4)
August	9.3 (3.7) b	9.1 (3.6) b	14.8 (5.8) a	13.2 (5.2) ab	8.4 (3.3)
Spring	9.5 (3.7) b	7.0 (2.8) c	12.0 (4.7) b	12.0 (4.7) b	8.4 (3.3)
	ANOVA P>F				
Source					
Weed Control	0.0823	<.0001	<.0001	0.0518	0.7593
LSD 0.10	0.8 (0.3)	1.0 (0.4)	1.0 (0.4)	1.2 (0.5)	-
LSD 0.05	0.9 (0.4)	1.2 (0.5)	1.1 (0.5)	1.5 (0.6)	-
LSD 0.01	1.3 (0.5)	1.6 (0.6)	1.5 (0.6)	2.0 (0.8)	-

†Letters within a column represent differences at LSD (0.05)

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Efficiency from Row-Crop Harvest to Wheat Seeding

SWREC-Tribune 2001-2007

Time Period	Efficiency
	Percent
Row-Crop Harvest to July Fallow	28.8
July Fallow to Wheat Planting	-4.6
Row-Crop Harvet to Wheat Planting	21.2

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Fallow efficiency during winter in standing wheat stubble

Table 1. Reported values for overwinter precipitation storage efficiency (PSE) in wheat stubble throughout the central Great Plains.

Location	Wheat residue	Years	PSE %	Reference
Colby, KS	Undisturbed	25	78.5	Kuska and Mathews, 1956
	Undisturbed	4	77.0	
North Platte, NE	Undisturbed	4	98.9	Smika and Whitfield, 1966
	Incorporated		-15.4	
Akron, CO	Undisturbed	11	80	Smika et al., 1986
	Stubble-mulch		57	

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Where do we go from here?

- We know that there is being water left on the table
  - i.e. Row crop to wheat 20% x 15.5” = 12.4”
- We know that reducing soil water at planting will negatively impact subsequent crop yields
- Can we strike a balance?

Crazier Things Have Happened
Weeds grown as residue….

W-F Delayed minimum tillage study. SWREC-Tribune, Kansas 1996-2001

Fallow Method	Previous Harvest to Fall Accumulation	Previous Harvest to Fall Efficiency	Fall to Spring Accumulation	Fall to Spring Efficiency	Spring to Seeding Accumulation	Spring to Seeding Efficiency	Previous H. Seedi Accumulation
	cm (in)	%	cm (in)	%	cm (in)	%	cm (in)
No-Till	8.0 (3.16) a†	27.6 a	3.0 (1.17) a	30.0 a	6.3 (2.47) b	19.1 ab	19.5 (7.66) a
Conservation Sweep Tillage	4.9 (1.94) b	14.5 b	1.1 (0.43) b	-0.6 b	4.4 (1.73) c	13.4 b	11.6 (4.58) c
Delayed Minimum Tillage	1.0 (0.40) c	-8.2 c	4.3 (1.70) a	45.5 a	8.0 (3.15) a	25.0 a	15.1 (5.93) b
			ANOVA P>F				
Source of Variation							
Fallow Method	<0.0001	<0.0001	<0.0001	0.0003	0.0002	0.0012	<0.0001
LSD 0.05	1.6 (0.64)	9.5	1.4 (0.54)	21.9	1.6 (0.64)	6.0	1.7 (0.67)

†Letters within a column represent differences at LSD (0.05)

It worked because the hit to soil water was early on, there was time to recover before seeding the next crop

Things we have looked at in recent years

- Safflower
- Field Pea
- Spring Wheat
- Cowpeas / Black-Eyed Peas
- Forages
- Camelina

Winter and Spring Pea in Kansas

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Northwest Area Agronomist and Associate Professor
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Pea Development Basics

- Indeterminate, cool season crop
- Growth Temperatures
  - Optimum 17°C / 63°F
  - Minimum 10°C / 50°F
    - RUE reduced at <12°C / 54°F and PSII at < 15°C / 59°F
  - Maximum 23°C / 73°F
  - Damaging 28-32°C / 82-90°F
  - Damage to Pollen and Ovule 36°C / 95°F

Winter vs. Spring Types

- We're not talking about vernalization
- Winter types tend to be more photoperiod sensitive
- Lower temperatures begin the cold acclimation process
  - Accumulation of solutes, changes in membrane lipid composition
  - Higher proportion of biomass accumulation to below-ground

Winter vs. Spring Types - Flowering

- The *Hr* gene blocks floral initiation when the days are short (13.5 hours, April 25 @ Colby)
- Recessive *If* gene results in plants that flower as early as the 8^{th} node
- If you combine *Hr* with If you get a plant that should flower after last freeze, but hopefully early enough to beat the heat

Pea Seed and Germination

- Seed Size
  - Spring Pea 1600-2500 Seeds/Lb
  - Winter Pea 2200-3500 Seeds/Lb
- Seed doubles in volume in first 2 days of germination
- Requires 3x the moisture for germination compared to small grains
  - Management Note: Plant at least ½" into moisture

Fig. 7, left. Mineralization of N in fallow following fall-sown peas and winter wheat on four farms in Washington in early May. **Fig. 8, above.** Seed quality characteristics of new food quality winter peas (PS113000287W and PS11300289W) compared with spring peas Hampton and Carousel, winter pea Windham, and Austrian winter pea Common.

Fig. 9. Branching habit of spring pea (*left*) vs. winter pea (*right*). Photos by H. Nelson.

Locations

- 2010 Pilot Study
  - NWREC-Colby
  - SWREC-Tribune
- 2011-2012 Additions
  - SWREC-Garden City
  - USDA-ARS Bushland

Field Peas

- DS Admiral Yellow Field Pea
- Planted mid March @ 150-180 lbs ac^{-1}
- Four Treatments
  - Terminated 15 May and left as cover crop
  - Terminated 1 June and left as cover crop
  - Allowed to fully mature and left as cover crop
  - Harvested for grain early July
- 2011 Winter wheat failed at Tribune and emerged late at Colby (end of February / early March)
- 2012 Winter wheat was harvested at the Kansas locations

Water Use by Field Peas vs. No-Till Fallow SWREC-Tribune

	Water Use to Date (Inches)		
	15-May Termination	1-Jun Termination	1-Jul Harvest
Peas	2.18	5.42	9.30
Fallow	1.81	3.94	5.92
Fallow Efficiency	23.3%	31.1%	25.9%

Peas effectively used 3.38" of water

Colby 2010 - Fallow Alternative Impacts on Available Soil Water at Wheat Planting

Table 2. Available soil water at wheat planting as affected by fallow method. NWREC-Colby 2010

Fallow Method	Available Soil Water at Wheat Planting		
	cm	(in)	
NT Fallow	30.6	(12.05)	a
Peas - Green Fallow	27.1	(10.66)	b
Safflower	18.8	(7.42)	c
ANOVA P>F			
Source of Variation			
Fallow Method	0.001		
LSD 0.10	3.2	(1.26)	

†Letters within a column represent differences at LSD (0.10)

Tribune 2010 - Fallow Alternative Impacts on Available Soil Water at Wheat Planting

Table 1. Available soil water at wheat planting as affected by fallow method. SWREC-Tribune 2010 Preliminary Data

Fallow Method	Available Soil Water at Wheat Planting		
	cm	(in)	
NT Fallow	20.4	(8.02)	a
Peas Terminated 6/1	13.9	(5.47)	ab
Peas Harvested for Grain	13.9	(5.47)	ab
Peas Terminated 5/18	13.1	(5.16)	abc
Peas - Green Fallow	12.2	(4.79)	bc
Safflower	6.4	(2.50)	c
ANOVA P>F			
Source of Variation			
Fallow Method	0.0951		
LSD 0.10	7.3	(2.87)	

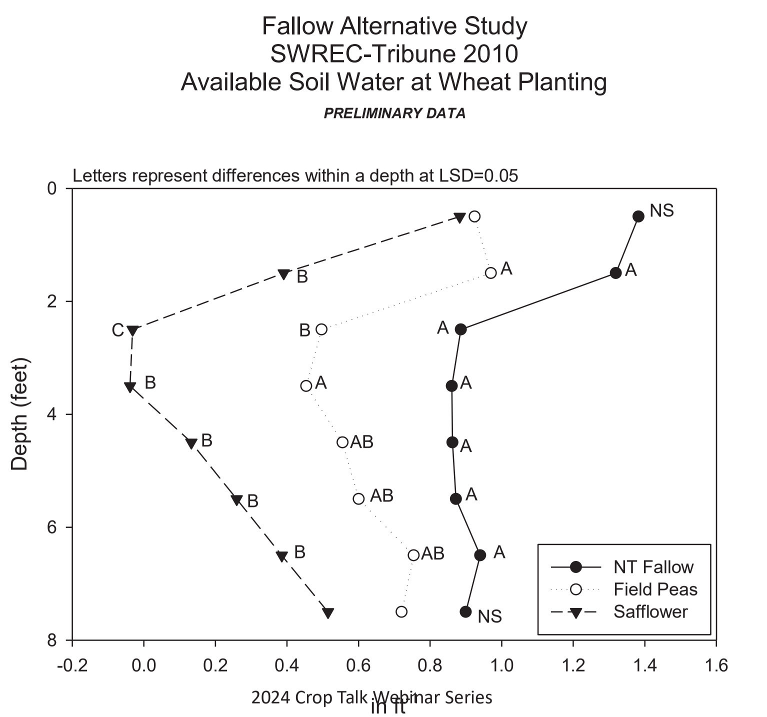
†Letters within a column represent differences at LSD (0.10)

Tribune 2011 – Fallow Alternative Impacts on Available Soil Water at Wheat Planting

Table 3. Available soil water at wheat planting as affected by fallow method. SWREC-Tribune 2011 Preliminary Data

Fallow Method	Available Soil Water at Wheat Planting		
	cm	(in)	
Peas Terminated 5/18	17.1	(6.72)	a
NT Fallow	16.7	(6.58)	a
Peas Terminated 6/1	14.4	(5.68)	ab
Peas Harvested for Grain	11.5	(4.53)	b
Peas - Green Fallow	10.2	(4.02)	b
Safflower	4.2	(1.67)	c
ANOVA P>F			
Source of Variation			
Fallow Method	0.0008		
LSD 0.10	4.2	(1.67)	

†Letters within a column represent differences at LSD (0.10)



2012 Colby Wheat Grain Yields

Table x. Subsequent wheat grain yields as affected by fallow method.
NWREC-Colby 2012 Preliminary Data

Fallow Method	Wheat Grain Yield	
	kg/ha (bu/ac)	
Peas Terminated 5/18	(56.59)	a
NT Fallow	(51.22)	ab
Peas Terminated 6/1	(49.19)	ab
Peas Harvested for Grain	(44.50)	bc
Peas - Green Fallow	(40.51)	c
Safflower	(38.44)	c

ANOVA P>F

Source of Variation	
Fallow Method	0.0099
LSD 0.10	(7.96)

†Letters within a column represent differences at LSD (0.10)

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2012 Garden City Wheat Grain Yields

Table x. Subsequent wheat grain yields as affected by fallow method.
SWREC-Garden City 2012 Preliminary Data

Fallow Method	Wheat Grain Yield	
	kg/ha (bu/ac)	
NT Fallow	(30.16)	a
Peas Terminated 5/18	(20.23)	b
Peas Terminated 6/1	(17.57)	bc
Peas - Green Fallow	(16.93)	bc
Midas Peas for Grain	(14.29)	bc
Admiral Peas for Grain	(13.06)	c
Safflower	(4.14)	d

ANOVA P>F

Source of Variation	
Fallow Method	0.0003
LSD 0.10	(6.47)

†Letters within a column represent differences at LSD (0.10)

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2012 Tribune Wheat Grain Yields

Table x. Subsequent wheat grain yields as affected by fallow method.
SWREC-Tribune 2012 Preliminary Data

Fallow Method	Wheat Grain Yield	
	kg/ha (bu/ac)	
NT Fallow	(6.61)	a
Peas Terminated 6/1	(6.22)	a
Peas - Green Fallow	(5.84)	a
Midas Peas for Grain	(5.51)	a
Peas Terminated 5/18	(5.29)	a
Safflower	(0.73)	b

ANOVA P>F

Source of Variation	
Fallow Method	0.0092
LSD 0.10	(3.62)

†Letters within a column represent differences at LSD (0.10)

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K-State Field Pea Research

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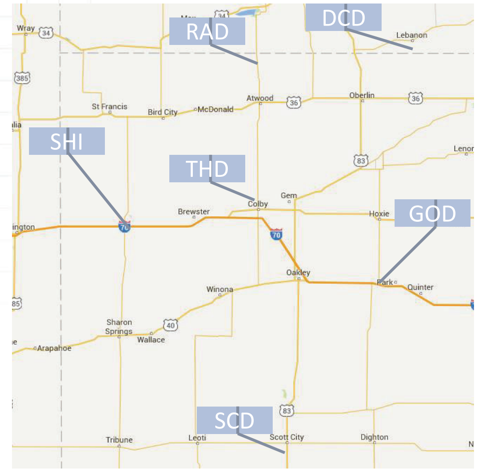
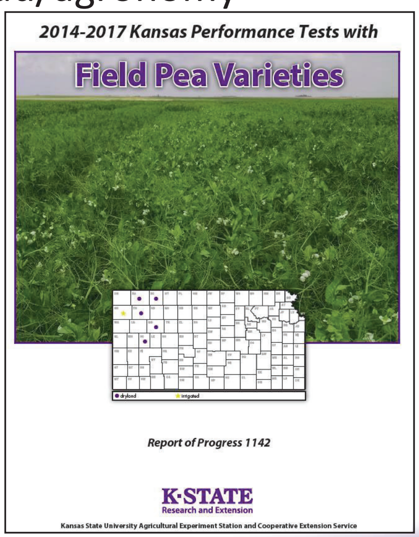
Northwest Research-Extension Center, Colby, Kansas

Field Pea VPT Locations



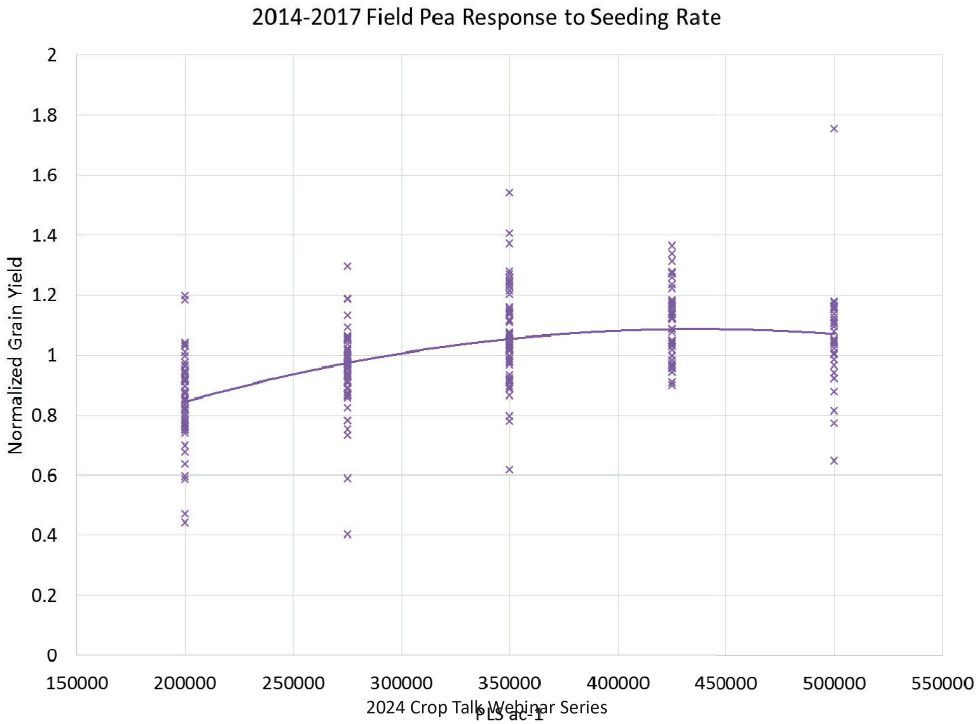
Trial Results and Field Pea Production Info

- www.northwest.ksu.edu/agronomy



Top yield group across site-years

Location	2014 Top Group Average Yield	2015 Top Group Average Yield	2016 Top Group Average Yield	2017 Top Group Average Yield	2018 Top Group Average Yield	2019 Top Group Average Yield	Top Group Across Years
Rawlins	49.2	40.9	31.4	29.7	39.5	19.9	35.1
Thomas	28.2	30.6	33.8	39.3	26.5	48.7	34.5
Decatur	-	47.5	31.7	-	34.9	36.1	37.6
Gove	-	-	27.9	29.6	23.1	52.3	33.2
Scott	4.6	-	-	-	-	-	4.6
Sherman IRR	-	55.2	-	-	-	-	55.2
Rooks	-	-	-	-	-	31.1	31.1
Republic	-	-	-	-	-	12.9	12.9



Seeding Rate Summary

- K-State data would suggest our optimal seeding rate is likely higher than the 350,000 PLS/acre that we initially recommended to producers
- Current KSU recommendation is 365,000 PLS/acre

Seeding Rate Summary

Some of my thoughts on this from a crop physiologist perspective:

- Why might we need higher seeding rates than the Northern Plains?
  - As peas are moved south our conversion of yield components into actual grain yield is more limited
    - Fewer flowers converted into pods
    - Fewer seeds per pod
  - Therefore it possibly takes more plants/acre to maximize yield potential

Seed Quality

- Warm Germination is all that is required for seed to be certified
- Is that really enough information?
- What about farm saved seed?
- Proper handling is essential
  - Cold temps, overly dry seed, contact with steel
- Keep a sample back of what you plant

Seed Quality - Testing

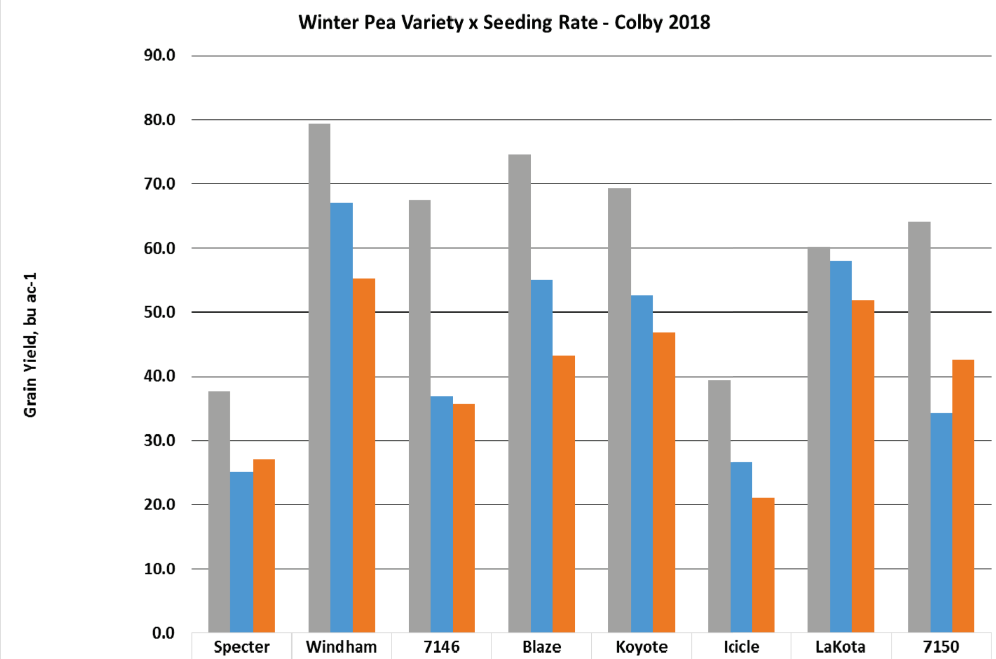
- Having warm germ, cold germ, and accelerated aging test ran provides you more information
- Once you start with a lab, stick with it
- Talk to your lab, while test procedures are standardized, philosophies and interpretation are not
- Other potential tests of interest
  - Disease Assay
  - Conductivity (detects mechanical damage in seed coat)

Fungicide Seed Treatments

- Seed Treatments
  - Untreated
  - Obvious (BASF)
  - VibranceMaxx (Syngenta)
  - Apron Maxx RTA (Syngenta)
- Seeded at 350,000 PLS
- Three locations

2017 Yield Results

	Rawlins	Gove	Thomas	
		-- bu/ac --		
Untreated	28.4	19.9	26.2	b
Obvious	28.5	19.6	28.4	a
VibranceMaxx	31.0	19.0	29.4	a
Apron Maxx RTA	.	.	28.2	ab
	ANOVA			
P>F	0.5945	0.8694	0.049	
LSD	NS	NS	2.18	



	Specter	Windham	7146	Blaze	Koyote	Icicle	LaKota	7150
DOP1 - 10/18/2017	37.7	79.4	67.5	74.6	69.3	39.4	60.1	64.2
DOP2 - 10/30/2017	25.1	67.0	36.9	55.0	52.6	26.6	57.9	34.2
DOP3 - 11/15/2017	27.1	55.3	35.7	43.2	46.9	21.1	51.9	42.7

2019 Winter Pea VPT at Colby

VARNUM	Entrant	Entry	Class	YieldLb	YieldBu	
WP1804	ProGene	Blaze	Yellow	5278	88.0	a
WP1803	ProGene	7146	Yellow	5169	86.1	ab
WP1908	ProGene	PRO_144-7211	Yellow	5092	84.9	abc
WP1805	ProGene	Koyote	Yellow	4922	82.0	abcd
WP1802	USDA-ARS	Windham	Yellow	4707	78.4	abcde
WP1808	ProGene	7150	Green	4654	77.6	abcde
WP1907	NS Seed	Mraz	Yellow	4522	75.4	bcde
WP1902	USDA	PS11300289W	Yellow	4376	72.9	bcde
WP1906	ProGene	Keystone	Green	4369	72.8	bcde
WP1807	USDA-ARS	LaKota	Green	4341	72.4	bcde
WP1905	USDA-ARS	PS1430NZ003W	Green	4300	71.7	cde
WP1901	USDA-ARS	PS11300240W	Green	4279	71.3	de
WP1903	USDA-ARS	PS12300049W	Green	3993	66.6	ef
WP1904	USDA-ARS	PS12300058W	Yellow	3134	52.2	f
	P>F				0.0039	
	LSD (0.05)			810	13.5	

K-STATE Research and Extension

Knowledge for Life

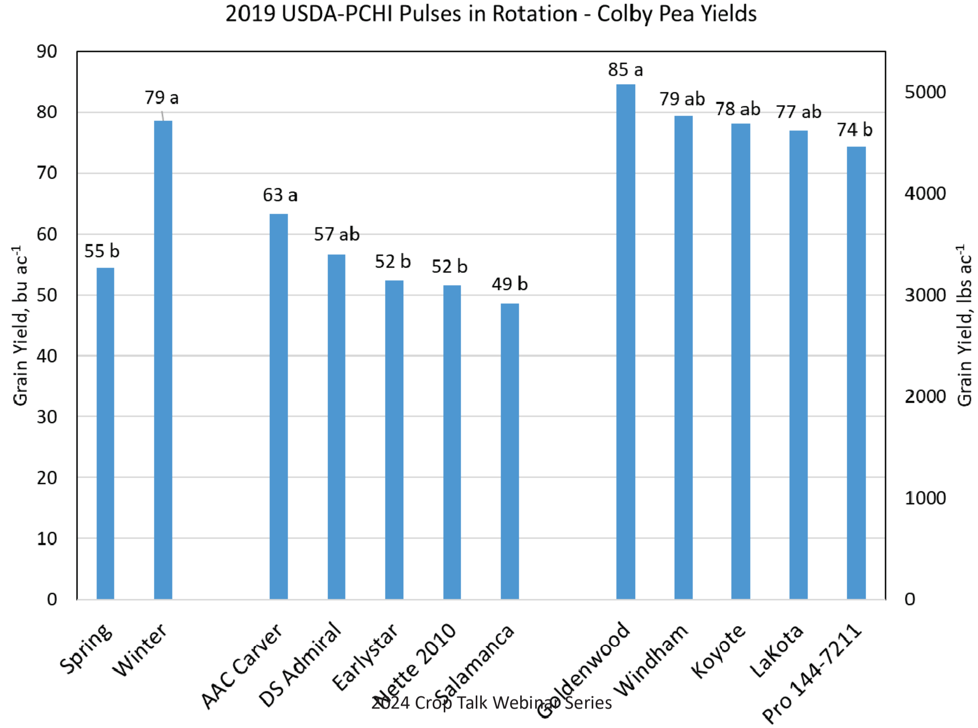
2021 K-State Winter Pea Variety Performance Test

Variety	RAD	THD	Average
Payback	35.8	40.0	37.9
Koyote	36.2	38.7	37.5
Blaze	32.8	41.0	36.9
MS-20W3	31.7	42.1	36.9
PRO_184-7148	33.5	40.1	36.8
MS-20W2	27.5	39.3	33.4
PRO_164-7117	27.3	38.5	32.9
PRO_144-7211	31.5	34.1	32.8
Goldenwood	28.2	36.5	32.3
Windham	28.2	33.8	31.0
PRO_154-7225	27.1	33.6	30.3
PS1430NZ010W	24.8	34.1	29.5
PS1430NZ003W	29.5	28.8	29.1
LaKota	.	27.3	27.3
MS-20W1	22.2	32.0	27.1
PRO_152-7121	24.6	25.6	25.1
Vail	24.0	21.3	22.6
Specter	23.6	19.6	21.6
PRO_184-7145	21.2	14.9	18.1
Keystone	15.9	17.0	16.4
	<0.0001	<0.0001	
	5.48	9.25	

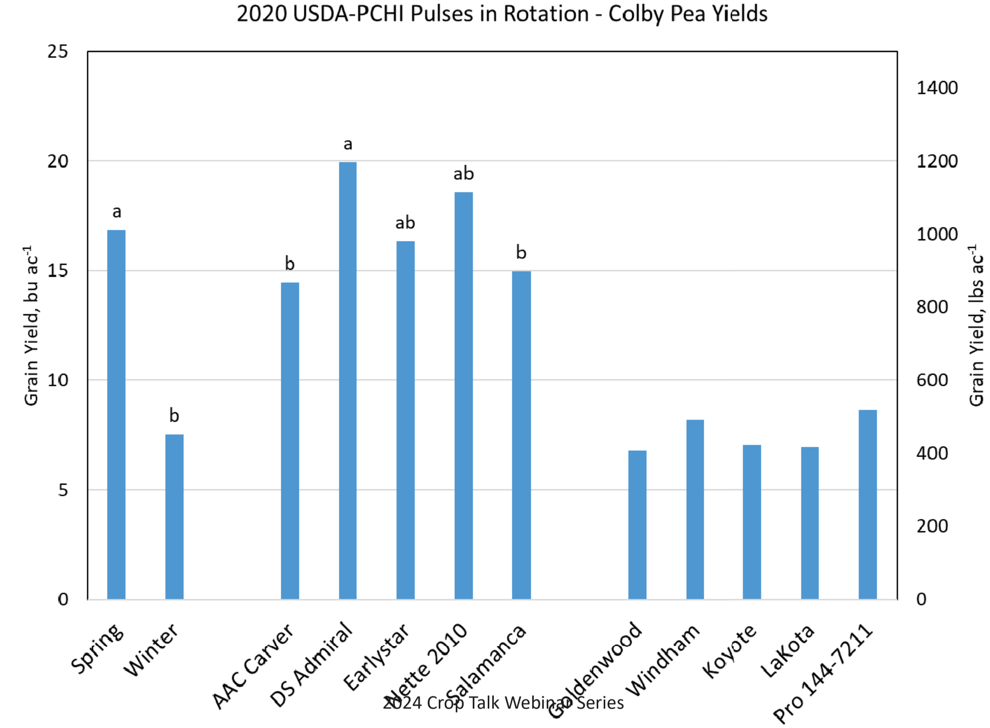
K-STATE Research and Extension

2024 Crop Talk Webinar Series

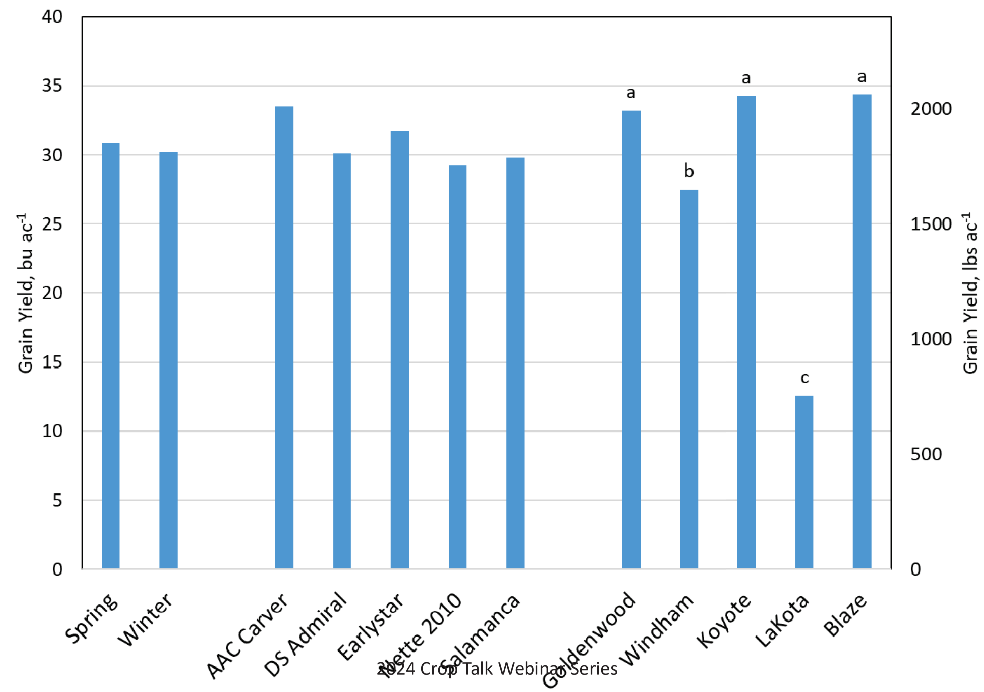
Knowledge for Life



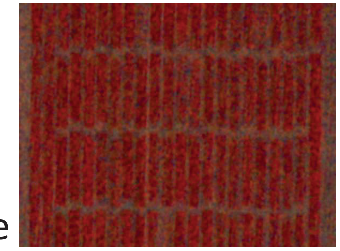
2024 Crop Talk Webinar Series



2024 Crop Talk Webinar Series



- Winter pea variety x date of planting
- Phenotyping 300+ lines of spring field pea for heat stress tolerance
  - Use planting date to generate stress levels
  - USDA PSP Collection, Australian lines, commercial varieties
  - Use of sUAVs: Thermal, RGB, NDVI
- Continue variety testing and management trials



Questions?

Spring Field Peas at the Colby Branch Experiment Station, 1915

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www.northwest.ksu.edu/agronomy
Twitter @LucasAHaag

Spring Wheat in Northwest Kansas

Spring Wheat

- 1915-1950: Averaged less than ½ of WW
- 2001-2005: Averaged 49% of WW (28-56%)
- 2019: Averaged 43% of WW (36-55%)

Colby, Kansas Spring Wheat and Winter Wheat, 2001-2005

Year	Winter Wheat Mean of Top LSD Group	Spring Wheat Mean
	-- Grain Yield, bu ac^{-1} --	
2001	82.1	46.0
2002	43.2	12.1
2003	78.7	42.4
2004	60.1	30.3
2005	78.2	37.5
Average	68.5	33.7

R. Aiken, 2008. unpublished data.

Cornerstone Ag Cash Bids

Notes	Basis Month	Basis	Cash Price	Futures Price
Corn				
IN-STORE BID	May 2024	-5	$4.35	440-2
2024 NEW CROP BID	December 2024	-25	$4.47	471-4
Hard Red Winter Wheat				
IN-STORE BID	May 2024	-70	$5.23	593-2
NEW CROP 2024	July 2024	-50	$5.32	581-6
Milo				
IN-STORE BID	May 2024	0	$4.40	440-2
2024 NEW CROP BID	December 2024	-45	$4.27	471-4
Soybeans				
IN-STORE BID	May 2024	-125	$10.57	1182-2
2024 NEW CROP BID	November 2024	-115	$10.60	1175-0
Spring Wheat				
IN-STORE BID	May 2024	-65	$6.00	664-4

$0.77/bu

Plus the difference in fallow cost

3/11/2024 Closing Prices

Spring Wheat

- So why would you do this?
  - Fallow alternative
  - Potential marketing opportunities for spring wheat
- Unknowns
  - Any economic return will be contingent on growing satisfactory quality, can we consistently do that in our environment?
- Be Aware
  - Different market class than HRWW, cannot be blended. However, white is a different story

Table x. Spring Wheat, Colby, Kansas 2019.

Variety	Grain yield			Moisture	Test Weight		Kernel weight		Plant Height	
	Mg ha^{-1}	(bu ac^{-1})					mg		in	
LCS_Cannon	3.51	(56)	a	11.8	59.8	a	30.7	abcd	28.8	bcd
WB7589	2.99	(48)	b	10.8	54.4	g	31.7	ab	26.0	cd
WB9590	2.98	(47)	b	11.2	55.0	fg	30.7	abc	27.3	bcd
WB9479	2.90	(46)	bc	11.0	56.3	def	30.2	bcde	26.8	cd
LCS_Trigger	2.89	(46)	bc	11.1	56.6	cdef	28.8	efg	28.8	bcd
WB7202CLP	2.80	(45)	bcd	11.4	55.5	defg	28.8	ef	28.3	bcd
MS_Barracuda	2.75	(44)	bcde	11.3	57.0	bcde	30.7	abcd	29.3	abcd
MS_Chevelle	2.71	(43)	cde	10.9	56.1	defg	28.1	fgh	30.5	ab
SY_Valda	2.71	(43)	cde	11.4	58.4	ab	29.9	cde	26.8	cd
LCS_Rebel	2.66	(42)	cde	10.9	57.2	bcd	26.9	h	32.5	a
WB97179	2.62	(42)	def	11.3	55.2	efg	28.5	efgh	26.5	cd
SY_Rustler	2.59	(41)	def	11.4	58.5	ab	32.0	a	29.2	abc
MS_Camaro	2.52	(40)	efg	11.5	58.0	bc	29.7	cde	25.5	d
WB7328	2.38	(38)	fg	11.1	55.6	defg	31.0	abc	27.3	bcd
MS_Stingray	2.37	(38)	g	11.9	55.9	defg	29.1	def	32.5	a
WB9668	2.30	(37)	g	11.3	55.3	efg	27.3	gh	26.8	cd
LSD = 0.05										
Variety	0.24	(3.7)		0.0	1.7		1.6		3.8	
	ANOVA P>F									
Effect										
Variety	<0.0001			0.7816	<0.0001		<0.0001		0.0058	

† Letters within a column and an effect represent differences at LSD (0.05) unless noted otherwise

Planted 4/23/2019 at 1.3M seeds/ac
Harvested 7/31/2019, yields reported at 13.5% moisture

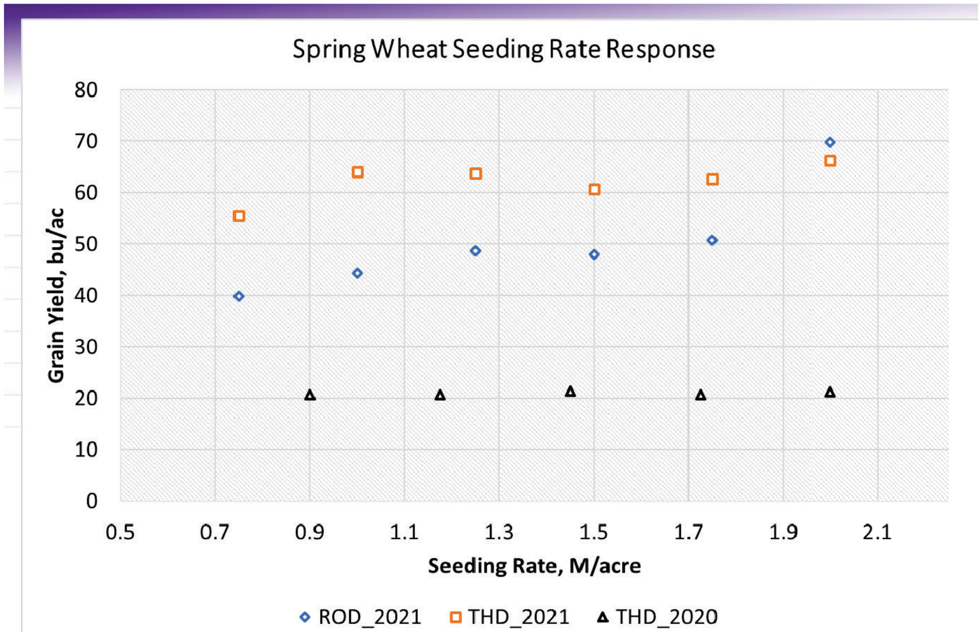
2020 Thomas County, Kansas Dryland Spring Wheat Variety Performace Test

Company	Variety	Grain Yield	Moisture	Test Weight	Protein	Heading Date	Seeds/Lb
		bu/ac	%	bu/ac	%	DOY	
WestBred	WB9590	**24.3** a	12.1	54.0 abcd	17.94	6/3 defg	21551 efgh
Meridian Seeds	MS Ranchero	**23.6** ab	13.1	52.9 cd	17.64	5/31 h	23366 abcd
Limagrain	LCS Cannon	**23.6** ab	12.2	55.9 ab	17.51	6/1 gh	24445 ab
Meridian Seeds	MS Chevelle	**23.5** ab	12.2	56.6 a	16.59	6/3 de	22541 cdefg
WestBred	WB9606	**22.9** ab	12.2	54.6 abc	16.93	6/4 cd	23033 abcde
Meridian Seeds	MS Barracuda	**22.6** ab	12.2	54.9 abc	17.71	6/2 efgh	21006 gh
WestBred	WB7202CL	**22.5** ab	12.0	51.7 d	17.47	6/1 fgh	24846 a
Syngenta AgriPro	SY Ingmar	**22.4** ab	12.8	55.8 ab	18.43	6/8 a	23389 abcd
WestBred	WB7696	**21.9** abc	12.0	53.3 bcd	17.94	6/2 efgh	23120 abcde
WestBred	WB9719	**21.7** abc	11.9	53.1 cd	17.68	6/5 bc	20499 h
WestBred	WB9479	**21.6** abc	12.3	53.6 bcd	18.00	6/3 de	21321 fgh
Meridian Seeds	MS Camaro	**21.2** abc	12.1	56.1 ab	17.66	6/4 cd	22089 cdefgh
Limagrain	LCS Trigger	**21.0** abc	12.0	55.2 abc	17.75	6/5 bc	22016 cdefgh
Limagrain	LCS Rebel	20.6 bc	12.4	56.4 a	19.00	6/3 defg	21809 defgh
Syngenta AgriPro	SY Rustler	19.0 c	12.2	53.2 abcd	17.36	6/3 def	23653 abc
Syngenta AgriPro	SY Valda	18.8 c	13.4	52.2 cd	17.87	6/6 ab	22774 bcdef
	P>F	**0.0404**	0.0839	**0.0165**	0.1350	**<0.0001**	**0.0002**
	LSD (0.05)	3.2	NS	2.8	NS	1.5727	1737

Bold yields represent the top yield group at LSD (0.05)
Spring wheat was seeded into fresh (2019 crop) dryland corn stalks
Seeded 3/12/2020 on 10" row spacing at 1.5M live seed/acre
130 lb/ac N applied as UAN topdress prior to joint
Different letters represent statistical differences at LSD=0.05.

K-State Dryland Spring Wheat Variety Trial Summary, 2019-2022

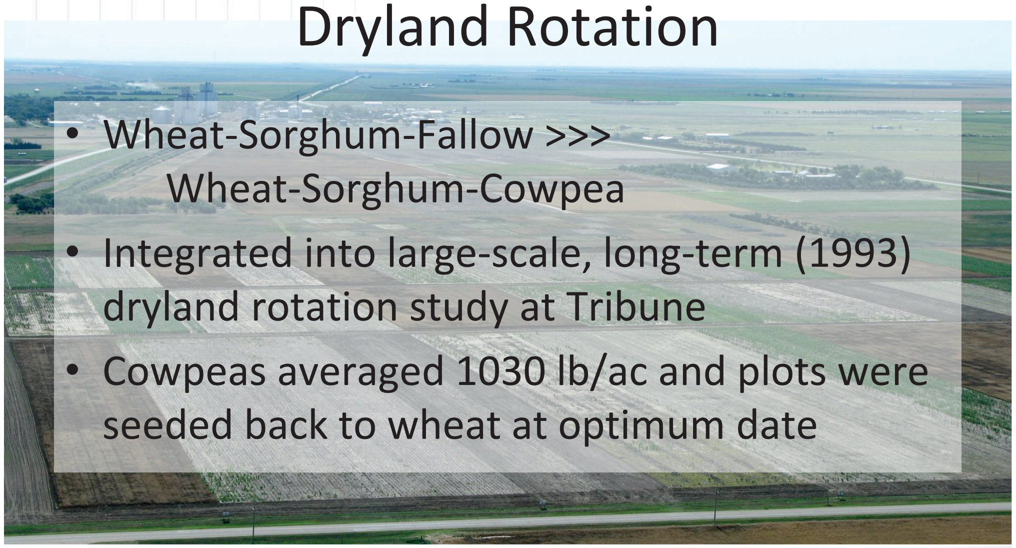
Variety	Thomas Dryland 2019	Thomas Dryland 2020	Thomas Dryland 2021	Rooks Dryland 2021	Rooks Dryland 2022	2-Site-Year Average	3-Site-Year Average	4-Site-Year Average	5-Site-Year Average
	Grain Yield, bu ac^{-1}								
LCS Cannon	55.9	23.6	53.8	50.7	21.0	.	.	.	46.0
WB9590	47.4	24.3	54.9	44.8	20.0	.	.	.	42.9
LCS Trigger	46.0	21.0	52.4	52.0	13.6	.	.	.	42.9
WB9719	41.7	21.7	54.0	41.0	14.5	.	.	.	39.6
LCS Rebel	42.4	20.6	49.4	40.6	.	.	.	38.3	.
WB9606	.	22.9	49.6	48.2	11.1	.	.	32.9	.
ND VitPro	.	.	47.0	38.0	14.5	.	33.2	.	.
ND Prohberg	.	.	42.6	36.0	14.0	.	30.9	.	.
WB7202CLP	44.6	22.5	.	.	24.3	.	30.5	.	.
WB9707	.	.	49.4	42.2	.	45.8	.	.	.
WB9479	46.1	21.6	.	.	.	33.9	.	.	.
MS Chevelle	43.1	23.5	.	.	.	33.3	.	.	.
MS Barracuda	43.8	22.6	.	.	.	33.2	.	.	.
SY Valda	43.1	18.8	.	.	.	31.0	.	.	.
MS Camaro	40.1	21.2	.	.	.	30.6	.	.	.
SY Rustler	41.3	19.0	.	.	.	30.2	.	.	.
AP Murdock	.	.	44.5	.	.	.	.	.	.
AP509-2	.	.	46.4	.	.	.	.	.	.
MS Ranchero	.	.	.	.	.	.	.	.	.
MS Stingray	37.7	.	.	.	.	.	.	.	.
SY Ingmar	.	22.4	.	.	.	.	.	.	.
WB7328	38.0	.	.	.	.	.	.	.	.
WB7589	47.7	.	.	.	.	.	.	.	.
WB7696	.	21.9	.	.	.	.	.	.	.
WB9668	36.7	.	.	.	.	.	.	.	.
LCS Hammer AX					15.2	.	.		.
LCS Heron					12.6	.	.		.
LCS Dual					11.1	.	.		.
LCS Buster					6.7	.	.		.
Site Average	43.5	21.8	49.5	43.7	14.9				
P>F	<0.0001	0.0404	0.0013	0.0016	<0.0001				
LSD (0.05)	3.7	3.2	5.8	7.6	2.9				



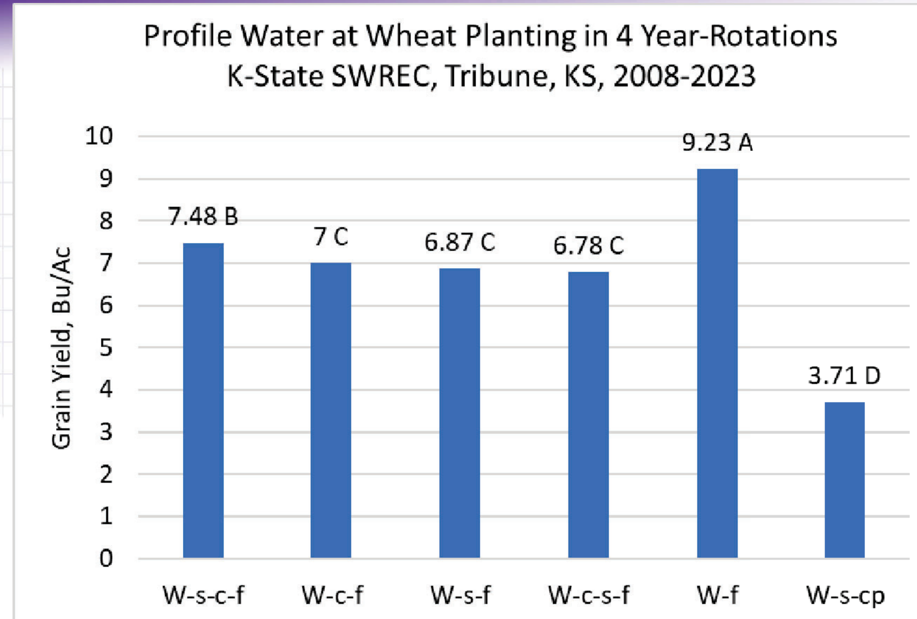
Cowpeas

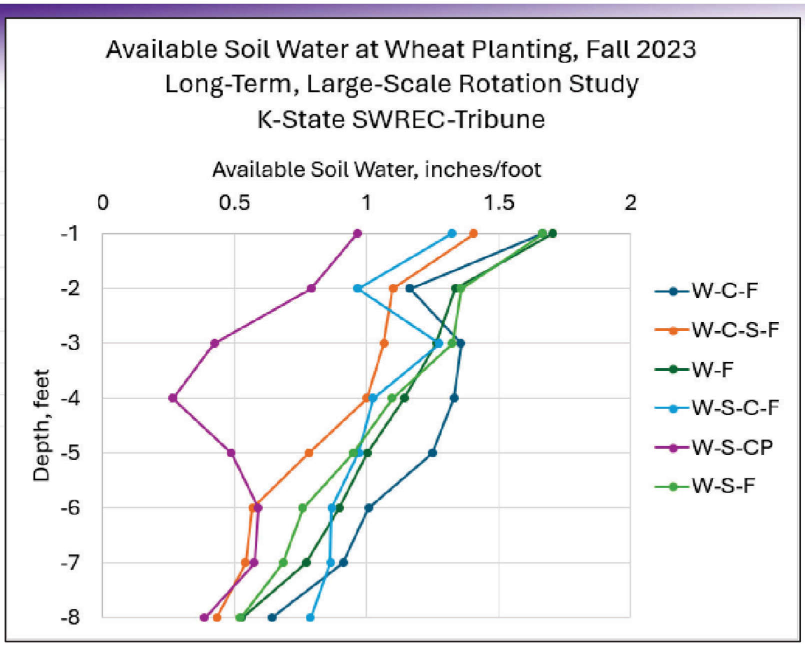
- Heat and drought tolerant
- Relatively low water use
- Short duration crop
  - Somewhat unintentionally we have seen cowpeas succeed in NWKS at late planting dates

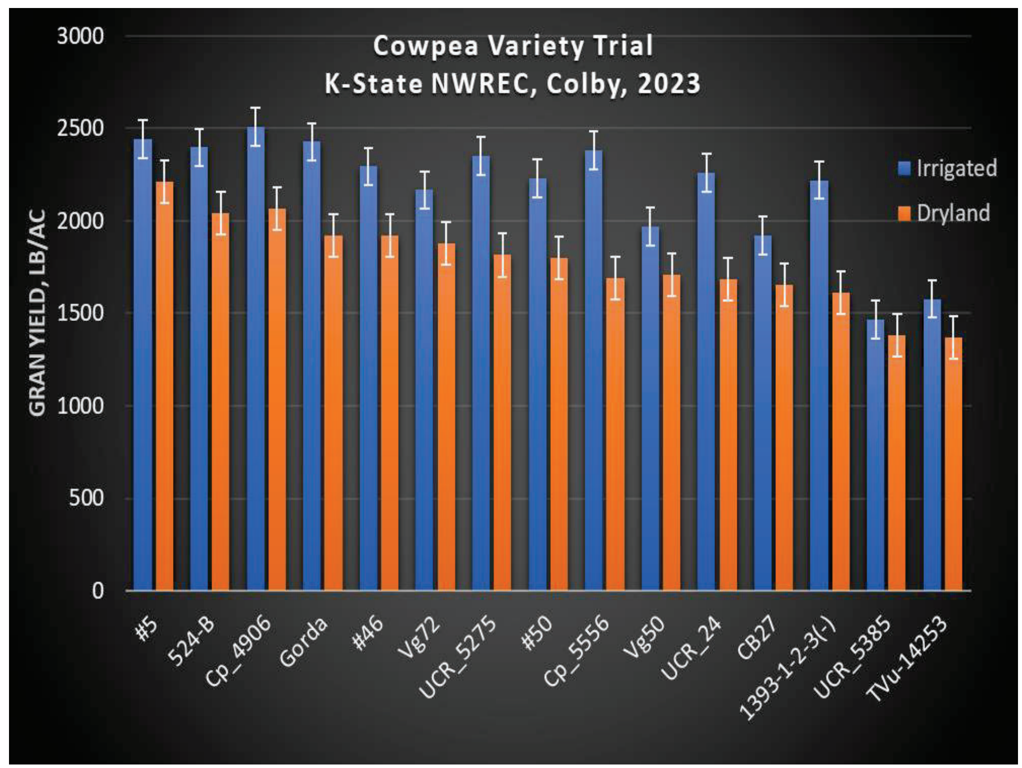
Cowpea Evaluation in a Dryland Rotation

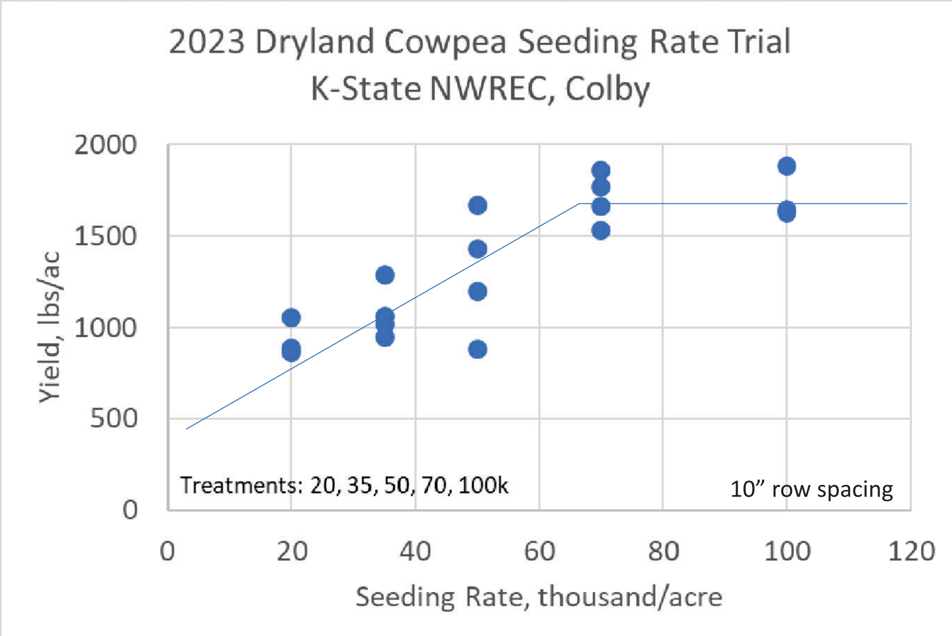


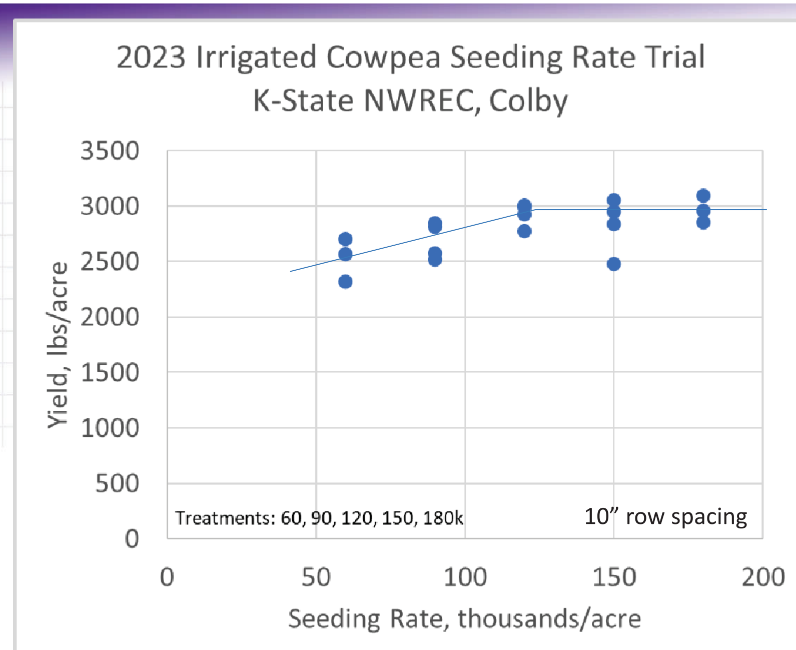
- Wheat-Sorghum-Fallow >>> Wheat-Sorghum-Cowpea
- Integrated into large-scale, long-term (1993) dryland rotation study at Tribune
- Cowpeas averaged 1030 lb/ac and plots were seeded back to wheat at optimum date











Inoculant and Nitrogen

- 2023 Colby
  - Irrigated: 0, 30, 60, 90, 150 lb/ac, with and without inoculant
  - Dryland: 0, 25, 50, 75, 100 lb/ac, with and without inoculant
  - Observed no differences in yield or any other measured parameter

Cowpea Evaluation - 2023

- 30 lines form MAGIC collection
  - (8 parents, 22 lines)
  - Thanks to Lam Huynh
- 126 lines from UCR Minicore
  - Thanks to Tim Close
- 15 varieties, breeding lines, misc.
  - Thanks to Sally Jones Diamond, CSU and María Muñoz Amatriaín, Universidad de León
- 171 Total
- Grown under dryland and irrigated, very limited notes, mostly seed increase
- 2024 – More active effort, two locations

Camelina

- Oilseed crop in the brassica family
- Grown as early as 600 BC in the Rhine valley
- Important oil crop in Europe pre WWII
- Winter and Spring types Exist
- Short Season Crop: 70-100 days
- Industrial (biodiesel and jet fuel) and human markets (high omega 3 fatty acid content)

Camelina - Management

- Planting Date: Winter: 9/5 - 10/5
  Spring: 2/15 – 4/1

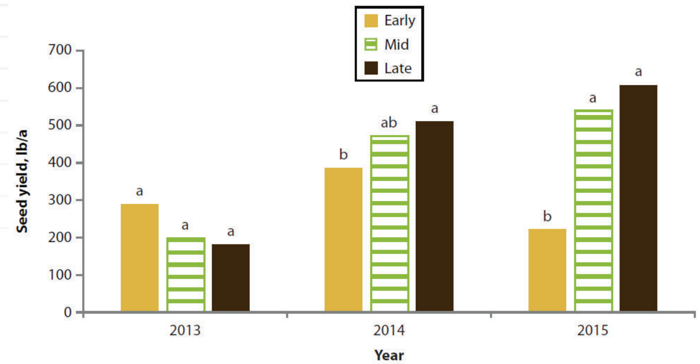


Figure 2. Camelina yield at early, mid, and late seeding dates in year 2013, 2014, and 2015, Agricultural Research Center–Hays; comparison is among planting dates within year. Within years, means followed by the same letter(s) are not significantly different at P>0.05.

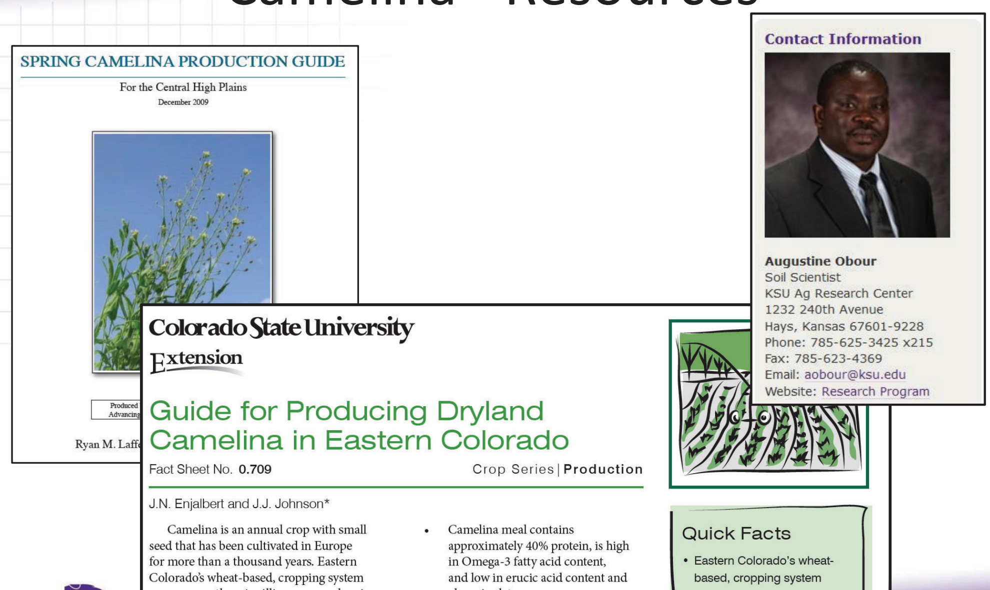
Camelina - Summary

Camelina Production Basics:

- ✓ Good quality seed
- ✓ Firm seedbed
- ✓ Clean field sanitation
- ✓ 1 lb N ≈ 25 lbs seed production
- ✓ or 35-40 lbs N for 1000lb yield*

  *provided good moisture and low weed pressure
- ✓ Seeding rate ≈ 3 to 5 lb/a
- ✓ Row spacing: 8” or less
- ✓ Planting date: Mid-March to mid-April (≈ 35 to 40°F soil temp)
- ✓ **Timely harvest**

Camelina - Resources



Winter Canola Variety Trials

Northwest Research-Extension Center, Colby, KS

2015/16 Great Plains Trial Results

Variety	50% bloom (d)	Yield (bu/a)	Yield (rank)
KS4658	127	55.6	1
Riley	119	52.7	4
Safran	126	50.4	7
KS4719**	129	48.8	12
Wichita	124	38.6	35
Sumner	121	31.8	36
Mean	124	45.6	
LSD (0.05)	3	11.8	

**Proposed for increase in 2019/20.

Spring Oilseed Variety Trials

Northwest Research-Extension Center, Colby, KS
(lb/acre)

	Year			
Variety	2003	2004	2005	2006
Hyola 401 (check)	978	868	1,204	91
High Yield B. napus	1,294	908	1,204	325
Low Yield B. napus	431	137	183	28
Camelina	1,370	289	1,034	93
B. juncea	1,171	417	607	---

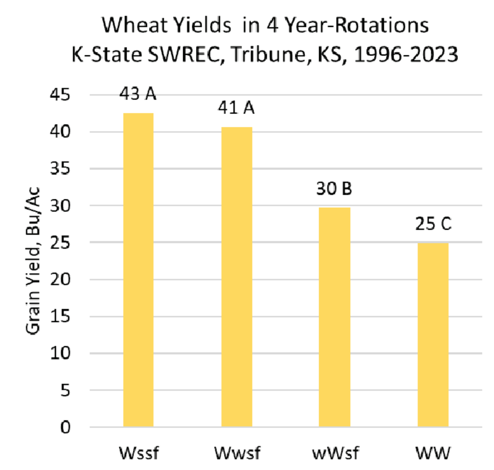
- Limited by available water, stand establishment, and heat at reproductive stage

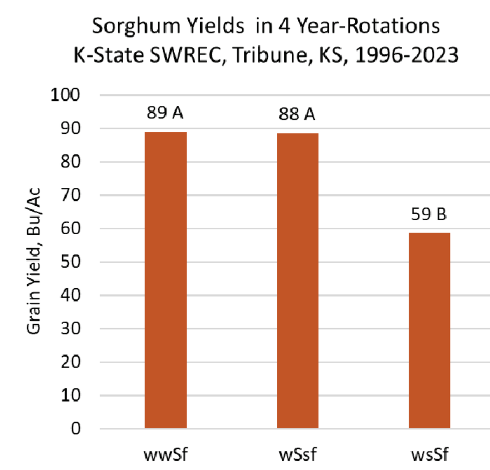
Shifting Gears… Intensified Rotations

Four Year Rotations (1996-present)

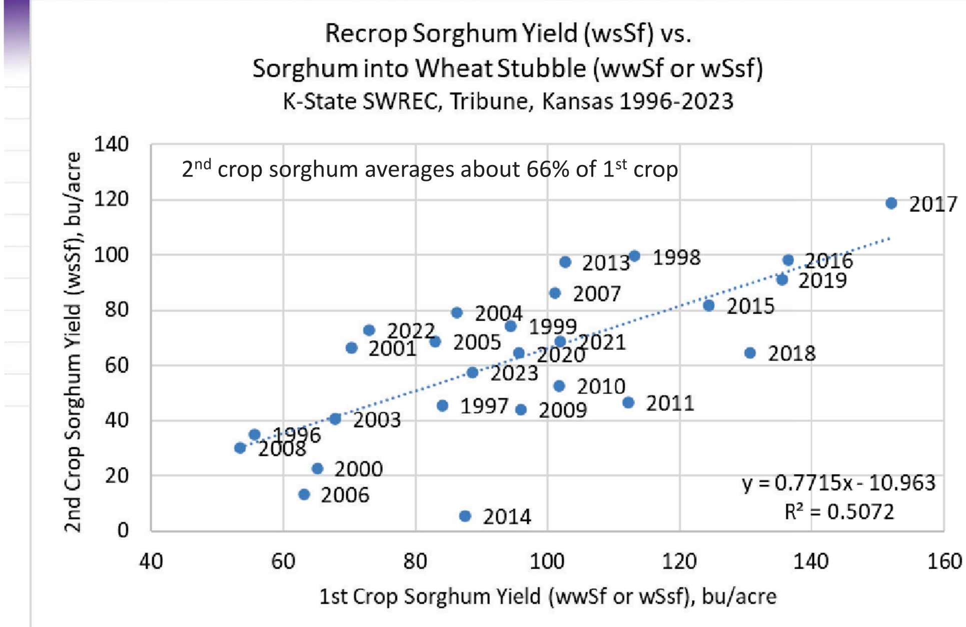
- Wheat-Wheat-Sorghum-Fallow
- Wheat-Sorghum-Sorghum-Fallow
- Continuous Wheat
- All Continuous No-Till

Average Yields, 1996-present

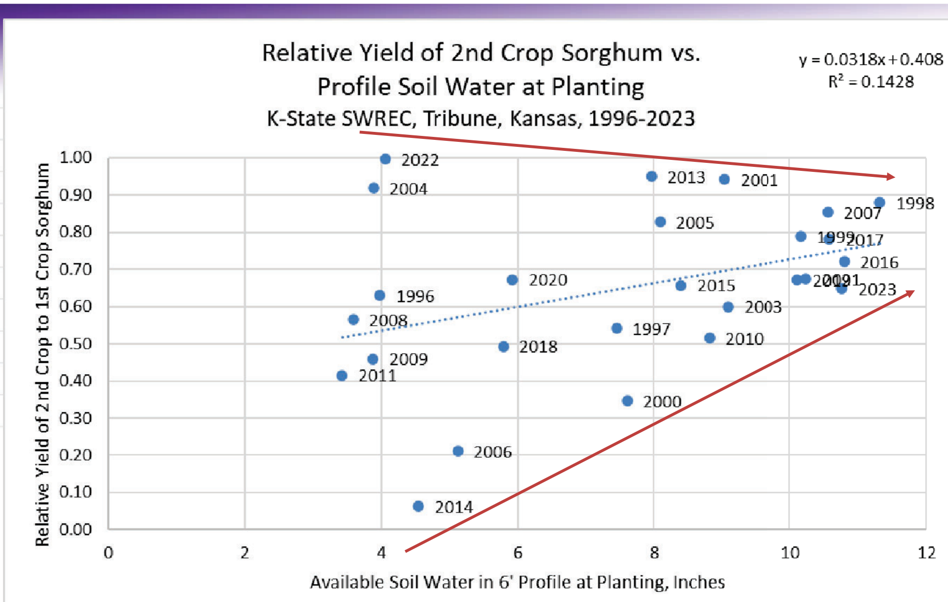




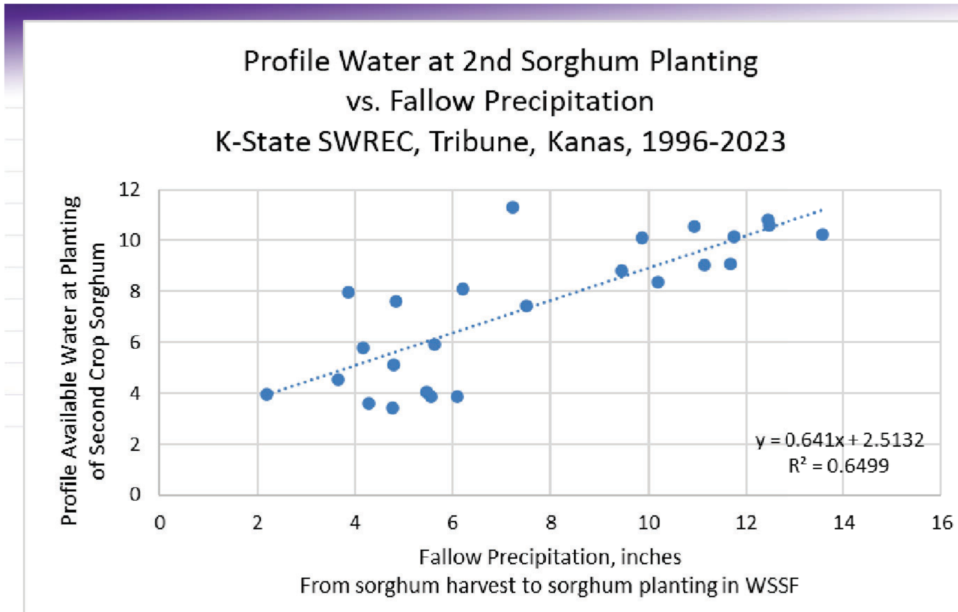
2024 Crop Talk Webinar Series



2024 Crop Talk Webinar Series

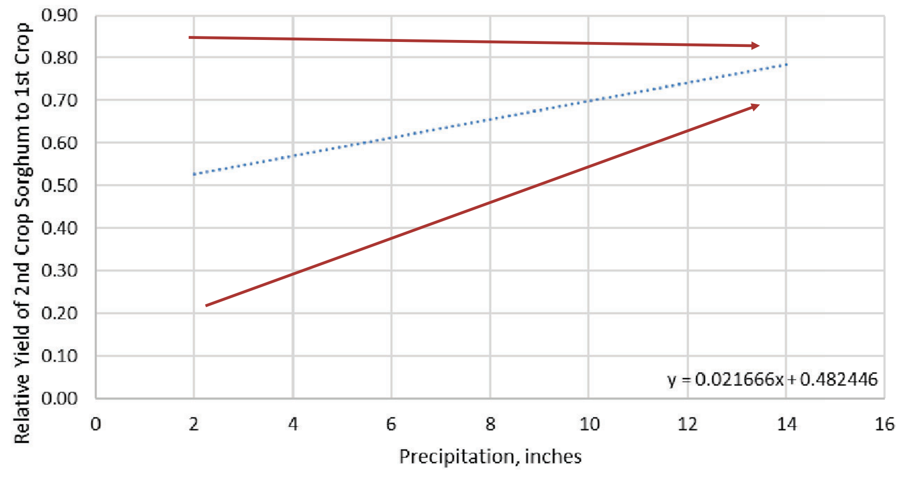


2024 Crop Talk Webinar Series



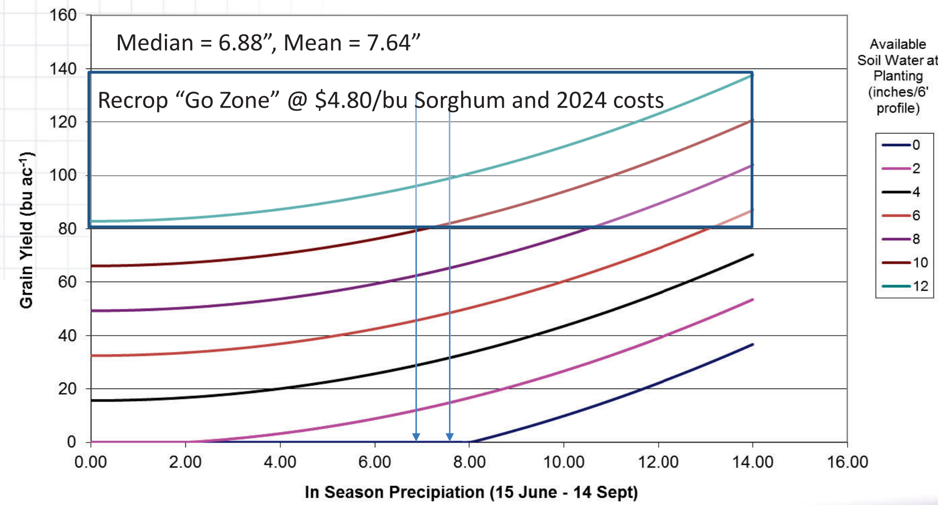
2024 Crop Talk Webinar Series

Relative Yield of 2nd Crop Sorghum vs. Fallow Precip (from 1st sorghum harvest to 2nd sorghum planting)



Grain Sorghum Yield associated with Water Supply Components SWREC-Tribune 1973-2003

Adapted by L. Haag from Stone and Schlegel, 2006. Agron. J. 98:1359-1366

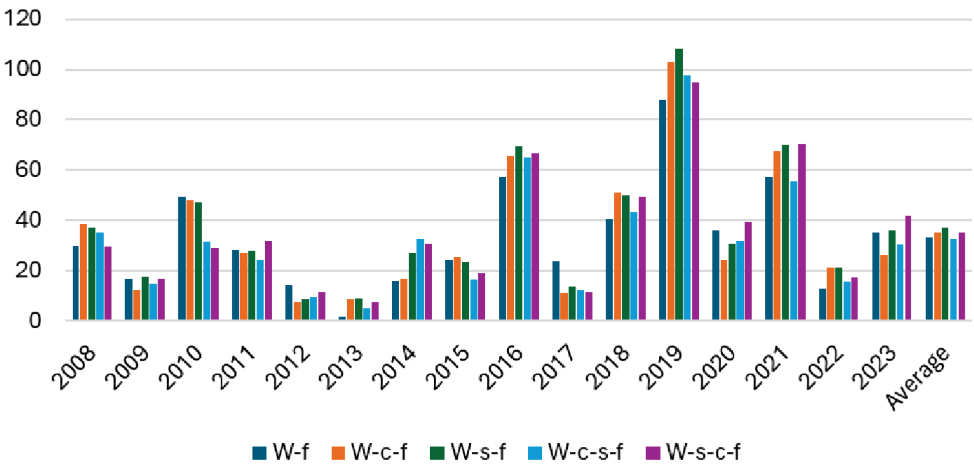


Long-Term, Large-Scale, Dryland Rotation Study

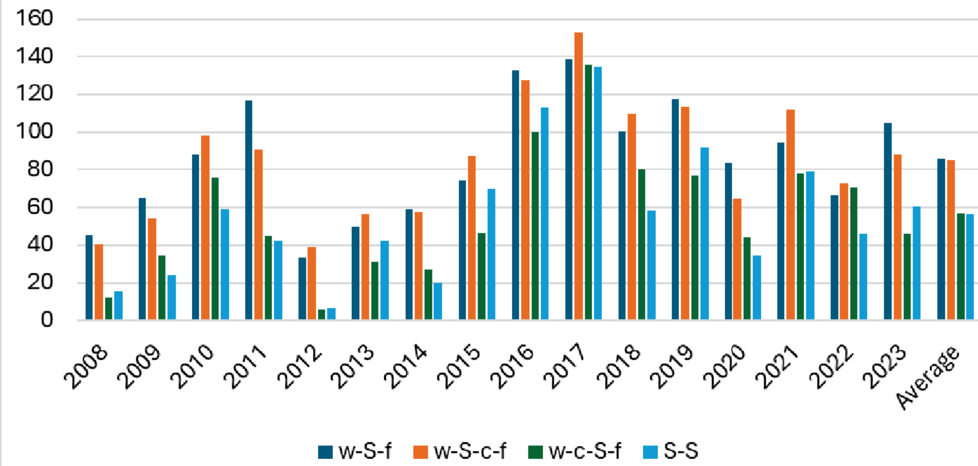
Current Rotations

- Wheat-Fallow (RT)
- Wheat-Corn-Fallow
- Wheat-Sorghum-Fallow
- Wheat-Corn-Sorghum-Fallow
- Wheat-Sorghum-Corn-Fallow
- Continuous Sorghum
- Wheat-Sorghum-Cowpea

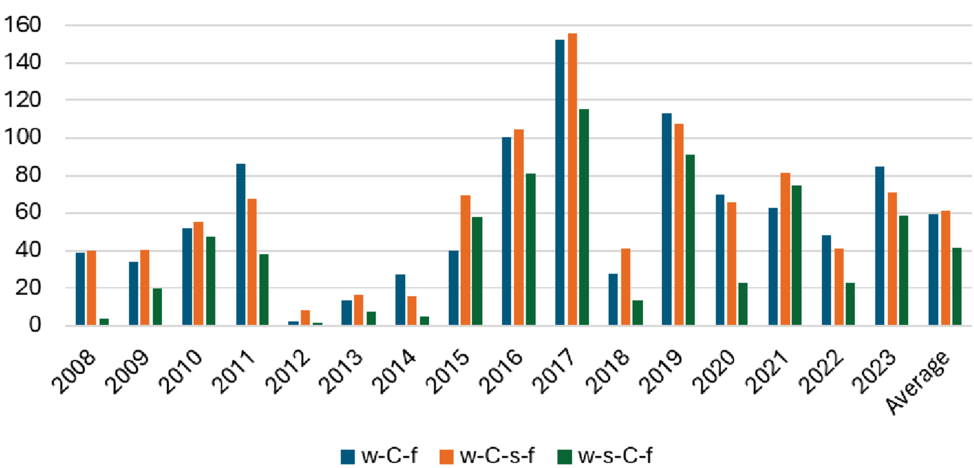
Long-Term, Large-Scale Dryland Rotation Study
Wheat Grain Yields by Rotation
K-State SWREC-Tribune, 2008-present



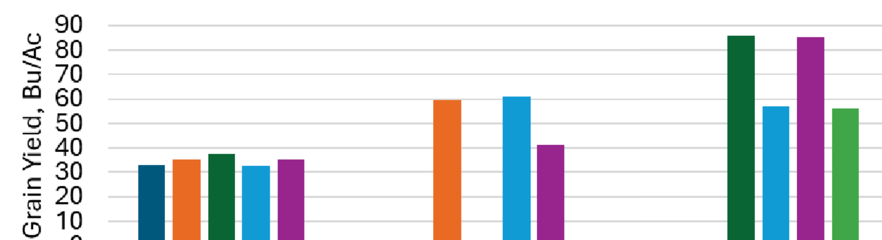
Long-Term, Large-Scale Dryland Ration Study
Sorghum Grain Yields by Rotation
K-State SWREC-Tribune, 2008-present



Long-Term, Large-Scale Dryland Rotatoin Study
Corn Grain Yields by Rotation
K-State SWREC-Tribune, 2008-present



Long-Term, Large-Scale Dryland Rotation Study
K-State SWREC, Tribune, KS, 2008-present



	Wheat	Corn	Sorghum
W-F	33.2		
W-C-F	35.2	59.6	
W-S-F	37.5		85.6
W-C-S-F	32.8	61.2	56.9
W-S-C-F	35.1	41.3	85.2
S-S			56.1

W-F W-C-F W-S-F W-C-S-F W-S-C-F S-S

Concluding Thoughts

- What is my profile water situation?
- What is my surface residue condition?
- Make decisions that will improve precipitation use efficiency
  - – Good fallow management
    - No-till, residue, and weed control
  - – System Intensification
    - Can we intensity with cash, forage, or green fallow (cover) crops
    - But efforts need to keep in mind “do no harm”
      - – hits on subsequent crops reduce surface residues, etc.