

## Crop Production Economics – Rotations, Tillage, and Cover Crops in SC KS

Presented at  
HV Co No-till producer group meeting  
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HV Co no-till  
discussion  
group

## Outline of talk...

- Economics associated with several studies from Hesston Experiment Field
  - Two-crop rotation x tillage (wheat versus alternative row crops)
  - No-till crop rotations
  - Cover crops
  - Double cropping forage behind wheat



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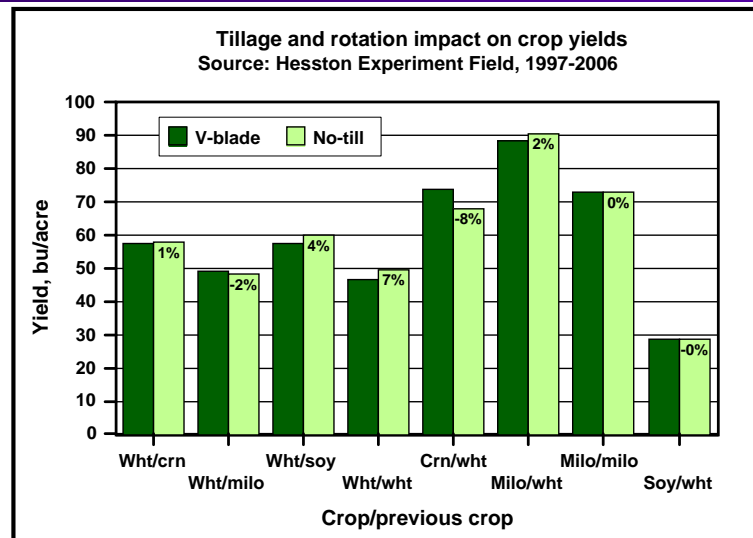
## Two-crop rotation x tillage study...

- Wheat rotated with...
  - wheat (continuous cropping), sorghum, corn, or soybeans
- Sorghum rotated with...
  - sorghum (continuous cropping) and wheat
- Tillage
  - v-blade and no-till (all wheat planted no-till after row crop)
- 10 years of yield data, 1997-2006 (no corn yields in 2000)
- Costs based on Mathew Pachta's M.S. thesis (2008 custom rates and 2009 input prices)



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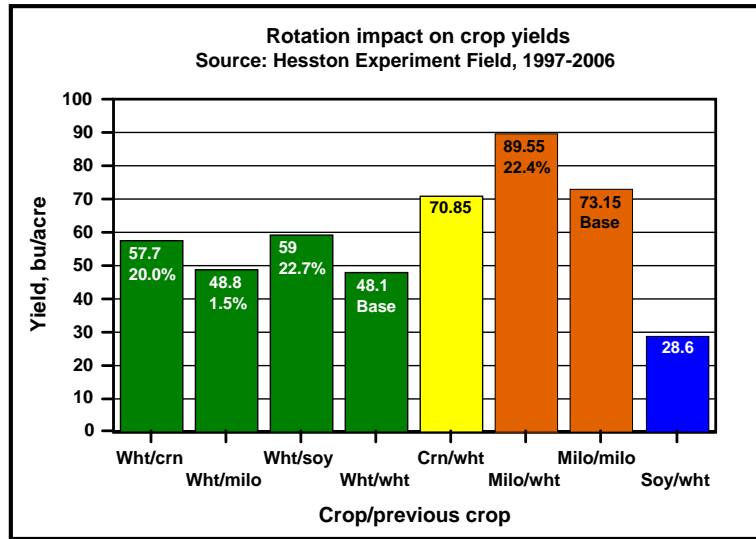
## Rotation has bigger impact on yield than tillage...



Source: M.M. Claassen, KSU Agronomy Field Research 2007 Report of Progress 992



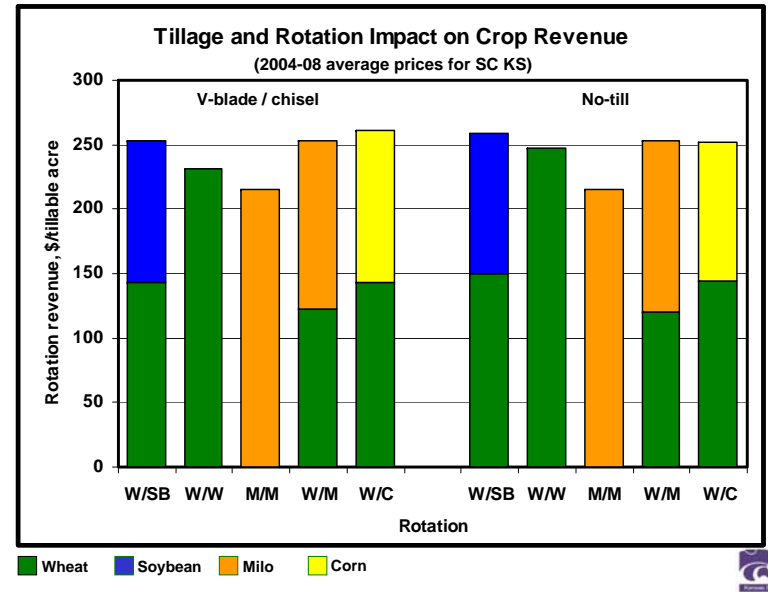
### Impact of rotation on yield (averaged across tillage)...



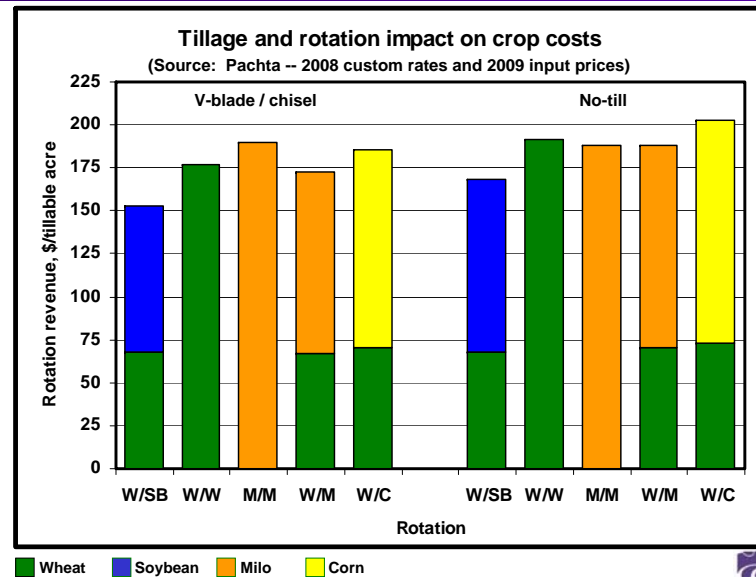
Source: M.M. Claassen, KSU Agronomy Field Research 2007 Report of Progress 992



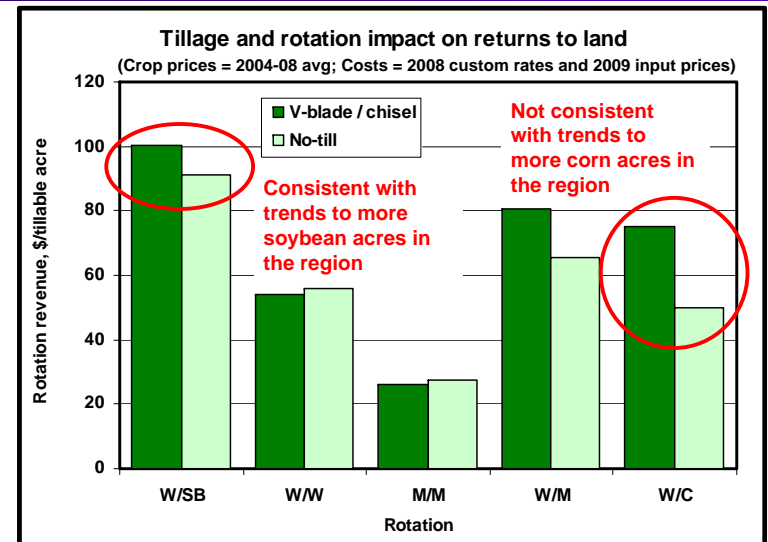
### Continuous cropping generates less revenue...



### Costs are slightly lower with tillage systems...



### No-till systems slightly less profitable, but rotation has bigger impact...



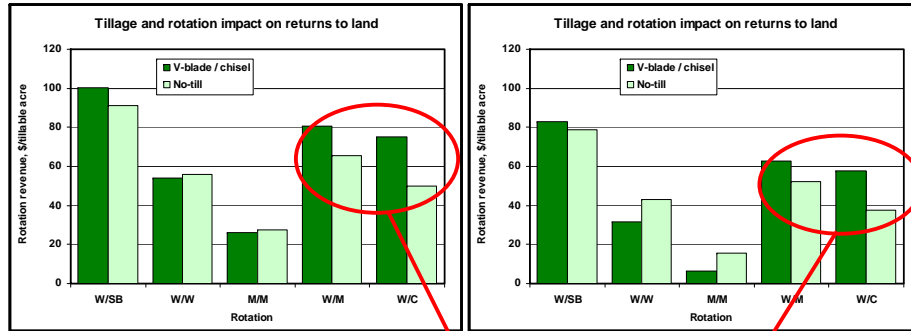
## Relative profitability is not particularly sensitive to cost assumptions...

### Baseline Scenario

Crop prices: 2004-08 averages  
 Costs: Machinery = 2008 custom rates  
 Herbicide = 2009 prices

### Alternative Scenario

2004-08 averages  
 Machinery = 2008 custom rates x 125%  
 Herbicide = 2009 prices x 90%



Hard to overcome the yield reduction observed in this study with no-till corn and milo



## Before we move on...

## Questions / discussion

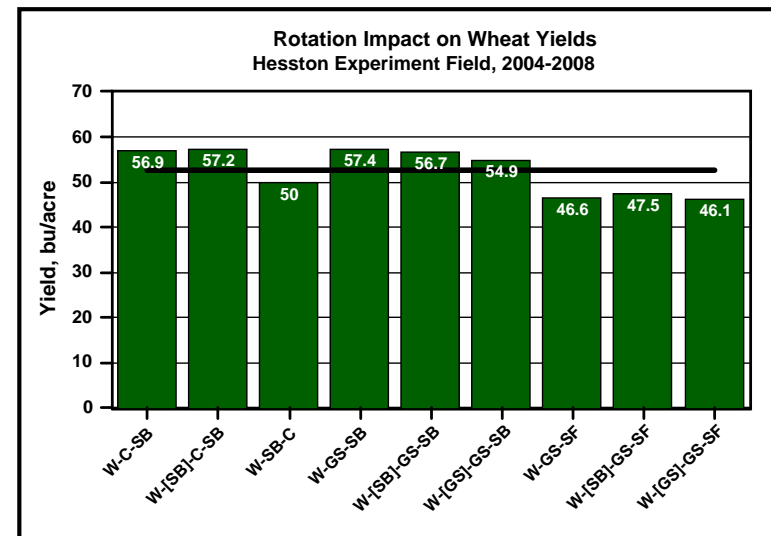


## No-till crop rotations study...

- Study initiated in 2001 (data collection to determine cropping system effects began in 2004)
- 11 no-till crop rotations (including five different crops)
  - W-C-SB | W-[SB]-C-SB | W-SB-C
  - W-GS-SB | W-[SB]-GS-SB | W-[GS]-GS-SB
  - W-GS-SF | W-[SB]-GS-SF | W-[GS]-GS-SF
  - GS-C-SB
  - GS-GS-GS
- 5 years of yield data, 2004-08
- Costs based on NC KS Farm Management Guides (with fertilizer rates adjusted to be consistent with yields)



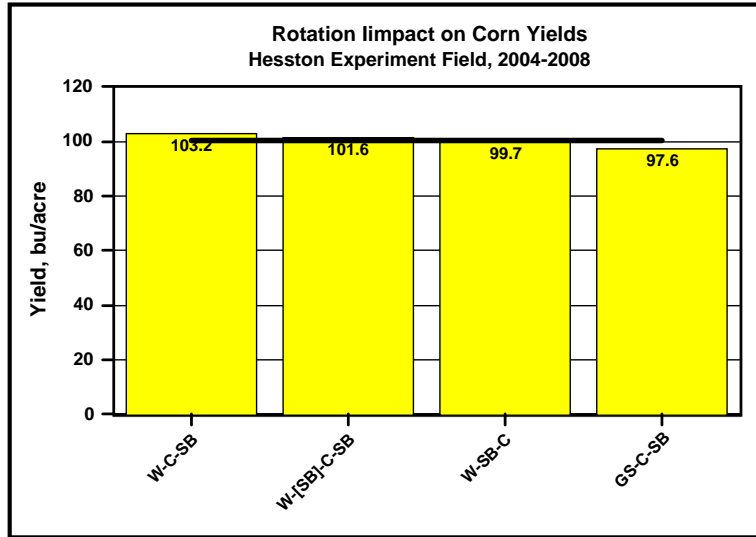
## Wheat yields are best following soybeans...



Source: Claassen and Regehr, KSU Agronomy Field Research 2009 Report of Progress 1017



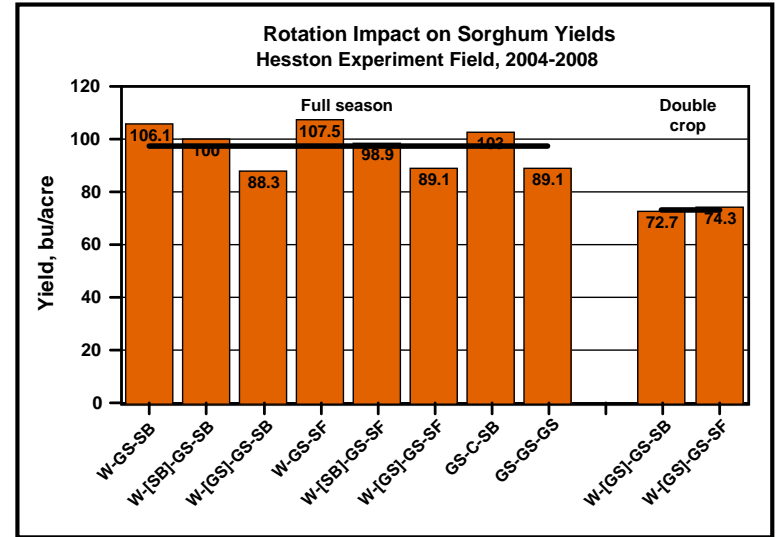
## No rotation effect on corn yields...



Source: Claassen and Regehr, KSU Agronomy Field Research 2009 Report of Progress 1017



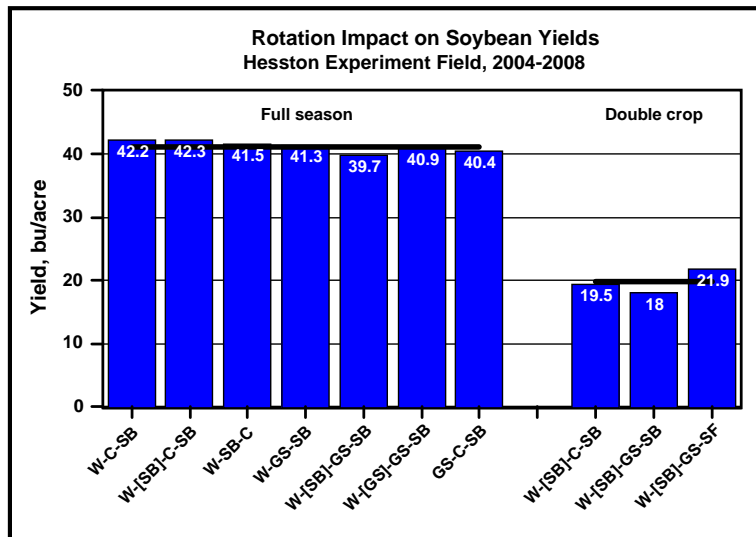
## Sorghum yields are best following wheat...



Source: Claassen and Regehr, KSU Agronomy Field Research 2009 Report of Progress 1017



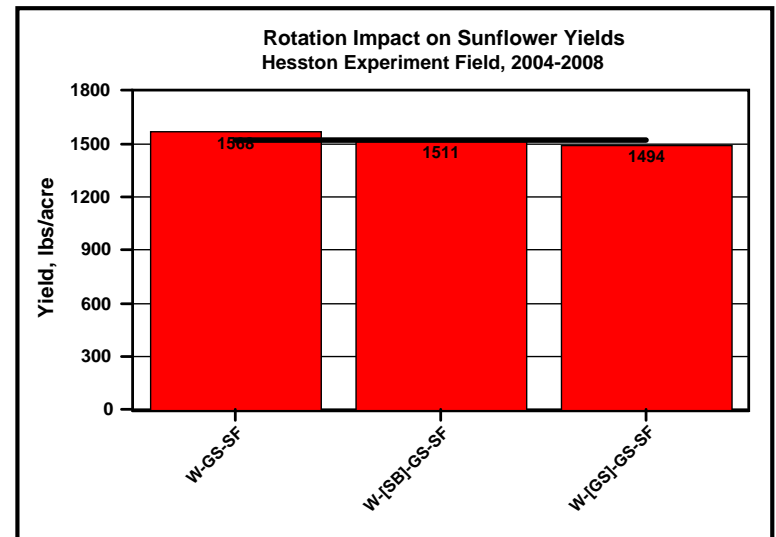
## No rotation effect on soybean yields...



Source: Claassen and Regehr, KSU Agronomy Field Research 2009 Report of Progress 1017



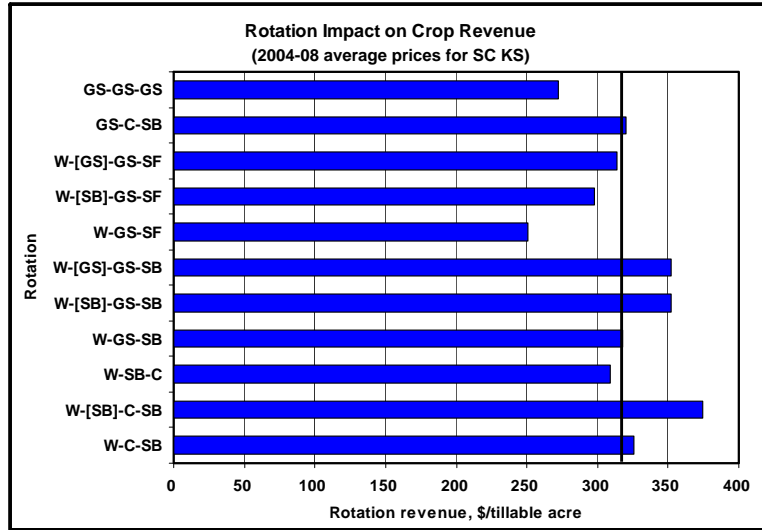
## No rotation effect on sunflower yields...



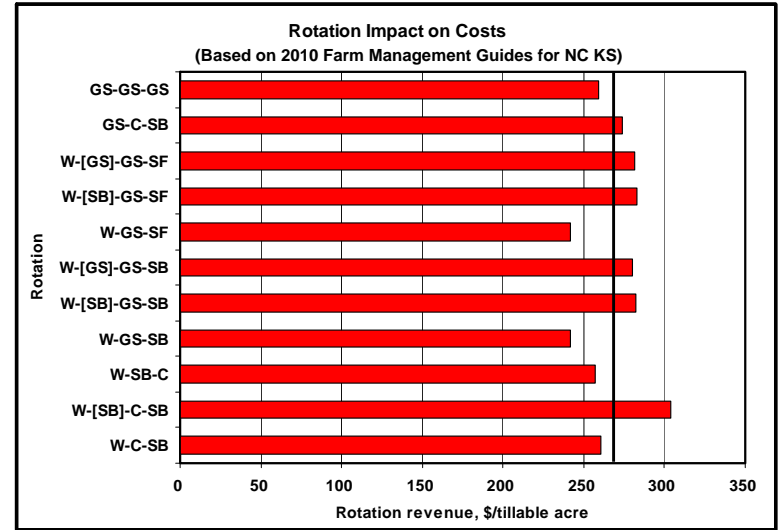
Source: Claassen and Regehr, KSU Agronomy Field Research 2009 Report of Progress 1017



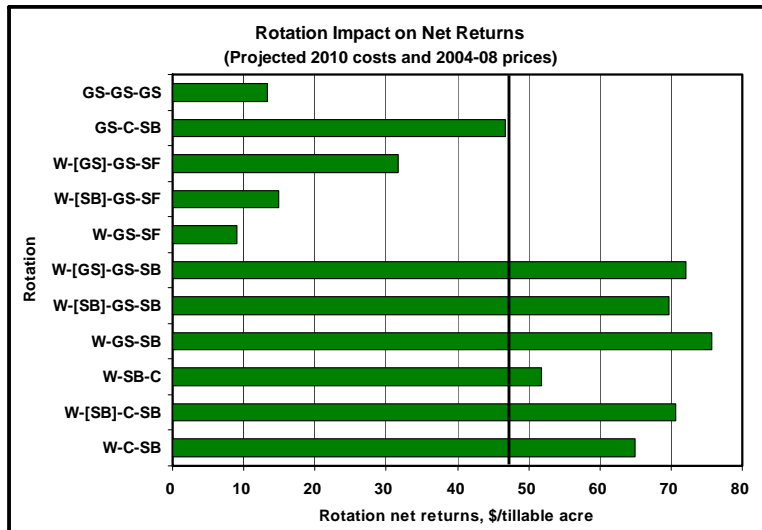
## Revenue by rotation...



## Costs by rotation...



## Net returns by rotation...



## Economic comparison of rotations (5-yr avg prices)...

Net Returns by Rotation (5-yr avg prices, current projected costs)			
Rotation	Gross revenue	Total costs	Profit
W-C-SB	\$325.76	\$260.73	\$65.02 #5
W-[SB]-C-SB	\$374.60	\$304.02	\$70.58 #3
W-SB-C	\$308.81	\$256.96	\$51.84
W-GS-SB	\$317.46	\$241.76	\$75.70 #1
W-[SB]-GS-SB	\$352.28	\$282.53	\$69.75 #4
W-[GS]-GS-SB	\$352.23	\$280.17	\$72.06 #2
W-GS-SF	\$250.64	\$241.56	\$9.08
W-[SB]-GS-SF	\$297.73	\$282.87	\$14.86
W-[GS]-GS-SF	\$313.54	\$281.86	\$31.68
GS-C-SB	\$320.34	\$273.66	\$46.67
GS-GS-GS	\$272.55	\$259.24	\$13.31
<b>Average</b>	<b>\$316.90</b>	<b>\$269.58</b>	<b>\$47.32</b>
<b>Min</b>	<b>\$250.64</b>	<b>\$241.56</b>	<b>\$9.08</b>
<b>Max</b>	<b>\$374.60</b>	<b>\$304.02</b>	<b>\$75.70</b>
<b>Range</b>	<b>\$123.96</b>	<b>\$62.46</b>	<b>\$66.62</b>

## Economic comparison of rotations (current prices)...

Net Returns by Rotation (current bids, current projected costs)

Rotation	Gross revenue	Total costs	Profit
W-C-SB	\$340.72	\$260.73	#5 \$79.98 #5
W-[SB]-C-SB	\$394.49	\$304.02	#1 \$90.47 #3
W-SB-C	\$324.20	\$256.96	\$67.23
W-GS-SB	\$328.92	\$241.76	#3 \$87.16 #1
W-[SB]-GS-SB	\$367.63	\$282.53	#4 \$85.11 #4
W-[GS]-GS-SB	\$367.34	\$280.17	#2 \$87.17 #2
W-GS-SF	\$282.43	\$241.56	\$40.87
W-[SB]-GS-SF	\$333.34	\$282.87	\$50.47
W-[GS]-GS-SF	\$340.84	\$281.86	\$58.98
GS-C-SB	\$351.61	\$273.66	\$77.95
GS-GS-GS	\$295.72	\$259.24	\$36.48
Average	\$338.84	\$269.58	\$69.26
Min	\$282.43	\$241.56	\$36.48
Max	\$394.49	\$304.02	\$90.47
Range	\$112.06	\$62.46	\$53.99

Rankings don't change much at current prices...



## Before we move on...

## Questions / discussion



## Economics of Double / Cover Crops

### Planting a crop after wheat to...

- harvest as an additional cash grain crop
  - i.e., double crop as in rotation study
- increase residue, improve soil quality, fix N, suppress weeds, etc.
  - Research study from Hesston (2005-2008)
- harvest as a forage crop (graze or bale)
  - Research study from Hesston (2002-2005)



## Key factors driving the economics of planting a crop after wheat...

- Prices of outputs (crops) and inputs (seed, fertilizer)
- Crop yield
- Value of nutrients removed / credited
- Costs of establishing and harvesting crop
  - No-till versus tillage
  - Baling vs. grazing
- Impact on yield of following crop(s)
- Impact of costs of following crop(s)



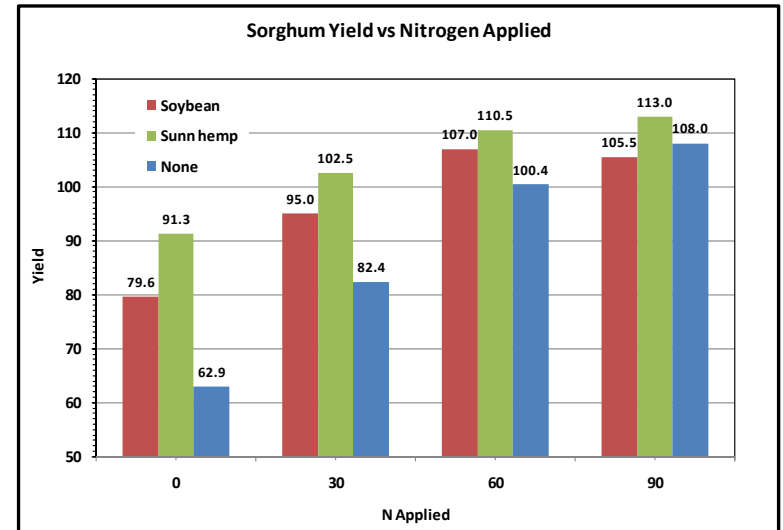
## Cover crop study (wheat-sorghum rotation)...

### Hesston Experiment Field, 2005-2009

- **Cover crops considered:**  
Sunn hemp and forage soybean
- **Nitrogen rates considered:**  
0, 30, 60, 90 lbs/acre applied
- **4-years of yield data**  
Sorghum, 2005-2008  
Wheat, 2006-2009



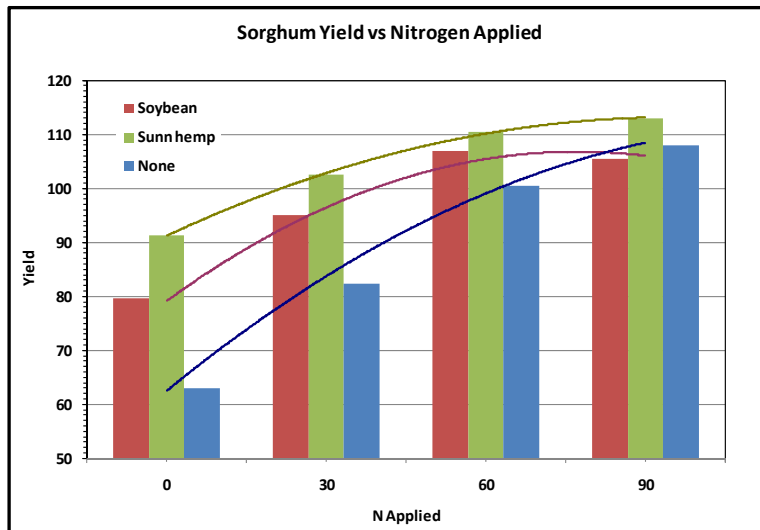
## 4-yr average (2005-08) sorghum yields...



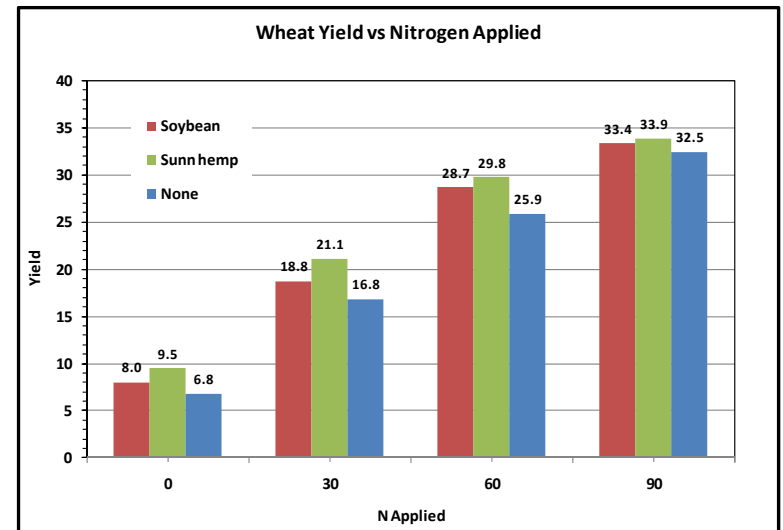
Source: Claassen, various KSU Agronomy Field Research reports



## “Flatter” response to N with cover crops...



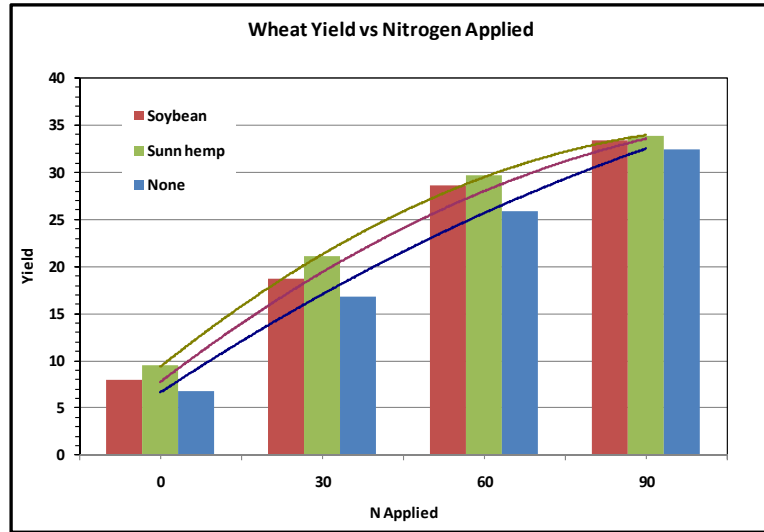
## 4-yr average (2005-09) wheat yields...



Source: Claassen, various KSU Agronomy Field Research reports



## Residual effect from cover crops exists...



## Economic analysis of summer cover crops planted after wheat harvest...

- **Partial budget comparing control (no cover crop) to alternative cover crops**
  - Cost of chemical fallow vs. establishment of cover crop
  - N credit for the following cash crop (if any)
  - Impact on yield of following crop (+/-)
- **Net returns to cover crop (improvement from control)**
- **Yields and N effects estimated two ways**
  - Model estimated yield and optimal N rate (lines on prev fig)
  - “Best” actual average yield and N rate (bars on prev fig)



## Cover crop partial budgets...

### Cover Crop Partial Budget

	No cover	Forage soybean	Sunn hemp
Seed, \$/ac	\$0.00	\$31.20	\$20.00
Seeding rate, lbs/ac	0	60	10
Seed cost, \$/lb	\$0.00	\$0.52	\$2.00
Planting, \$/ac	\$0.00	\$12.00	\$12.00
Herbicide, \$/ac	\$21.54	\$21.54	\$34.05
Chemical, \$/ac	\$11.41	\$11.41	\$19.43
Number of applications	2.25	2.25	3.25
Application cost, \$/ac	\$4.50	\$4.50	\$4.50
Roller/crimper, \$/ac	\$0.00	\$6.00	\$6.00
<b>Total Cost</b>	<b>\$21.54</b>	<b>\$70.74</b>	<b>\$72.05</b>



### Assumptions:

- Planted with no-till drill
- Chemical costs for wheat harvest through end of fall time period
- Sunn hemp sprayed 50% of the time to terminate crop



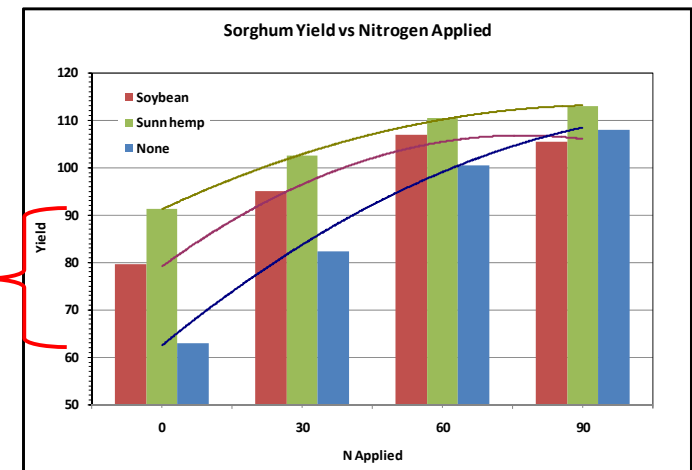
## Yield Benefits from Cover Crops

Notice the yield boost with no applications of N.

The boost comes from improvements in soil productivity.

For sunn hemp, this persists, even with increasing N.

Is it high enough with N credit to cover establishment costs?



## Model-estimated yields and N rates analysis...

### Return over Optimal N and Cover Crop Establishment Costs

	No cover (base)		Cover crop	
	Soybean	Sunn hemp	Soybean	Sunn hemp
<b>Sorghum</b>				
Optimal N, lbs/a	105.3	71.9	64.8	71.9
Yield, bu/a	111.0	111.8	106.1	111.8
Return over N, \$/a	\$346.33	\$362.66	\$345.41	\$362.66
<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$16.33</b>	<b>-\$0.92</b>	<b>\$16.33</b>
Cover crop establishment, \$/a	\$21.54	\$72.05	\$70.74	\$72.05
Return over N and cover costs, \$/a	\$324.79	\$290.61	\$274.67	\$290.61
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$34.18</b>	<b>-\$50.12</b>	<b>-\$34.18</b>
<b>Wheat</b>				
N, lbs/a	120.0	90.8	105.2	90.8
Yield, bu/a	37.6	34.0	35.2	34.0
Return, \$/a	\$132.48	\$127.01	\$127.02	\$127.01
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$5.47</b>	<b>-\$5.46</b>	<b>-\$5.47</b>
Rotation average, \$/a	\$228.64	\$208.81	\$200.84	\$208.81
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$19.82</b>	<b>-\$27.79</b>	<b>-\$19.82</b>

Requires an N price of \$1.59/lb to breakeven (all else equal)

Requires an N price of \$0.94/lb to breakeven (all else equal)

Prices: N = \$0.40/lb; sorghum = \$3.50/bu; wheat = \$4.80/bu



## Actual average yields and N rates analysis...

### Return over Optimal N and Cover Crop Establishment Costs

	No cover (base)		Cover crop	
	Soybean	Sunn hemp	Soybean	Sunn hemp
<b>Sorghum</b>				
N rate, lbs/a	90.0	60.0	60.0	60.0
Yield, bu/a	108.0	110.5	107.0	110.5
Return over N, \$/a	\$342.09	\$362.66	\$350.33	\$362.66
<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$20.57</b>	<b>\$8.24</b>	<b>\$20.57</b>
Cover crop establishment, \$/a	\$21.54	\$72.05	\$70.74	\$72.05
Return over N and cover costs, \$/a	\$320.55	\$290.61	\$279.59	\$290.61
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$29.94</b>	<b>-\$40.96</b>	<b>-\$29.94</b>
<b>Wheat</b>				
N, lbs/a	90.0	90.0	90.0	90.0
Yield, bu/a	32.5	33.9	33.4	33.9
Return, \$/a	\$119.76	\$126.60	\$124.08	\$126.60
<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$6.84</b>	<b>\$4.32</b>	<b>\$6.84</b>
Rotation average, \$/a	\$220.16	\$208.61	\$201.83	\$208.61
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$11.55</b>	<b>-\$18.32</b>	<b>-\$11.55</b>

Prices of N needs to increase to \$0.67/lb to before reduce to 60 lbs (all else equal)

Prices of N needs to increase to \$0.75/lb to before reduce to 60 lbs (all else equal)

Prices: N = \$0.40/lb; sorghum = \$3.50/bu; wheat = \$4.80/bu



## Impact of doubling the prices of N...

### Return over Optimal N and Cover Crop Establishment Costs

	No cover (base)		Cover crop	
	Soybean	Sunn hemp	Soybean	Sunn hemp
<b>Sorghum</b>				
Optimal N, lbs/a	87.9	48.1	52.6	48.1
Yield, bu/a	108.0	107.8	104.0	107.8
Return over N, \$/a	\$307.70	\$338.68	\$321.92	\$338.68
<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$30.98</b>	<b>\$14.23</b>	<b>\$30.98</b>
Cover crop establishment, \$/a	\$21.54	\$72.05	\$70.74	\$72.05
Return over N and cover costs, \$/a	\$286.16	\$266.63	\$251.18	\$266.63
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$19.53</b>	<b>-\$34.97</b>	<b>-\$19.53</b>
<b>Wheat</b>				
N, lbs/a	106.2	70.7	80.5	70.7
Yield, bu/a	35.5	29.8	32.1	29.8
Return, \$/a	\$85.38	\$94.71	\$89.87	\$94.71
<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$9.33</b>	<b>\$4.48</b>	<b>\$9.33</b>
Rotation average, \$/a	\$185.77	\$180.67	\$170.53	\$180.67
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$5.10</b>	<b>-\$15.24</b>	<b>-\$5.10</b>

Prices: N = \$0.80/lb; sorghum = \$3.50/bu; wheat = \$4.80/bu

### Return over Optimal N and Cover Crop Establishment Costs

	No cover (base)		Cover crop	
	Soybean	Sunn hemp	Soybean	Sunn hemp
<b>Sorghum</b>				
N rate, lbs/a	90.0	60.0	60.0	60.0
Yield, bu/a	108.0	110.5	107.0	110.5
Return over N, \$/a	\$306.09	\$338.66	\$326.33	\$338.66
<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$32.57</b>	<b>\$20.24</b>	<b>\$32.57</b>
Cover crop establishment, \$/a	\$21.54	\$72.05	\$70.74	\$72.05
Return over N and cover costs, \$/a	\$284.55	\$266.61	\$255.59	\$266.61
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$17.94</b>	<b>-\$28.96</b>	<b>-\$17.94</b>
<b>Wheat</b>				
N, lbs/a	90.0	60.0	60.0	60.0
Yield, bu/a	32.5	29.8	28.7	29.8
Return, \$/a	\$83.76	\$94.80	\$89.64	\$94.80
<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$11.04</b>	<b>\$5.88</b>	<b>\$11.04</b>
Rotation average, \$/a	\$184.16	\$180.71	\$172.61	\$180.71
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$3.45</b>	<b>-\$11.54</b>	<b>-\$3.45</b>

Prices: N = \$0.80/lb; sorghum = \$3.50/bu; wheat = \$4.80/bu



Need to figure out ways to lower cost of establishing cover crop because yield and nitrogen benefits are not large enough to overcome costs...

Sunn hemp has an advantage over forage soybeans (what if you decide to hay/graze?)

## Revised cover crop partial budgets...

### Cover Crop Partial Budget

	No cover	Forage soybean	Sunn hemp
Seed, \$/ac	\$0.00	\$31.20	\$20.00
Seeding rate, lbs/ac	0	60	10
Seed cost, \$/lb	\$0.00	\$0.52	\$2.00
Planting, \$/ac	\$0.00	\$8.00	\$8.00
Herbicide, \$/ac	\$21.54	\$17.11	\$17.11
Chemical, \$/ac	\$11.41	\$9.24	\$9.24
Number of applications	2.25	1.75	1.75
Application cost, \$/ac	\$4.50	\$4.50	\$4.50
Roller/crimper, \$/ac	\$0.00	\$0.00	\$0.00
<b>Total Cost</b>	<b>\$21.54</b>	<b>\$56.31</b>	<b>\$45.11</b>



#### Assumptions:

- Planted with no-till drill (only included 67% of custom rate)
- One less chemical application with cover crops compared to chem fallow
- Rolling cover crop is not required

Are these assumptions realistic?



## Benefits with lower cost assumptions...

	Return over Optimal N and Cover Crop Establishment Costs			Return over Optimal N and Cover Crop Establishment Costs		
	No cover (base)	Cover crop Soybean Sunn hemp		No cover (base)	Cover crop Soybean Sunn hemp	
<b>Sorghum</b>						
Optimal N, lbs/a	105.3	64.8	71.9	N rate, lbs/a	90.0	60.0 60.0
Yield, bu/a	111.0	106.1	111.8	Yield, bu/a	108.0	107.0 110.5
Return over N, \$/a	\$346.33	\$345.41	\$362.66	Return over N, \$/a	\$342.09	\$350.33 \$362.66
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$0.92</b>	<b>\$16.33</b>	<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$8.24 \$20.57</b>
Cover crop establishment, \$/a	\$21.54	\$56.31	\$45.11	Cover crop establishment, \$/a	\$21.54	\$56.31 \$45.11
Return over N and cover costs, \$/a	\$324.79	\$289.09	\$317.55	Return over N and cover costs, \$/a	\$320.55	\$294.01 \$317.55
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$35.70</b>	<b>-\$7.24</b>	<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$26.54 -\$3.00</b>
<b>Wheat</b>						
N, lbs/a	120.0	105.2	90.8	N, lbs/a	90.0	90.0 90.0
Yield, bu/a	37.6	35.2	34.0	Yield, bu/a	32.5	33.4 33.9
Return, \$/a	\$132.48	\$127.02	\$127.01	Return, \$/a	\$119.76	\$124.08 \$126.60
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$5.46</b>	<b>-\$5.47</b>	<b>Difference from base, \$/a</b>	<b>base</b>	<b>\$4.32 \$6.84</b>
Rotation average, \$/a	\$228.64	\$208.06	\$222.28	Rotation average, \$/a	\$220.16	\$209.05 \$222.08
<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$20.58</b>	<b>-\$6.35</b>	<b>Difference from base, \$/a</b>	<b>base</b>	<b>-\$11.11 \$1.92</b>

Prices: N = \$0.40/lb; sorghum = \$3.50/bu; wheat = \$4.80/bu

Even with considerably lower cost assumptions, the economics of cover crops are not particularly favorable...

Is there a longer-term yield benefit associated with cover crops?  
If so, how long until it starts showing up?



## Summary of cover crops ...

- When considering the economics of adding cover crops to existing cropping rotations, consider:
  - Benefits: soil productivity, yield gains, nitrogen fixation (credit), and cost savings
  - Costs: establishment costs, management intensity, foregone opportunities (e.g., forage, double crop), equipment needs.
- Benefits and costs for a given crop enterprise depend on economic factors, such as N price, commodity prices, seed costs, crop rotations, etc.
  - With higher N prices, cover crops become more economically viable.
  - Management will play a key factor in the success of a cover crop, as well.



## Before we move on...

# Questions / discussion



## Double crop forages after wheat study...

Hesston Experiment Field, 2002-2005

Crops considered:

Cowpea, Soybean, Forage soybean, Sunn hemp, Sunflower, Pearl millet, Grain sorghum, Sudangrass, Sorghum x sudangrass





**Table 6. Economics of Double-crop Summer Forages after Wheat -- KSU Hesston Experiment Field**  
 Scenario #4: N credit on some crops and impact on yield (+/-) for following crop -- increase all costs by 25% (except fertilizer removal)

	Double-crop Forage									
	Control	Cowpea	Soybean	Forage soybean	Sunn Hemp	Sunflower	Pearl millet	Grain sorghum	Sudangrass	Sorghum x sudangrass
<b>INCOME</b>										
Yield, DM tons	0.00	1.16	1.65	1.60	2.37	2.34	1.76	3.48	3.15	4.54
Harvested yield, tons/ac	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83	4.08
Nitrogen credit, lbs	0	17	25	24	36	0	0	0	0	0
Forage price, \$/ton	\$60.00	\$60.00	\$60.00	\$60.00	\$60.00	\$60.00	\$60.00	\$60.00	\$60.00	\$60.00
Income, \$/ac	\$0.00	\$69.44	\$98.82	\$95.59	\$141.84	\$126.02	\$94.92	\$187.51	\$169.71	\$244.67
<b>COSTS</b>										
Seed, \$/ac	\$0.00	\$22.50	\$56.76	\$33.15	\$25.00	\$30.53	\$10.00	\$13.41	\$24.75	\$33.15
Seeding rate, lbs/ac	0.0	30.0	\$9.8	\$1.0	10.0	22.0	10.0	5.0	15.0	15.0
Seed cost, \$/b	\$0.00	\$0.75	\$0.95	\$0.65	\$2.50	\$1.39	\$1.00	\$2.68	\$1.65	\$2.21
Planting, \$/ac	\$17.16	0	1	1	1	1	1	1	1	1
Herbicides	\$15.01	\$6.90	\$6.90	\$6.90	\$6.90	\$6.90	\$6.90	\$6.90	\$6.90	\$6.90
Herbicide application	\$6.26	2	1	1	1	1	1	1	1	1
Tillage	\$11.28	0	0	0	0	0	0	0	0	0
Disk, \$/ac	\$13.99	0	0	0	0	0	0	0	0	0
Field cultivation, \$/ac	\$11.19	0	0	0	0	0	0	0	0	0
Nitrogen removed	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$19.14	\$15.50	\$26.70	\$30.61	\$37.16
Phosphorus removed	\$0.40	\$0.00	\$5.95	\$6.53	\$6.32	\$10.30	\$6.85	\$4.90	\$10.71	\$12.92
Harvesting	\$14.79	0	1	1	1	1	1	1	1	1
Swathing, \$/ac	\$5.26	0	1	1	1	1	1	1	1	1
Sideraking, \$/ac	\$17.99	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
Baling, \$/ton	\$7.08	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
Hauling, \$/ton										
Total Cost	\$37.48	\$126.90	\$175.55	\$150.21	\$167.78	\$188.16	\$145.80	\$214.56	\$222.74	\$283.88
<b>FOLLOWING CROP</b>										
Change in expected yield, bu/ac	0.0	4.0	4.0	4.0	7.0	-5.0	0.0	-5.0	-5.0	-5.0
Price, \$/bu	\$2.40	\$2.40	\$2.40	\$2.40	\$2.40	\$2.40	\$2.40	\$2.40	\$2.40	\$2.40
Increased income, \$/ac	\$0.00	\$9.60	\$9.60	\$9.60	\$16.80	-\$12.00	\$0.00	-\$12.00	-\$12.00	-\$12.00
Marginal cost, \$/bu	\$0.40	\$0.00	\$1.78	\$1.78	\$3.11	-\$2.22	\$0.00	-\$2.22	-\$2.22	-\$2.22
Nitrogen	\$0.40	\$0.00	\$0.70	\$0.70	\$1.22	-\$0.87	\$0.00	-\$0.87	-\$0.87	-\$0.87
Phosphorus	\$0.40	\$0.00	\$1.40	\$1.40	\$2.45	-\$1.75	\$0.00	-\$1.75	-\$1.75	-\$1.75
Harvesting	\$0.35	\$0.00	\$3.88	\$3.88	\$6.78	-\$4.84	\$0.00	-\$4.84	-\$4.84	-\$4.84
Increased cost, \$/ac										
Net Returns to Forage Crop	-\$37.48	-\$51.74	-\$71.01	-\$48.89	-\$15.92	-\$69.29	-\$50.87	-\$34.21	-\$60.18	-\$46.36
Improvement from Control	xxx	-\$14.25	-\$33.52	-\$11.41	\$21.56	-\$31.81	-\$13.39	\$3.27	-\$22.70	-\$8.88
Break-even forage price, \$/ton	xxx	\$80.36	\$89.29	\$74.63	\$56.54	\$75.14	\$68.46	\$58.95	\$68.03	\$62.18
Break-even forage yield, tons/ac	xxx	1.45	2.44	1.76	1.51	3.01	1.97	3.03	3.48	4.33



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## Summary of double crop for forage...

- Returns to double crop forages after wheat are highly variable depending on crop and year and individual producer situation (and seed costs).
- Assumptions about N credit and impact on yield of following crop effects relative profitability of alternative forage crops (i.e., sunn hemp vs. sorgxsudan).
- Realizing higher returns from forage crop could be higher for livestock producers if difficulties exist with marketing a forage crop.
- Harvesting forage removes most bio-mass, but still can be beneficial compared to chem fallow



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## Summary...

- Rotation has a bigger impact on returns than tillage
- Returns with tillage slightly better than no-till given study assumptions (machinery costs will vary considerably between operations, but yield impact is critical)
- Returns similar for rotations including combinations of W, GS, SB, and C – rotations including sunflowers and continuous sorghum had lowest returns
- Cover crops (forage soybean and sunn hemp) reduce N requirements and provide yield benefit, but benefits are not large enough to offset establishment costs
- Returns to double crop forages depend on many factors and are highly variable



## Questions ???

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