

# Economics of Cover Crops for Residue and Forage Production

**Kevin C. Dhuyvetter**

**kcd@ksu.edu -- 785-532-3527**

**and**

**Jason Bergtold**

**JasonBergtold@agecon.ksu.edu -- 785-532-0984**

**Department of Agricultural Economics  
Kansas State University**

Department of Agronomy Evening Field Tour  
Cover Crops in No-Till Cropping Systems  
Ashland Bottoms Research Farm  
Manhattan, KS. September 9, 2009.



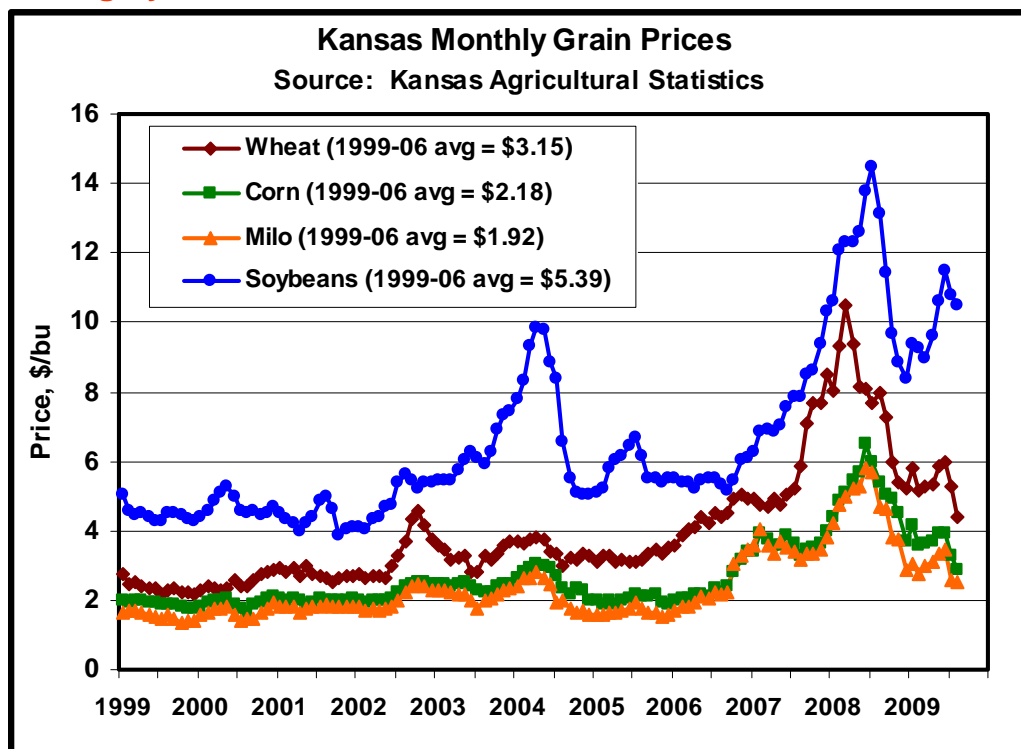
## Planting a crop after wheat...

- **Harvest an additional cash grain crop**
- **Harvest an additional forage crop (graze or bale)**
  - **Research study from Hesston (2002-2005)**
- **Plant a cover crop to increase residue, improve soil quality, fix N, suppress weeds, etc.**
  - **Research study from Hesston (2005-2008)**
  - **Research study from Ashland Bottoms (2008)**

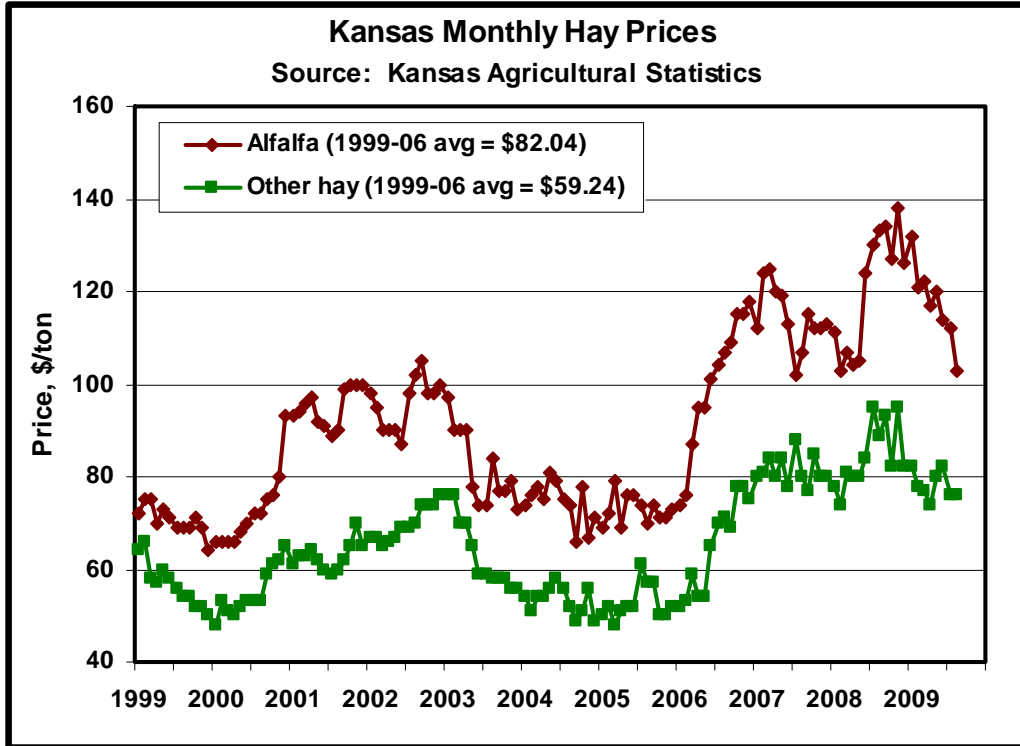
## Key factors driving the economics of planting a crop after wheat...

- 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)

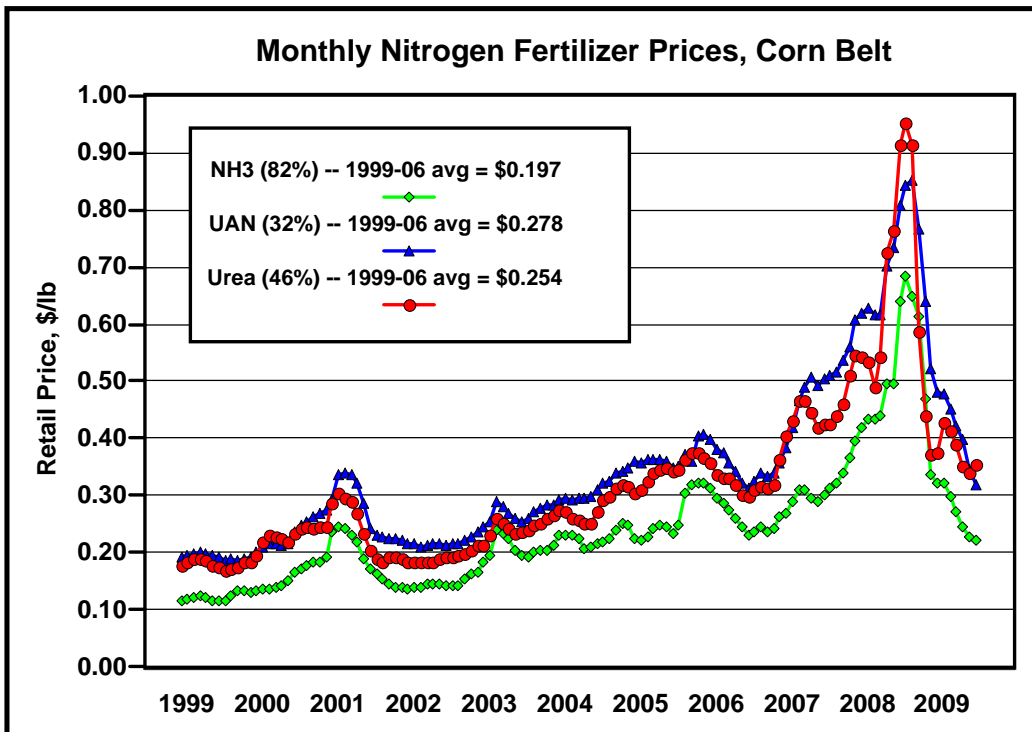
Crop prices have fallen significantly, but they are still relatively strong by historical standards...



## Strength in crop markets impacts hay prices...



## Nitrogen fertilizer prices are down significantly...



## **Double crop summer forages after wheat**

**Hesston Experiment Field, 2002-2005**

**Mark Claassen**

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

### **Economic analysis of double crop forage after wheat...**

- **Partial budget comparing control (no double crop) to alternative forage crops**
  - Income of forage crop + N credit (if any)
  - Costs of chem fallow vs. establishing cover crop
  - Harvest costs
  - Impact on yield of following crop (+/-)
  - Impact of costs on following crop (+/-)
- **Net returns to forage crop (improvement from control)**
- **All forages assumed to be of equal value**
- **Breakeven forage price and yield**
- **Ignored land tenure (i.e., assumed owned land or cash rent)**

**Table 3. Economics of Double-crop Summer Forages after Wheat -- KSU Hesston Experiment Field**

**Scenario #1: No nitrogen credit for legumes & no impact on yield of following crop**

	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	0	0	0	0	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	\$62.49	\$88.93	\$86.02	\$127.64	\$126.02	\$94.92	\$187.51	\$169.71	\$244.67
<b>COSTS</b>										
Seed, \$/ac	\$0.00	\$18.00	\$45.41	\$26.52	\$20.00	\$24.42	\$8.00	\$10.73	\$19.80	\$26.52
Seeding rate, lbs/ac	0.0	30.0	59.8	51.0	10.0	22.0	10.0	5.0	15.0	15.0
Seed cost, \$/lb	\$0.00	\$0.60	\$0.76	\$0.52	\$2.00	\$1.11	\$0.80	\$2.15	\$1.32	\$1.77
Planting, \$/ac	\$13.73	0	1	1	1	1	1	1	1	1
Herbicides	\$12.01	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52
Herbicide application	\$5.01	2	1	1	1	1	1	1	1	1
<b>Tillage</b>										
Disk, \$/ac	\$9.02	0	0	0	0	0	0	0	0	0
Chisel, \$/ac	\$11.19	0	0	0	0	0	0	0	0	0
Field cultivation, \$/ac	\$8.95	0	0	0	0	0	0	0	0	0
Nitrogen removed	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$19.14	\$15.50	\$26.70	\$30.61
Phosphorus removed	\$0.40	\$0.00	\$5.95	\$6.53	\$6.32	\$10.30	\$6.85	\$4.90	\$10.71	\$12.92
<b>Harvesting</b>										
Swathing, \$/ac	\$11.83	0	1	1	1	1	1	1	1	1
Sideraking, \$/ac	\$4.21	0	1	1	1	1	1	1	1	1
Baling, \$/ton	\$14.39	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
Hauling, \$/ton	\$5.67	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
Total Cost	\$25.99	\$86.96	\$123.79	\$103.71	\$115.08	\$134.66	\$102.25	\$152.93	\$162.18	\$207.55
<b>FOLLOWING CROP</b>										
Change in expected yield, bu/ac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>Marginal cost, \$/bu</b>										
Nitrogen	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Phosphorus	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Harvesting	\$0.35	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Increased cost, \$/ac	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Net Returns to Forage Crop	-\$25.99	-\$24.47	-\$34.86	-\$17.69	\$12.56	-\$8.64	-\$7.33	\$34.57	\$7.53	\$37.12
Improvement from Control	xxx	\$1.52	-\$8.86	\$8.30	\$38.55	\$17.35	\$18.66	\$60.57	\$33.52	\$63.11
Breakeven forage price, \$/ton	xxx	\$58.54	\$65.98	\$54.21	\$41.88	\$51.74	\$48.20	\$40.62	\$48.15	\$44.52
Breakeven forage yield, tons/ac	xxx	1.00	1.70	1.23	1.16	1.67	1.11	1.61	1.99	2.50



**Table 4. Economics of Double-crop Summer Forages after Wheat -- KSU Hesston Experiment Field**

**Scenario #2: Nitrogen credit on some crops and impact on yield (positive or negative) for following crop**

	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	\$18.00	\$45.41	\$26.52	\$20.00	\$24.42	\$8.00	\$10.73	\$19.80	\$26.52
Seeding rate, lbs/ac	0.0	30.0	59.8	51.0	10.0	22.0	10.0	5.0	15.0	15.0
Seed cost, \$/lb	\$0.00	\$0.60	\$0.76	\$0.52	\$2.00	\$1.11	\$0.80	\$2.15	\$1.32	\$1.77
Planting, \$/ac	\$13.73	0	1	1	1	1	1	1	1	1
Herbicides	\$12.01	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52
Herbicide application	\$5.01	2	1	1	1	1	1	1	1	1
<b>Tillage</b>										
Disk, \$/ac	\$9.02	0	0	0	0	0	0	0	0	0
Chisel, \$/ac	\$11.19	0	0	0	0	0	0	0	0	0
Field cultivation, \$/ac	\$8.95	0	0	0	0	0	0	0	0	0
Nitrogen removed	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$19.14	\$15.50	\$26.70	\$30.61
Phosphorus removed	\$0.40	\$0.00	\$5.95	\$6.53	\$6.32	\$10.30	\$6.85	\$4.90	\$10.71	\$12.92
<b>Harvesting</b>										
Swathing, \$/ac	\$11.83	0	1	1	1	1	1	1	1	1
Sideraking, \$/ac	\$4.21	0	1	1	1	1	1	1	1	1
Baling, \$/ton	\$14.39	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
Hauling, \$/ton	\$5.67	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
Total Cost	\$25.99	\$86.96	\$123.79	\$103.71	\$115.08	\$134.66	\$102.25	\$152.93	\$162.18	\$207.55
<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
<b>Marginal cost, \$/bu</b>										
Nitrogen	\$0.40	\$0.00	\$1.78	\$1.78	\$1.78	\$3.11	-\$2.22	-\$2.22	-\$2.22	-\$2.22
Phosphorus	\$0.40	\$0.00	\$0.70	\$0.70	\$0.70	\$1.22	-\$0.87	-\$0.87	-\$0.87	-\$0.87
Harvesting	\$0.35	\$0.00	\$1.40	\$1.40	\$1.40	\$2.45	-\$1.75	-\$1.75	-\$1.75	-\$1.75
Increased cost, \$/ac	\$0.00	\$3.88	\$3.88	\$3.88	\$6.78	-\$4.84	\$0.00	-\$4.84	-\$4.84	-\$4.84
Net Returns to Forage Crop	-\$25.99	-\$11.79	-\$19.24	-\$2.39	\$36.77	-\$15.80	-\$7.33	\$27.42	\$0.37	\$29.97
Improvement from Control	xxx	\$14.20	\$6.75	\$23.60	\$62.77	\$10.20	\$18.66	\$53.41	\$26.36	\$55.96
Breakeven forage price, \$/ton	xxx	\$53.04	\$62.12	\$50.22	\$37.17	\$55.14	\$48.20	\$42.91	\$50.68	\$46.28
Breakeven forage yield, tons/ac	xxx	0.69	1.31	0.84	0.56	1.85	1.11	1.79	2.17	2.68

↑ (Sunn hemp = \$47.86 and Sorg x sud = -\$4.98 when N = \$0.80/lb)

**Table 5. Economics of Double-crop Summer Forages after Wheat -- KSU Hesston Experiment Field**  
**Scenario #3: No nitrogen credit for legumes & no impact on yield of following crop -- reduce forage yield by 25% (i.e., crop failure)**

	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	0.87	1.24	1.20	1.78	1.75	1.32	2.61	2.36	3.40
Harvested yield, tons/ac	0.00	0.78	1.11	1.08	1.60	1.58	1.19	2.34	2.12	3.06
Nitrogen credit, lbs	0	0	0	0	0	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	\$46.87	\$66.70	\$64.52	\$95.73	\$94.52	\$71.19	\$140.63	\$127.28	\$183.51
<b>COSTS</b>										
Seed, \$/ac	\$0.00	\$18.00	\$45.41	\$26.52	\$20.00	\$24.42	\$8.00	\$10.73	\$19.80	\$26.52
Seeding rate, lbs/ac	0.0	30.0	59.8	51.0	10.0	22.0	10.0	5.0	15.0	15.0
Seed cost, \$/lb	\$0.00	\$0.60	\$0.76	\$0.52	\$2.00	\$1.11	\$0.80	\$2.15	\$1.32	\$1.77
Planting, \$/ac	\$13.73	0	1	1	1	1	1	1	1	1
Herbicides	\$12.01	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52	\$5.52
Herbicide application	\$5.01	2	1	1	1	1	1	1	1	1
<b>Tillage</b>										
Disk, \$/ac	\$9.02	0	0	0	0	0	0	0	0	0
Chisel, \$/ac	\$11.19	0	0	0	0	0	0	0	0	0
Field cultivation, \$/ac	\$8.95	0	0	0	0	0	0	0	0	0
Nitrogen removed	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$14.36	\$11.62	\$20.03	\$22.96	\$27.87
Phosphorus removed	\$0.40	\$0.00	\$4.46	\$4.90	\$4.74	\$7.72	\$5.14	\$3.68	\$8.03	\$9.69
<b>Harvesting</b>										
Swathing, \$/ac	\$11.83	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Sideraking, \$/ac	\$4.21	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Baling, \$/ton	\$14.39	0.00	0.78	1.11	1.08	1.60	1.58	1.19	2.34	2.12
Hauling, \$/ton	\$5.67	0.00	0.78	1.11	1.08	1.60	1.58	1.19	2.34	2.12
Total Cost	\$25.99	\$76.24	\$110.71	\$90.93	\$97.83	\$113.62	\$85.21	\$123.90	\$133.11	\$168.82
<b>FOLLOWING CROP</b>										
Change in expected yield, bu/ac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Marginal cost, \$/bu										
Nitrogen	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Phosphorus	\$0.40	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Harvesting	\$0.35	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Increased cost, \$/ac	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Net Returns to Forage Crop	-\$25.99	-\$29.37	-\$44.02	-\$26.42	-\$2.10	-\$19.11	-\$14.02	\$16.73	-\$5.83	\$14.69
Improvement from Control	xxx	-\$3.38	-\$18.02	-\$0.42	\$23.89	\$6.89	\$11.97	\$42.72	\$20.17	\$40.68
Breakeven forage price, \$/ton	xxx	\$64.33	\$76.21	\$60.39	\$45.03	\$55.63	\$49.91	\$41.77	\$50.49	\$46.70
Breakeven forage yield, tons/ac	xxx	0.87	1.56	1.09	1.00	1.40	0.89	1.27	1.62	2.04



**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	59.8	51.0	10.0	22.0	10.0	5.0	15.0	15.0
Seed cost, \$/lb	\$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
<b>Tillage</b>										
Disk, \$/ac	\$11.28	0	0	0	0	0	0	0	0	0
Chisel, \$/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
<b>Harvesting</b>										
Swathing, \$/ac	\$14.79	0	1	1	1	1	1	1	1	1
Sideraking, \$/ac	\$5.26	0	1	1	1	1	1	1	1	1
Baling, \$/ton	\$17.99	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
Hauling, \$/ton	\$7.08	0.00	1.04	1.48	1.43	2.13	2.10	1.58	3.13	2.83
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										
Nitrogen	\$0.40	\$0.00	\$1.78	\$1.78	\$1.78	\$3.11	-\$2.22	\$0.00	-\$2.22	-\$2.22
Phosphorus	\$0.40	\$0.00	\$0.70	\$0.70	\$0.70	\$1.22	-\$0.87	\$0.00	-\$0.87	-\$0.87
Harvesting	\$0.35	\$0.00	\$1.40	\$1.40	\$1.40	\$2.45	-\$1.75	\$0.00	-\$1.75	-\$1.75
Increased cost, \$/ac	\$0.00	\$3.88	\$3.88	\$3.88	\$6.78	-\$4.84	\$0.00	-\$4.84	-\$4.84	-\$4.84
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
Breakeven forage price, \$/ton	xxx	\$80.36	\$89.29	\$74.63	\$56.54	\$75.14	\$68.46	\$58.95	\$68.03	\$62.18
Breakeven forage yield, tons/ac	xxx	1.45	2.44	1.76	1.51	3.01	1.97	3.03	3.48	4.33



## **Summary of double crop for forage ...**

- **Current prices provide an opportunity to increase returns by intensifying land use (i.e., double cropping after wheat).**
- **Returns to double cropping summer forages after wheat are highly variable depending on crop and year and individual producer situation (and seed costs).**
- **Assumptions about N credit and impact of yield of following crop effects relative profitability of alternative forage crops (i.e., sunn hemp vs. sorg x sudan).**
- **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**

## **Summer cover crops after wheat**

**Hesston Experiment Field, 2005-2008**

**Mark Claassen**

**Crops considered: Sunn hemp and forage soybean**

**Ashland Bottom Experiment Field, 2008**

**Kraig Roozeboom**

**Crops considered: Winterpeas, canola, forage soybean and sorghum sudan**

## Economic analysis of summer cover crops after wheat... (Hesston Experiment Field)

- Partial budget comparing control (no cover crop) to alternative cover crops
  - Cost of chemical fallow vs. establishing 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)

### Cover Crop Budgets

<b>Cover Crop Budgets</b>			
	<b>No Cover</b>	<b>Forage Soybean</b>	<b>Sunn Hemp</b>
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	\$13.73	\$13.73
Herbicide (\$/ac)	\$22.03	\$10.53	\$10.53
Chemical	\$12.01	\$5.52	\$5.52
# of Applications	2	1	1
Application Cost	\$5.01	\$5.01	\$5.01
Roller/Crimper (\$/ac)	\$0.00	\$0	\$5.00
<b>Total Variable Cost</b>	<b>\$22.03</b>	<b>\$55.46</b>	<b>\$49.26</b>

Assumptions:

- No-till grain drill
- Burndown for cover crops only
- Sunn hemp rolled for management of biomass

Seed costs are the largest proportion of the cost.



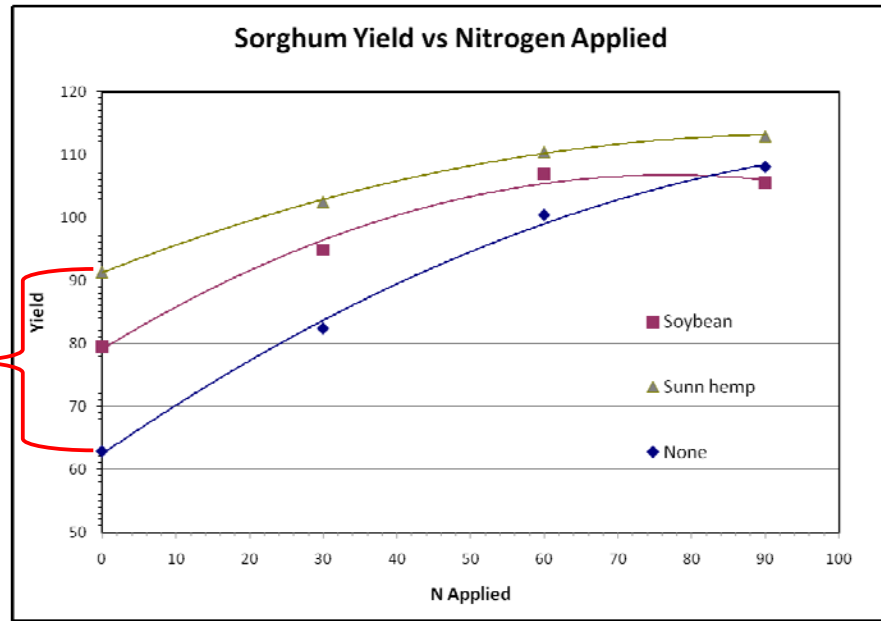
## Yield Benefits from Cover Crops

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?



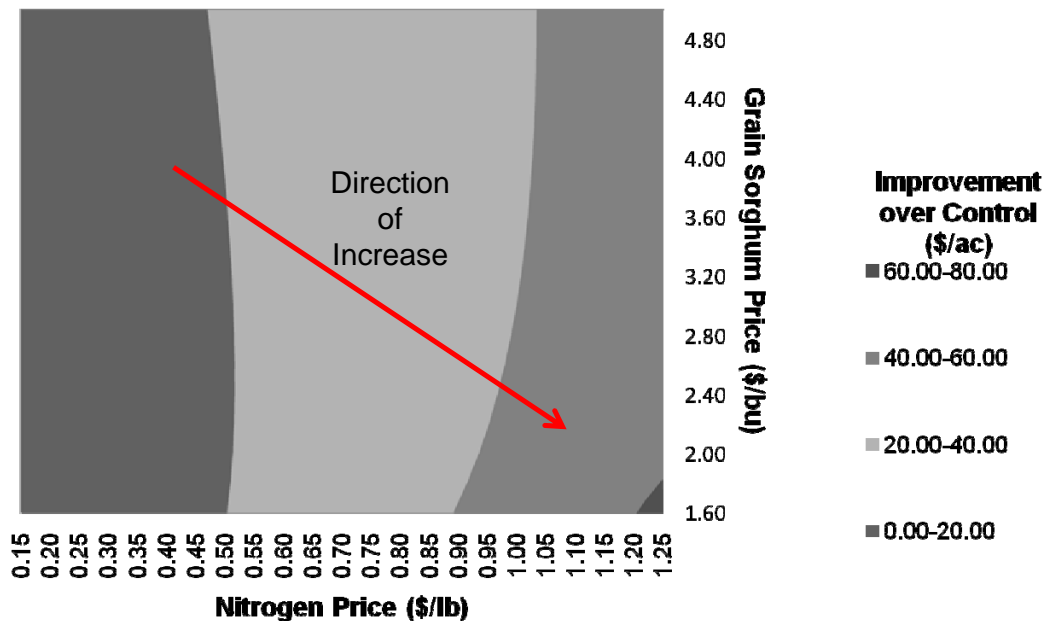
### Return over Optimal N and Cover Crop Establishment Costs

	Cover crop		
	No Cover	Soybean	Sunn hemp
<b>Sorghum</b>			
Optimal N, lbs/a	97.3	59.2	61.0
Yield, bu/a	109.9	105.3	110.3
Return over N, \$/a	\$224.75	\$229.05	\$240.34
<b>Improvement from Control, \$/a</b>	base	<b>\$4.30</b>	<b>\$15.59</b>
Cover Crop Establishment, \$/a	\$22.03	\$55.46	\$49.26
Return over N & Cover Costs, \$/a	\$202.72	\$173.59	\$191.08
<b>Improvement from Control, \$/a</b>	base	<b>(\$29.13)</b>	<b>(\$11.64)</b>

Prices: N = \$0.40/lb; sorghum = \$2.40/bu

- A positive economic return from a cover crop will occur only if the value of the N credit, yield gain and cost savings (e.g., less herbicide) from using the cover crop covers establishment and management costs.
- When the price of N reaches \$0.70, sunn hemp shows a positive return (> \$0). Forage soybean shows a positive return, when the price of N reaches \$1.42/lb.

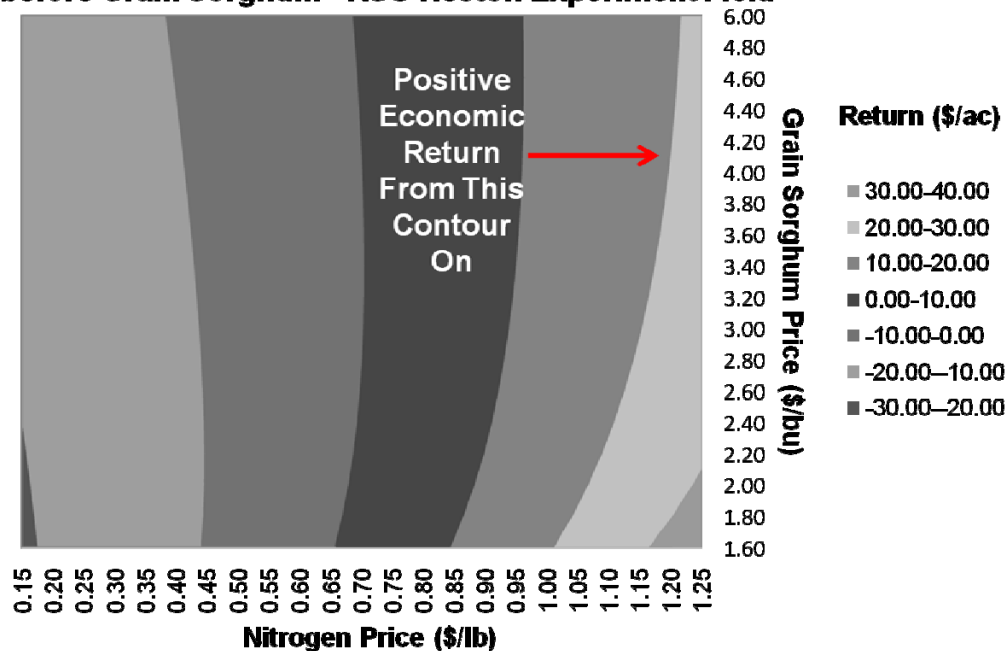
### Marginal Benefits (\$/ac) of a Sunn Hemp Summer Cover Crop before Grain Sorghum -KSU Heston Experiment Field



- As the price of N increases, the value of the N credit from using a legume increases.

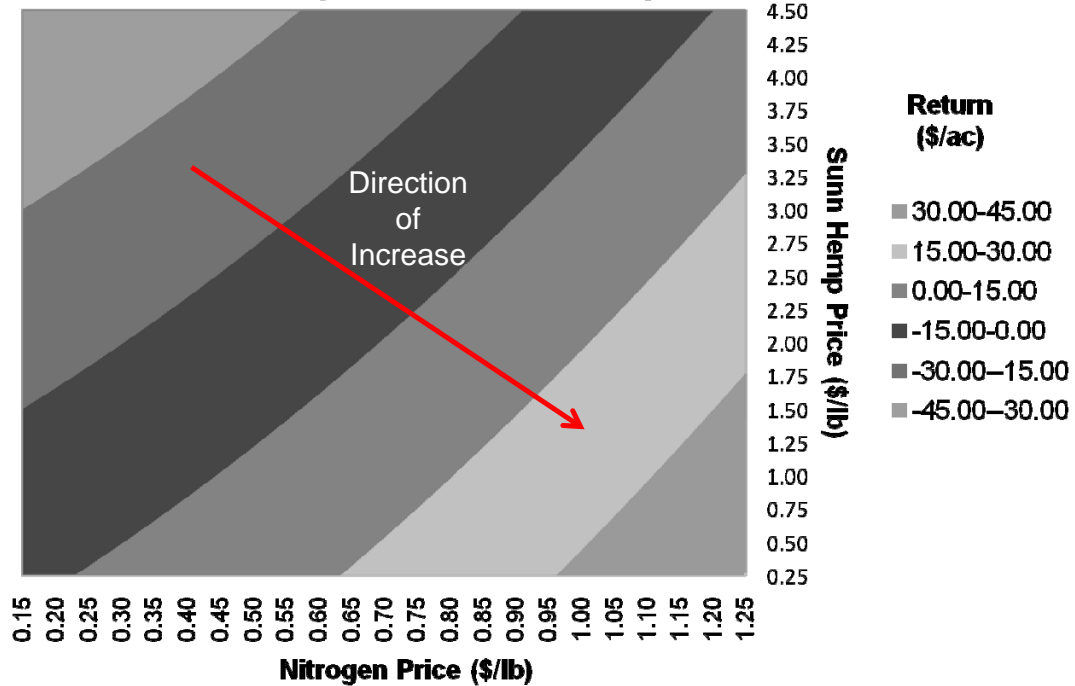
- As commodity prices decrease, the value of the yield boost from a cover crop increases (i.e., recall the larger gap in yield curves at lower levels of N).

### Economic Return (\$/ac) of a Sunn Hemp Summer Cover Crop before Grain Sorghum - KSU Heston Experiment Field



When the economic return is greater than \$0, it is economically viable to plant a cover crop. Again, as N prices increase and commodity prices decrease the economic return increases.

### Economic Return (\$/ac) of a Sunn Hemp Summer Cover Crop before Grain Sorghum - KSU Heston Experiment Field



Seed costs are the largest input cost. As seed costs decrease, positive economic returns will be realized at lower N and commodity prices.

## Ashland Bottom Experiment Field, 2008

#### Return to Sorghum over Optimal N

	No Cover	Winterpea	Canola	Forage Soybean	Sorg. Sudan
Scenario 1: N Price = \$0.40/lb					
Optimal N, lbs/a	81.6	0.0	73.4	0.0	0.0
Yield, bu/a	163.2	147.9	156.7	142.4	128.3
Return over N, \$/a	\$359.08	\$354.74	\$346.67	\$341.79	\$307.80
<b>Improvement from Control, \$/a</b>	base	<b>(\$4.34)</b>	<b>(\$12.41)</b>	<b>(\$17.29)</b>	<b>(\$51.28)</b>
Scenario 1: N Price = \$0.80/lb					
Optimal N, lbs/a	65.3	0.0	54.0	0.0	0.0
Yield, bu/a	159.1	147.8	151.8	142.4	128.3
Return over N, \$/a	\$329.71	\$354.74	\$321.19	\$341.79	\$307.80
<b>Improvement from Control, \$/a</b>	base	<b>\$25.03</b>	<b>(\$8.52)</b>	<b>\$12.08</b>	<b>(\$21.91)</b>
Scenario 1: N Price = \$1.20/lb					
Optimal N, lbs/a	49.0	0.0	34.6	0.0	0.0
Yield, bu/a	152.4	147.8	143.7	142.4	128.3
Return over N, \$/a	\$306.83	\$354.74	\$303.47	\$341.79	\$307.80
<b>Improvement from Control, \$/a</b>	base	<b>\$47.91</b>	<b>(\$3.36)</b>	<b>\$34.96</b>	<b>\$0.97</b>

Prices: Sorghum = \$2.40/bu. Optimal N capped at 160 lbs/ac.

- Again, the cover crop treatments become more economically viable as N prices increase.

- Preliminary results from a year of data.

- Not all the cover crops are legumes. For these other options, which include small grains, biomass production may be more critical to see agronomic/ economic benefits.

For tillage benefits, one may consider brassicas; e.g. turnips.

## 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.

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**Questions?**

**Kevin Dhuyvetter**  
785-532-3527  
kcd@ksu.edu