# A Risk Analysis of Converting CRP Acres to a Wheat-Sorghum-Fallow Rotation

Richard Llewelyn[1]
Jeffery Williams[1]
Dustin Pendell[2]
Alan Schlegel[1]
Troy Dumler[1]

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[1]Kansas State University
[2]Colorado State University



## Objectives

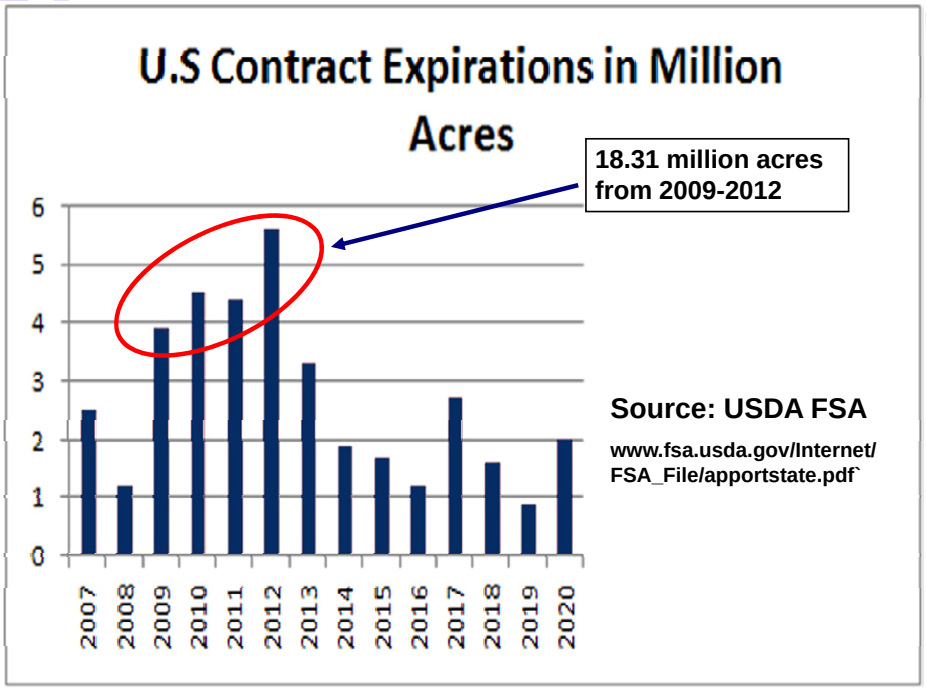
- Determine if CRP or a wheat-sorghum-fallow crop production strategy is preferred for a semi-arid region of the Great Plains.
- Determine if conventional, reduced or no-tillage is preferred for the W-S-F cropping system.



## Background and Rationale

- Between 2009-2012, 18.31 million acres of CRP contracts will expire nationally.
- In Kansas: 436,710 acres expire in 2009; 618,521 acres in 2010 and 532,000 acres in 2011.
- 70% of the expiring land is in the western one-third of the state.
- By 2012, 505,326 acres of CRP contracts will expire in Greeley County, KS and four surrounding counties in western Kansas and eastern Colorado.






Source: USDA FSA
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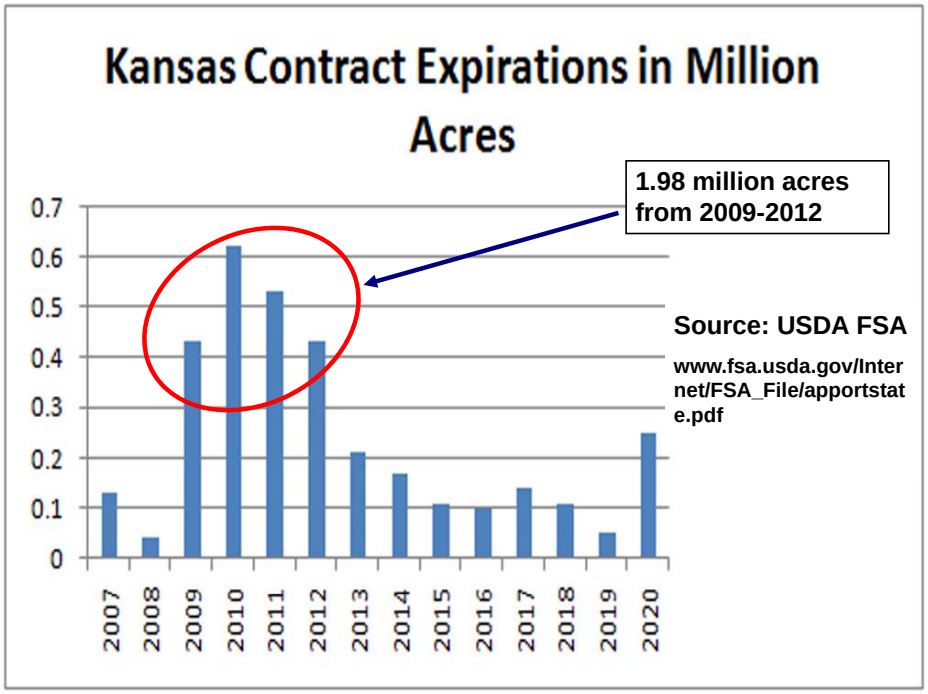



Source: USDA FSA

www.fsa.usda.gov/Internet/FSA_File/apportstate.pdf

## Background and Rationale (continued)

- Higher crop prices and net returns in 2008 increased interest in converting CRP to crop production.
- 2008 Farm Bill lowered CRP cap from 39.2 million acres to 32.0 million beginning in 2010, lower than 2009 33.7 million enrolled acres. 2010: 31.1 million acres.
- Kansas ranks 3rd in total CRP acreage: 3.098 million acres in 2009, dropping to 2.773 million acres in 2010.
- Half of Kansas' CRP acres will expire by 2012.



## Recent CRP News

- May, 2009: FSA announced 3-5 year extensions would be available for some of the expired CRP.
- Nationally, 40% of expiring contracts in 2009 were eligible for extension. In Kansas, only 28% were eligible.
- 118,416 acres eligible for the extension in Kansas in 2009.
- September, 2009: Of the 118,416 acres eligible for extension in Kansas, 79% or 94,395 acres, were extended.
- Nationally, 70% of eligible acres were extended.



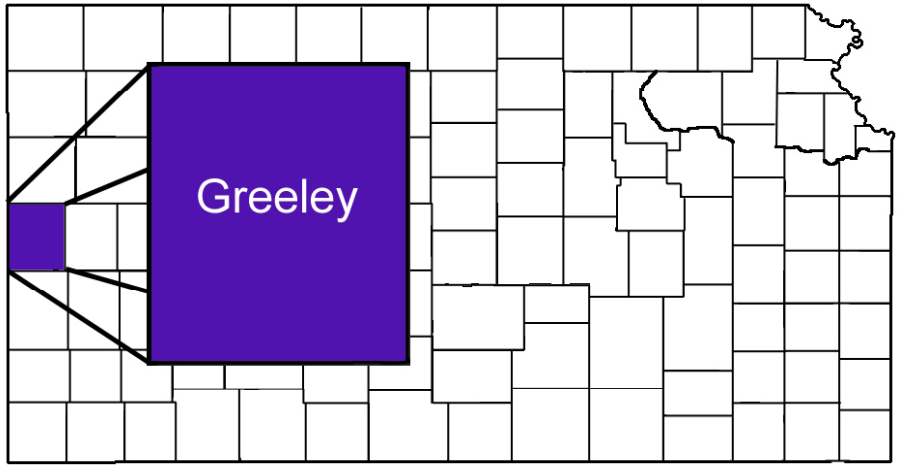
## Some Previous Research

- No research with CRP as one of the alternatives.
- Factors affecting conversion from CRP to crops:
  - Grain prices and rental payments (Kalaitzandonakes and Monson (1994)
  - Presence of livestock operation & participation in government commodity programs (Johnson, et al, 1997)
  - Expiring CRP contract acres, renewable energy (biofuels), rising (and volatile) grain prices, and advances in biotechnology (Stubbs, 2008).
- Disk tillage of CRP, followed by reduced till or no-till was best when converting CRP to crops (Unger, 1999).

## Some Previous Research

- **Reduced tillage or no-till cropping systems generally better than conventional tillage in this region** (Bordovsky, et al., 1998; Shapiro, et. al. (2001); Williams, 1988; Williams et al., 1987;
- **Wheat-grain sorghum-fallow rotation found to be better than wheat-fallow or continuous wheat or continuous grain sorghum for this area** (Norwood, et al., 1990; Williams et al., 1987; Williams et al., 1989).
- **Risk analysis: a rotation of reduced-tillage grain sorghum and no-till wheat was preferred by moderately risk-averse producers, while more strongly risk-averse producers preferred a rotation of reduced-tillage grain sorghum and reduced-tillage wheat.** (Williams, et al., 2000).








## This research:
## Cropping System (W-S-F) and Native Grass

**The wheat-sorghum-fallow rotation takes three years.**

**Wheat planted in September of year 1**
**Wheat harvest in June of year 2**
**Land is fallow 11 months**
**Sorghum planted in May of year 3**
**Sorghum harvest in October of year 3**
**Land is fallow 11 months**

**This crop rotation is compared to native grass CRP.**



## Methods

- **Enterprise budgeting is used.**
- **Simulated prices are multiplied by simulated yields to calculate gross returns.**
- **Net returns to land and management, are calculated by subtracting 2008 costs.**
- **Assumes that CRP acres returning to crop production will be eligible for commodity programs.**
- **Simulation & Econometrics to Analyze Risk (SIMETAR©) is used to simulate yield and price based on empirical data (500 observations of net returns are generated).**

## Methods (continued)

- Stochastic Efficiency with Respect to a Function (SERF) is used to calculate utility-weighted certainty equivalents (CEs) for various degrees of risk aversion.
- The CEs are used to rank the alternative production strategies and calculate risk premiums.
- The CE is the amount of money at which the decision-maker is indifferent between the certain dollar value and the expected value of the risky strategy at each level of risk aversion.
- For risk-averse decision-makers, the estimated CE is usually less than the expected value of the risky strategy



## Methods (continued)

- A utility weighted risk premium (RP) is calculated by subtracting the CE of a less preferred strategy from the preferred strategy at each level of risk aversion.
- The RP reflects the minimum amount ($/acre) that will have to be paid to a decision-maker to justify a switch from the preferred strategy to an alternative.
- A Cumulative Probability Function of each yield and price series with probability ranging from 0.0 to 1.0 is constructed by ordering each empirical data set and assigning a cumulative probability for each observation
  - 11 observations of yield for each crop strategy
  - 24 observations of price for each crop



## Data

- Yields, input types and rates, and field operations are from eleven years (1991-2001) of data from an experiment station in Tribune, Kansas.
- Yields are from land converted to cropping from native grass in 1988.
- Production costs are based upon actual field operations and input rates. Costs of two disking operations included for conversion of native grass CRP to cropland.
- Field operation costs are custom rates.



## Yield Characteristics:

| | Strategies | | |
|---|---|---|---|
| | CT | RT | NT |
| Mean Yield (bu./acre) | | | |
| Wheat | 36.0 | 42.2 | 45.0 |
| Sorghum | 41.5 | 67.0 | 75.2 |
| Std. Dev. Yield (bu./acre) | | | |
| Wheat | 19.3 | 20.3 | 20.4 |
| Sorghum | 30.7 | 30.4 | 34.8 |

Yields by tillage system not significantly different statistically.

## Characteristics of Simulated Prices ($/bu.)

| | 2006-2008 | | 2007-2008 | |
|---|---|---|---|---|
| | Wheat | Grain Sorghum | Wheat | Grain Sorghum |
| **Mean** | $5.90 | $3.50 | $6.71 | $4.08 |
| **Std. Dev.** | $1.72 | $1.06 | $1.60 | $0.80 |
| **Minimum** | $3.59 | $1.95 | $4.56 | $2.90 |
| **Maximum** | $10.40 | $5.82 | $10.37 | $5.82 |

**Prices are from the Kansas Agricultural Statistics Service west-central crop and livestock reporting district for January 2006 – December 2008.**



## Simulated Net Return Characteristics ($/acre)

| | Strategies | | |
|---|---|---|---|
| | CT | RT | NT |
| **Jan. 2006 through Dec. 2008 Prices** | | | |
| Mean | ($6.59) | $31.64 | $28.06 |
| Std. Dev. | $55.72 | $71.16 | $76.42 |
| Minimum | ($91.63) | ($78.91) | ($90.40) |
| Maximum | $232.44 | $298.68 | $317.74 |
| **Jan. 2007 through Dec. 2008 Prices** | | | |
| Mean | $10.53 | $54.87 | $53.04 |
| Std. Dev. | $58.88 | $70.34 | $74.75 |
| Minimum | ($88.08) | ($65.39) | ($87.14) |
| Maximum | $265.79 | $307.65 | $304.62 |



## Results: Average Net Returns

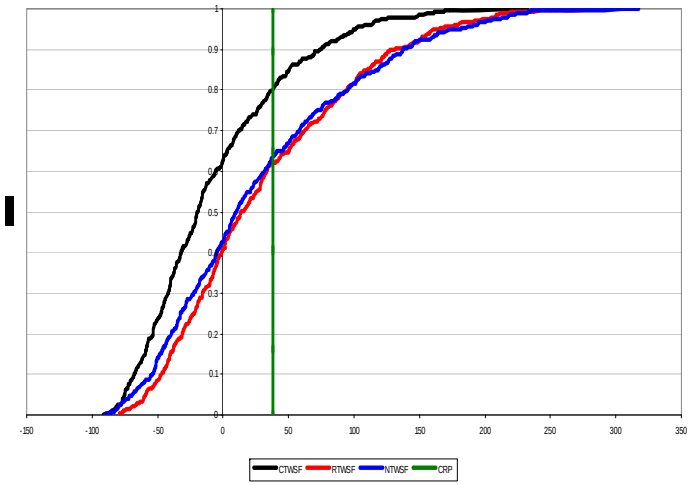
- **Average net return is highest for RT. NT strategy has 2nd highest net return for cropping.**
  - **NT has higher yields, but additional gross income does not offset the higher costs.**
  - **Higher chemical costs outweigh lower field operation costs.**
- **Using 2006-2008 prices:**
  - **CRP typical payment of $38/acre is higher than CT, RT or NT tillages.**
- **Using 2007-2008 (higher) prices:**
  - **RT and NT have higher average net returns than the typical CRP payment of $38/A.**



## Results: Risk Analysis

- **For 2006-2008 prices AND 2007-2008 prices with maximin criterion (the highest minimum value);**
  - **RT preferred to NT and CT**
  - **CRP preferred to all cropping systems**
- **For both sets of prices with Cumulative Probability Function analysis:**
  - **RT and NT are preferred to CT**
  - **Unable to determine preference between RT, NT, and CRP.**

## CDF of Simulated Net Returns for Each Strategy ($/acre). 2006-2008 prices



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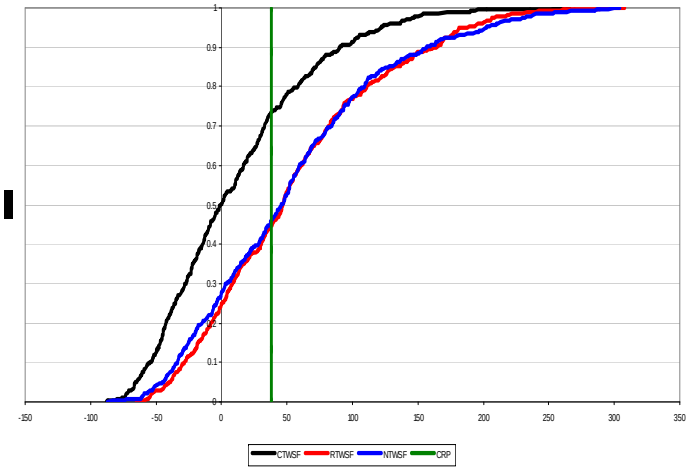





## Results: Probability of Loss or Greater than CRP (2006-2008 prices)

**Probability of a loss (negative net return):**

- RT = 41%
- NT = 43%
- CT = 63%
- CRP = 0%

**Probability of return above $38/acre (typical CRP payment)**

- RT - 38%
- NT - 36%
- CT - 20%



## Results: Probability of Loss or Greater than CRP (2007-2008 prices)

**Probability of a loss (negative net return):**

- RT = 25%
- NT = 28%
- CT = 50%
- CRP = 0%

**Probability of return above $38/acre (typical CRP payment)**

- RT - 55%
- NT - 54%
- CT - 27%

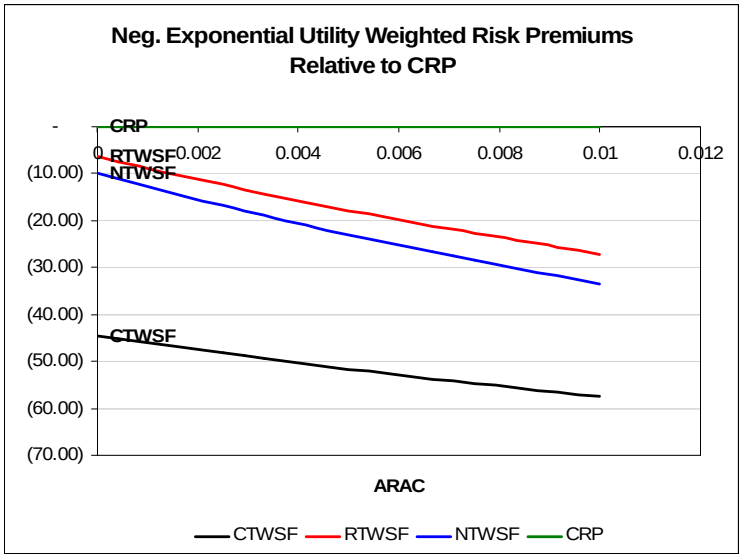
## Results: SERF Analysis

- For 2006-2008 prices:
  - CRP is preferred by risk-neutral and risk-averse decision-makers over all cropping systems.
  - RT is preferred to NT, which is preferred to CT.



2006-2008 prices.

Assumes CRP payment is $38/acre





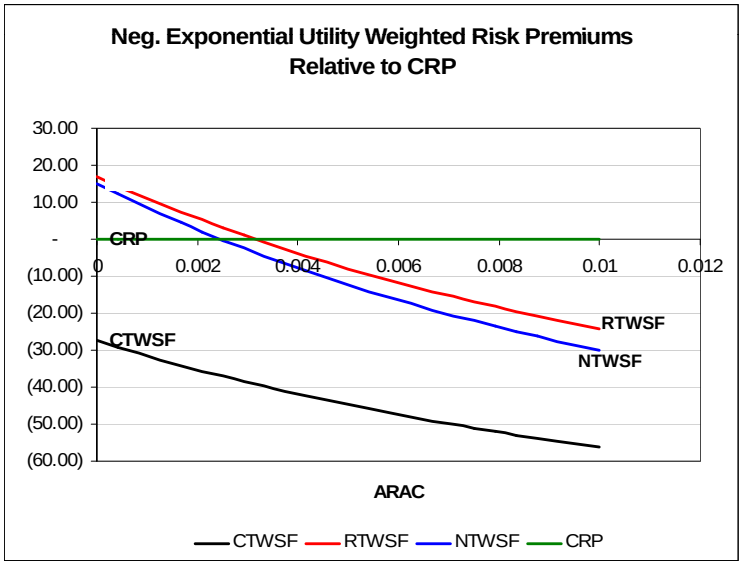

## Results: SERF Analysis 2007-2008 prices

- RT is preferred to NT and CT (RT line is always above CT and NT).
- RT and NT are preferred to CRP by risk-neutral and slightly risk-averse decision-makers, with RT being preferred to NT (0.0 < RAC < 0.0033).
- CRP is preferred by moderately and strongly risk-averse decision-makers (RAC > 0.0033).



2007-2008 prices.

Assumes CRP payment is $38/acre



## SERF Analysis–Risk Premiums: 2007-2008 prices

- The difference between the net returns of CRP and RT on the vertical axis is $16.87/A at an RAC of 0.0 (risk-neutral) indicating the risk-neutral manager will need to receive $16.87/A more for CRP to be equivalent.
- The manager needs to be paid $11.55/A to use RT and $16.32/acre to use NT at an RAC of 0.006 (slightly risk-averse) rather than CRP.



## Conclusions

- The RT system is preferred to the other tillage systems by risk-neutral and risk-averse decision-makers.
- With lower prices, CRP is preferred at all levels of risk-aversion.
- With relatively high prices, only risk-neutral or slightly risk-averse managers prefer RT system to CRP.
- Moderate or strongly risk-averse individuals prefer CRP to any of the tillage systems at any level of prices.
- Haying or grazing options were not considered.



## Conclusions

- High net returns as in 2008 may entice producers to consider converting CRP land to crop production. However, results suggest that care should be taken when making this decision, since lower prices result in CRP being more preferred.
- **Bottom line:**
  - For risk-averse producers, if eligible for extension, keep it in CRP if possible.
  - If coming out of CRP, put into reduced or no-till rotation of wheat and grain sorghum.



## Questions?

**Rich Llewelyn**
rvl@ksu.edu
785.532.1504

**Jeff Williams**
jwilliam@agecon.ksu.edu
785.532.4491

KANSAS STATE UNIVERSITY
DEPARTMENT OF AGRICULTURAL ECONOMICS
www.AgManager.info