11. A Risk Analysis of Converting CRP Acres to a Wheat-Sorghum-Fallow Rotation in Western Kansas

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Abstract/Summary

This study examines the economic potential of producing a wheat-grain sorghum-fallow rotation with three different tillage strategies (conventional, reduced, and no-tillage) compared to the Conservation Reserve Program (CRP) in western Kansas. Yields, input rates, and field operations from an experimental field at Tribune, KS are used to calculate net returns for each tillage strategy and the preferred management strategies are determined for various risk preferences. Although net returns to crop production using reduced tillage and no-tillage strategies with average crop prices for 2007-2008 are higher than CRP payments, risk analysis indicates CRP would be the preferred strategy for more risk-averse managers. When average crop prices for 2006-2008 are used, CRP payments are higher than returns from crop production. Based on this analysis, only those individuals who are risk-neutral or slightly risk-averse would prefer crop production to continue CRP enrollment in this region unless commodity prices reach the historically high levels of late 2007 and early 2008 and remain there.

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

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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. (Topeka Capital Journal, July 11, 2009).
- By 2012, 505,326 acres of CRP contracts will expire in Greeley County, KS and four surrounding counties in western Kansas and eastern Colorado.

Background and Rationale (continued)

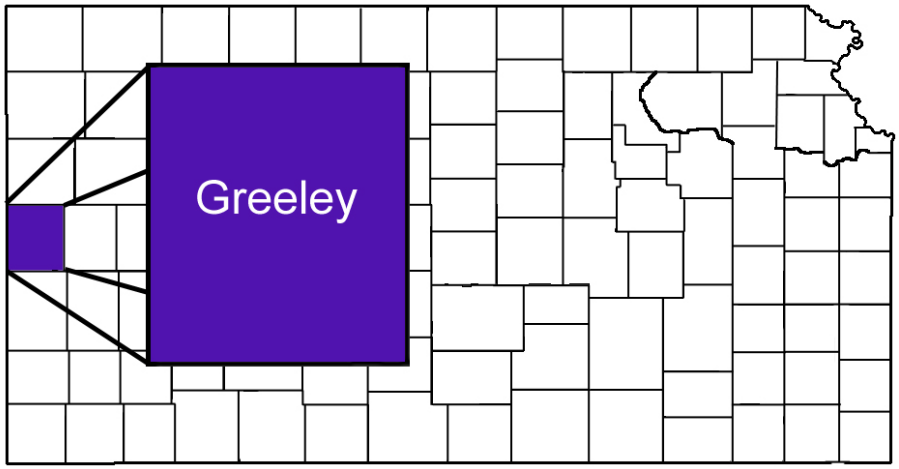
- Higher crop prices and net returns in 2008 increased interest in converting CRP to crop production.
- 2008 Farm Bill lowered CRP cap from 39.2 million acres to 32.0 million beginning in 2010, lower than current 33.8 million enrolled acres.
- Kansas ranks 3rd in total CRP acreage: 3.1 million acres
- Half of Kansas' CRP acres will expire by 2012.
- In May, FSA announced 3-5 year extensions would be available for some of the expired CRP: 118,416 acres eligible for the extension in Kansas.

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 is 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).



Cropping System 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 (1,000 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 at each risk aversion level.
- 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.
- 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.
- 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 CDF (Cumulative Distribution 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

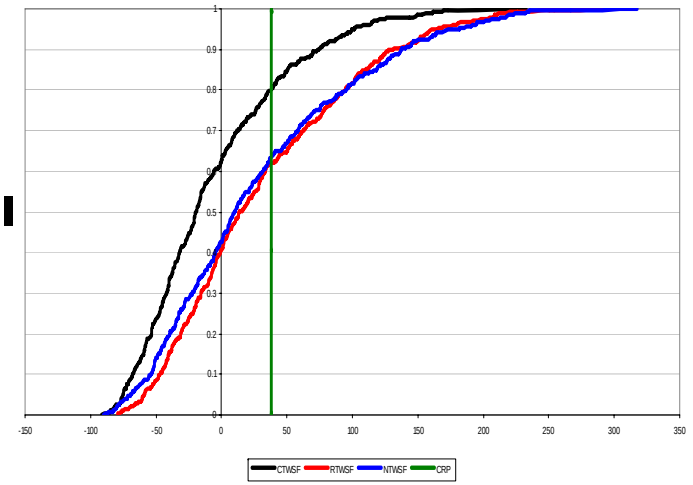
Results: Average Net Returns

- Average net return is highest for RT. NT strategy has 2nd highest net return.
  - 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.

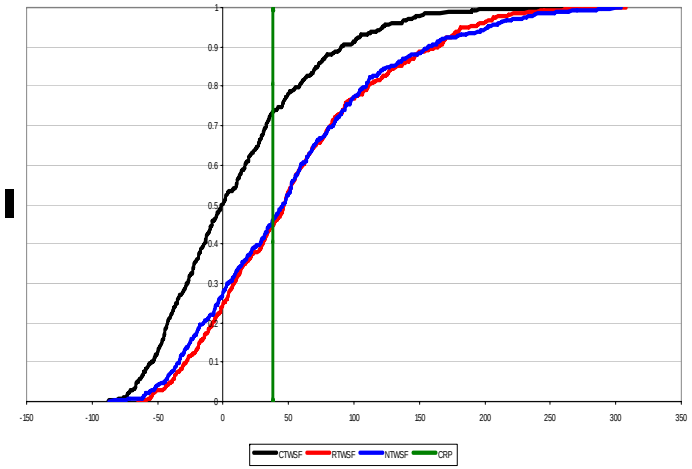
Results: Risk Analysis

- For 2006-2008 prices AND 2007-2008 prices with maximin criterion;
  - RT preferred to NT and CT
  - CRP preferred to all cropping systems
- For both sets of prices with CDF 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



CDF of Simulated Net Returns for Each Strategy ($/acre). 2007-2008 prices



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)

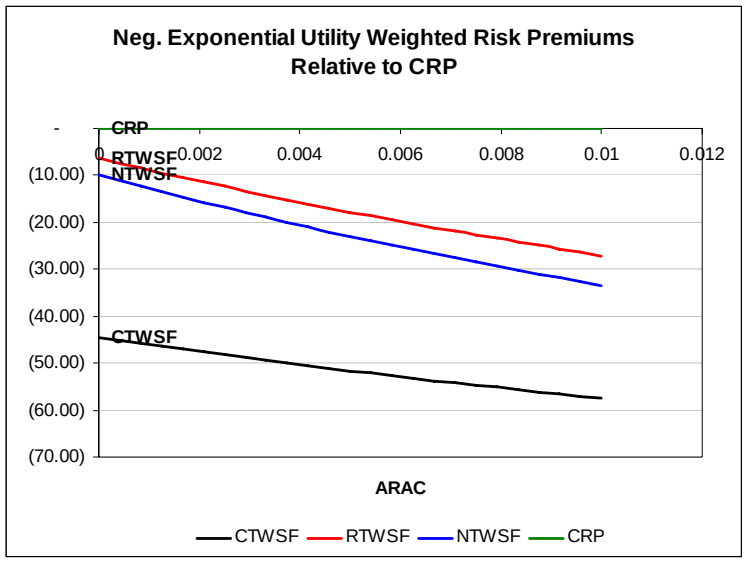
RT - 55%
NT - 54%
CT - 27%

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

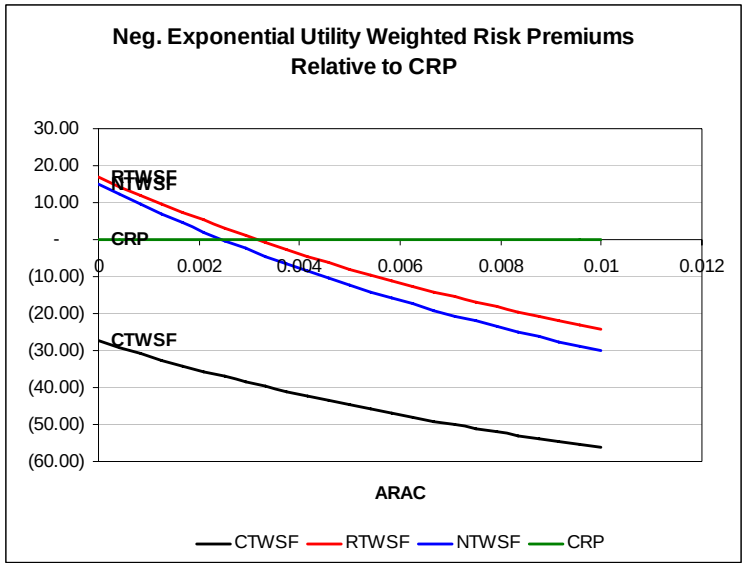


Results: SERF Analysis 2007-2008 prices

- 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

- For risk-neutral decision-makers (RAC = 0):
  - $16.87/A more for CRP to be equivalent to RT and $15.04/A more for CRP to be equivalent to NT.
- For risk-averse decision-makers (RAC=0.006):
  - $11.55/A more for RT to be equivalent to CRP and $16.32/A more for NT to be equivalent to CRP.

- The difference between the net returns of CRP and RT on the vertical axis is $16.87/A at an RAC of 0.0 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 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.

- 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.

Questions?

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