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Profit and risk analysis of alternative no-till and conventional tillage
crop rotation systems in east central South Dakota

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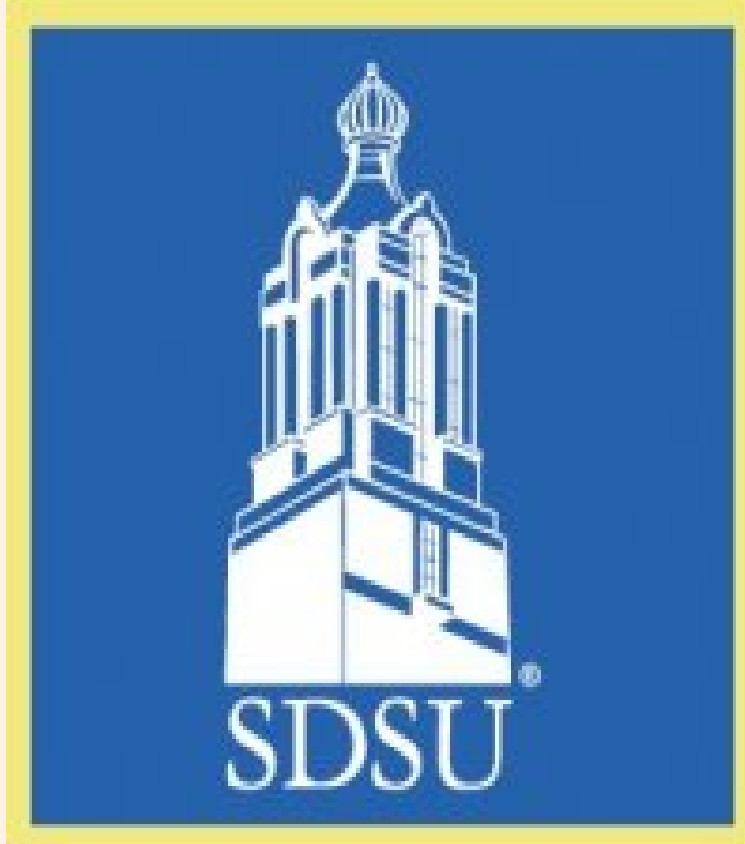
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Introduction

Crop rotations can serve as an important risk management strategy for producers. Lower returns from one crop can be offset by another crop. Producers face three major risks: yield risk, price risk, and input risk. Simetar© software was used to simulate data for the analysis of alternative crop rotations and tillage systems.

In this project, we seek:

- 1) Identify the profitability of various no-till rotations versus standard no-till corn-soybean rotation
- 2) Implications of no-till farm management practices compared to conventional tillage practices
- 3) Differences in risk associated with each rotation.

Materials and methods

This study used twelve years (2001-2012) of data from field trials collected by the Agricultural Research Service (USDA-ARS). The focus of the study was to empirically analyze the performance of 10 different no-till crop rotations and two conventional tillage rotations that all include corn and soybeans within each rotation. CTM represent a conventional tillage medium fertilizer rate. CT-85% is 85 percent of the counties average yield. The information was used to construct a 1200 acre representative farm to analyze the returns to labor and management.

Rotation Designation	Rotation Crop Description
Rotation 1 (R1)	Corn-Sunflowers-Spring wheat-Soybeans
Rotation 2 (R2)	Corn-Soybeans-Spring wheat-Soybeans
Rotation 3 (R3)	Corn-Peas-Winter wheat-Soybeans
Rotation 4 (R4)	Corn-Canola-Winter wheat-Soybeans
Rotation 5 (R5)	Corn-Soybeans-Spring wheat-Sunflowers
Rotation 6 (R6)	Corn-Corn-Soybeans-Spring wheat
Rotation 7 (R7)	Corn-Soybeans-Spring wheat-Peas
Rotation 8 (R8)	Corn-Oats-Winter wheat-Soybeans
Rotation 9 (R9)	Corn-Soybeans
Rotation 10 (R10)	Corn-Soybeans-Spring wheat
CT85%	Corn-Soybeans (conventional till)
CTM	Corn-Soybeans (conventional till)

Figure 1. Crop rotations

Results : Ranking Crop Rotations

Rotation	Mean	Standard Deviation	Coefficient of Variation	Mini-Max
R1	10	6	11	2
R2	6	7	6	9
R3	3	8	3	4
R4	8	3	7	6
R5	9	4	9	5
R6	11	9	12	7
R7	5	5	5	8
R8	4	2	2	3
R9	7	10	10	12
R10	12	1	8	1
CT85%	2	11	1	10
CTM	1	12	4	11

Figure 2. Actual budget analysis for net returns

When risk is not considered conventional tillage practices have the highest return to labor and management. However, both conventional systems have the largest standard deviations of net returns.

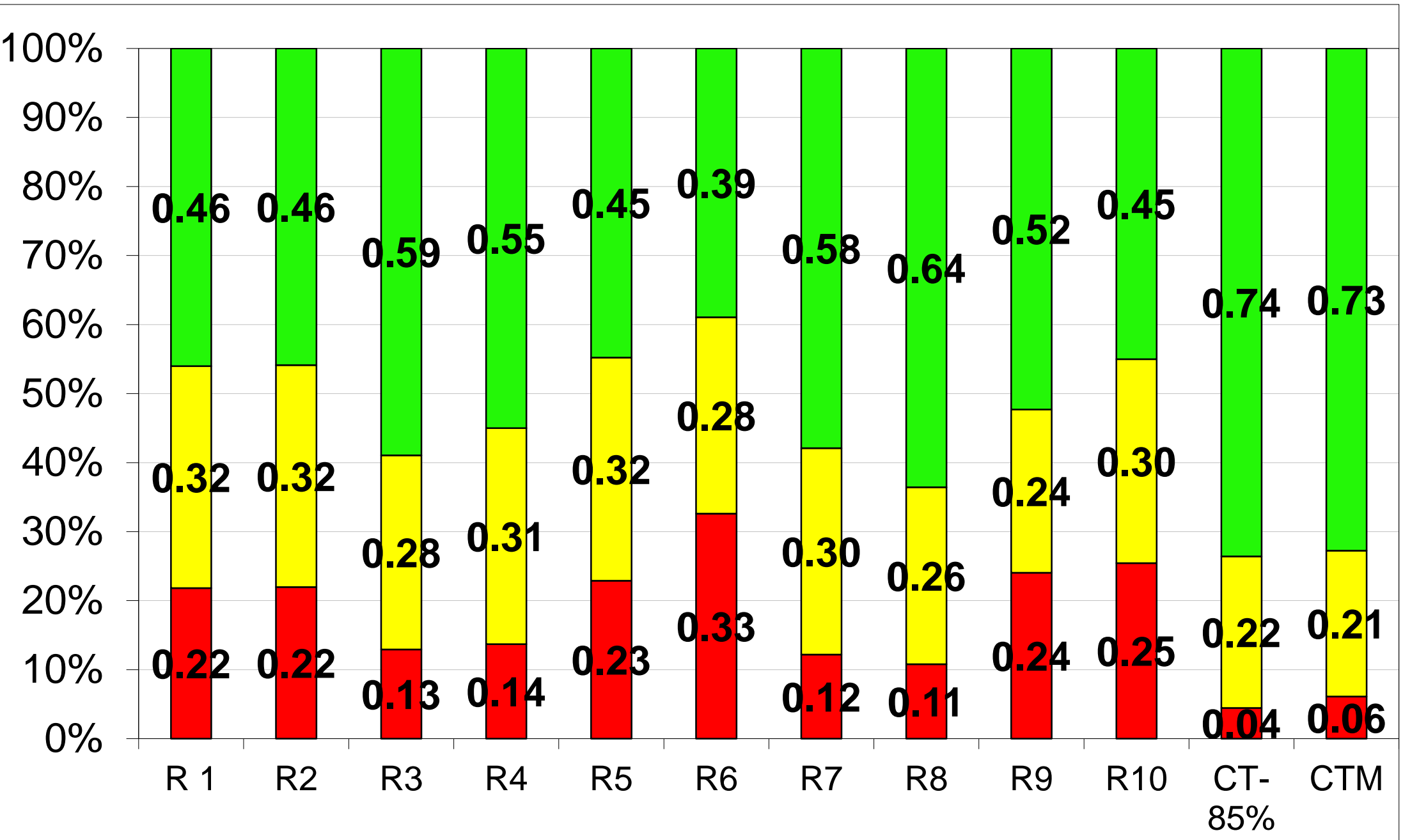


Figure 3. Stoplight Function

The stop light function of Simetar© uses the simulated data to assign probabilities of predetermined returns to labor and management. Red represents the probability of having negative returns. Yellow represents returns from \$0 to \$60,000. Finally, green represents the probability of having net returns greater than \$60,000 for the 1200 acre crop farm. The conventional tillage systems have the highest probability of making more than \$60,000. R8, R3, and R7 are the three highest performing no-till management systems.

Risk Aversion

Risk Aversion Coefficient (RAC)								
Preference	0	0.00001	0.00003	0.00005	0.00007	0.00009	0.00011	RAC > 0.0001859
1st	CTM	CT-85%	CT-85%	CT-85%	CT-85%	CT-85%	CT-85%	CT-85%
2nd	CT-85%	CTM	CTM	CTM	CTM	CTM	R8	R8
3rd	R3	R8	R8	R3	R8	R8	CTM	CTM
4th	R7	R3	R3	R8	R3	R3	R3	R3
5th	R8	R7	R7	R4	R4	R4	R4	R4
6th	R9	R4	R4	R7	R7	R6	R6	R6
7th	R4	R9	R9	R9	R6	R7	R7	R9
8th	R1	R10	R10	R6	R9	R9	R9	R7
9th	R5	R1	R6	R10	R10	R10	R10	R10
10th	R10	R5	R1	R1	R1	R1	R1	R1
11th	R2	R6	R5	R5	R5	R5	R5	R5
12th	R6	R2	R2	R2	R2	R2	R2	R2

Figure 4. Stochastic efficiency analysis of 12 crop rotations

- CMT and CT-85% are most preferred rotations for risk neutrality.
- CT-85% and R8 become most preferred rotations as risk aversion increases.

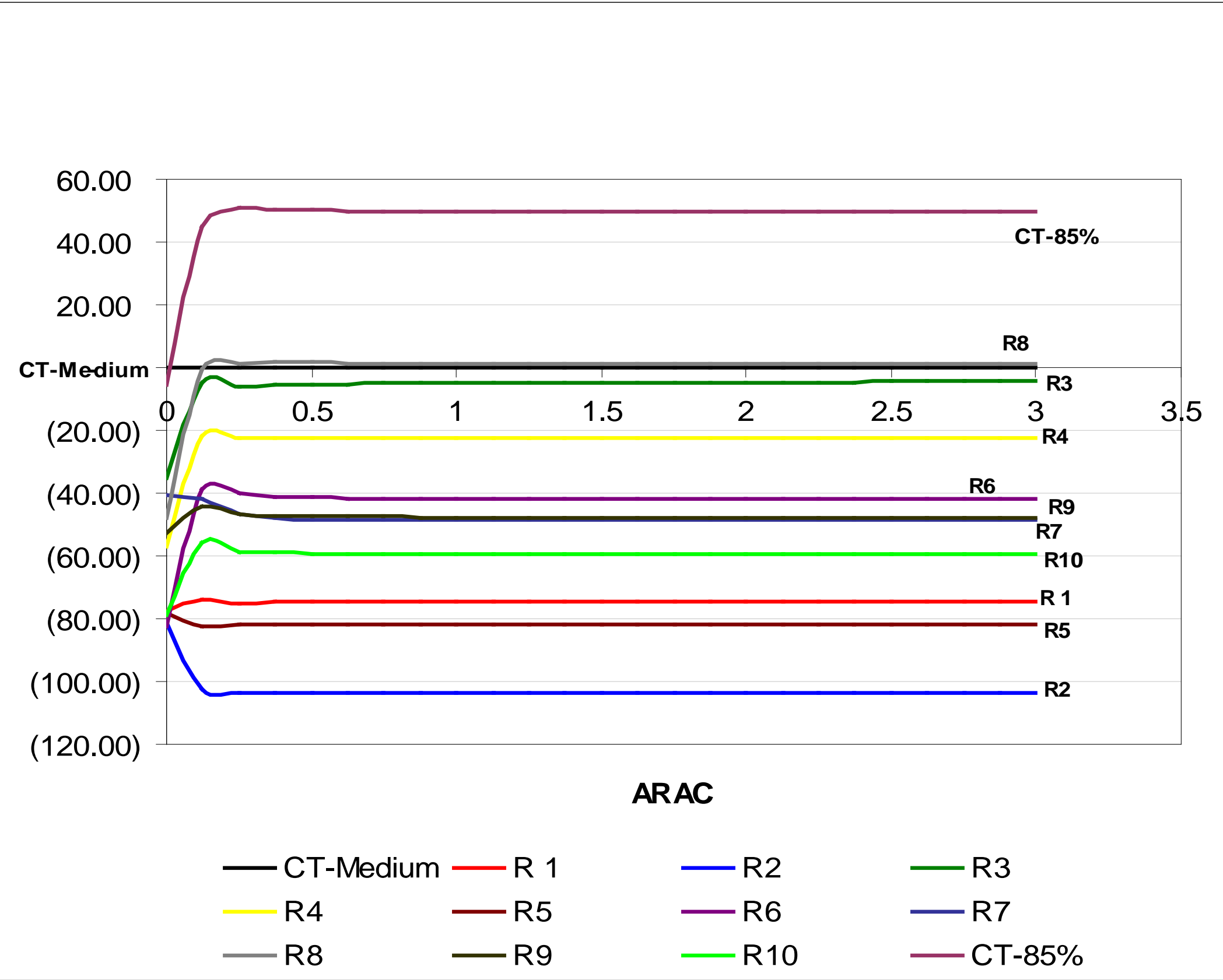


Figure 5. Negative Exponential Utility Function

- CT-85% and R8 risk premium are positive compared to CMT when risk aversion increases.
- All other rotations have negative risk premiums relative to CMT.

Conclusions

Conventional tillage systems had the highest average net (mean) returns. As risk aversion increases, no-till rotations with corn, soybeans, wheat, and another summer crop become more competitive with conventional tillage corn / soybean systems. No-till systems can provide additional agronomic and ecological benefits that were not captured in this study. Additional management practices such as installing drainage tile could help no-till systems become more competitive with conventional tillage in eastern South Dakota

Future Directions

The final four years of data from the study will be key.

The first two transition years of no-till management had negative returns. The returns from conventional tillage and no-till systems will likely see a convergence when more data is available.

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