Analyzing Risk and Risk Management in Cropping Systems

David Archer
North Central Soil Conservation Research Laboratory, Morris, MN

Joseph L. Pikul Jr. and Walter E. Riedell
Northern Grain Insects Research Laboratory, Brookings, SD
Introduction

- Risk – broadly defined as uncertain consequence, especially unfavorable consequences

- Five Categories:
  1. Production Risk
  2. Price or Market Risk
  3. Institutional Risk
  4. Human or Personal Risk
  5. Financial Risk
Introduction (cont’d.)

- Risk averse – willing to give up some expected returns for a reduction in risk

- Ways agricultural operations deal with risk:
  - Eliminate:
    - seek information to reduce uncertainty
    - find less risky ways to produce a commodity
    - build flexibility into operation
  - Transfer:
    - purchase insurance
    - use futures markets
    - contracting
Stochastic Budgeting

- Extension of other types of budgeting (e.g. enterprise, whole-farm)
- Explicitly considers risk by including uncertainty in some variables
- Spreadsheet add-ins make stochastic budgeting much easier to use
Cropping Systems Example

- Data for 1991-1999 from study at Brookings, SD

- Four cropping systems:
  - Continuous corn, conventional tillage
  - Corn-soybean, conventional tillage
  - Corn-soybean, ridge tillage
  - Corn-soybean-wheat/alfalfa-alfalfa, conventional tillage

- Analyze price and yield uncertainty
Corn Yield Distributions

- **Continuous corn Conventional Tillage**
- **2-year Conventional Tillage**
- **2-Year Ridge Tillage**
- **4-Year Conventional Tillage**
Simulation Process

2-Year, Conventional Tillage

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Price</td>
<td>2.13 $/bu</td>
<td>Stochastic</td>
</tr>
<tr>
<td>Corn Yield</td>
<td>120.6 /ac</td>
<td>Stochastic</td>
</tr>
<tr>
<td>Soybean Price</td>
<td>5.64 $/bu</td>
<td>Stochastic</td>
</tr>
<tr>
<td>Soybean Yield</td>
<td>34.6 /ac</td>
<td></td>
</tr>
<tr>
<td>Corn Production Cost</td>
<td>227.54 $/ac</td>
<td>Fixed</td>
</tr>
<tr>
<td>Soybean Production Cost</td>
<td>204.86 $/ac</td>
<td></td>
</tr>
<tr>
<td>Corn Net Returns</td>
<td>29.38 $/ac</td>
<td></td>
</tr>
<tr>
<td>Soybean Net Returns</td>
<td>(9.55) $/ac</td>
<td></td>
</tr>
<tr>
<td>Rotation Average Net Returns</td>
<td>9.92 $/ac</td>
<td></td>
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</tbody>
</table>
Distribution of Net Returns
without government payments or crop insurance
Government Payments

3 Types of Payments

- Direct Payments
  - fixed payment determined by producer’s base acres and program yield with a fixed payment rate

- Counter-cyclical Payments (CCP)
  - payment varies with price of crops for which producer has base acres
  - payed on established base acres and program yields

- Loan Deficiency Payments (LDP)
  - variable payment determined by price of crop relative to loan rate
  - payed on actual production
Simulating Government Payments

2-Year, Conventional Tillage

- Corn Price: $2.13 /bu
- Corn Yield: 120.6 bu/ac
- Soybean Price: $5.64 /bu
- Soybean Yield: 34.6 bu/ac
- Corn Production Cost: $227.54 /ac
- Soybean Production Cost: $204.86 /ac
- Corn program price: $2.13
- Soybean program price: $5.64
- Corn base CCP & Direct: $22.35
- Soybean base CCP & Direct: $10.10
- Rotation average CCP & Direct: $16.23
- Corn Net Returns: $45.61 /ac
- Soybean Net Returns: $6.68 /ac
- Rotation Average Net Returns: $26.14 /ac
Crop Insurance

- **2 Types of Insurance**
  - yield-based insurance – protects against production risk
  - gross revenue insurance – protects against price and yield risk

- For this example analyzed Multiple-Peril Crop Insurance (MPCI) – yield-based insurance with coverage based on the Actual Production History (APH) for the farm and a fixed payment price.
Distribution of Net Returns
including government payments or crop insurance

Cumulative Probability

Net Returns ($/acre)
Effect of Alternative Risk Management Tools

Cumulative Probability vs. Net Returns ($/acre)

- 2YRR gpi
- 2YRR gp
- 2YRR
- 2YRR gpi ob
Timeliness Risk

- Varying weather conditions can lead to variation in a producer’s ability to complete field operations in a timely manner.

- Timeliness of field operations can have significant effects on economic returns.

- Risks associated with completing field operations in a timely manner translate into economic risk.
Analysis of Timeliness Risk

- Used EPIC model to simulate field conditions and crop yields for different planting dates.
- Based on assumptions of farm size and labor and equipment limits estimated acreage that could be planted each year by planting date.
- Compared results to economic returns for a constant year-to-year planting date.
Distribution of Net Returns without Planting Risk

Cumulative Probability

Whole-Farm Net Return ($)

No Planting Risk CT

No Planting Risk NT
Distribution of Net Returns with Planting Risk

Cumulative Probability

Whole-Farm Net Return ($)

-50,000 0 50,000 100,000

Planting Risk CT — Planting Risk NT
Effect of Planting Risk

Expected whole-farm cost of planting risk:
- NT: $4800/year
- CT: $3043/year
Conclusion

- Important to include relevant sources of risk and available risk management tools in comparing alternative cropping systems.
- Techniques can be extended to more complex situations.
  - Flexible management (new information during the decision process).
  - Dynamic effects.