Analyzing Risk and Risk Management in Cropping Systems

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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
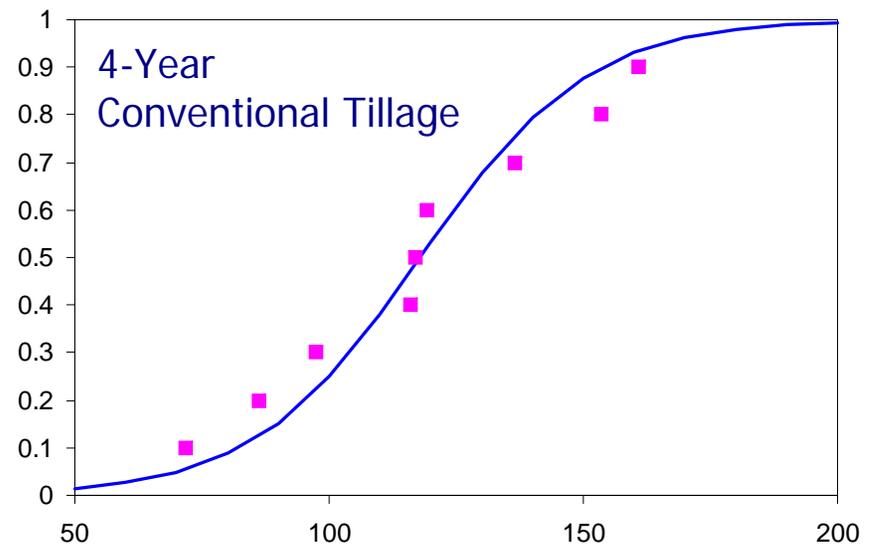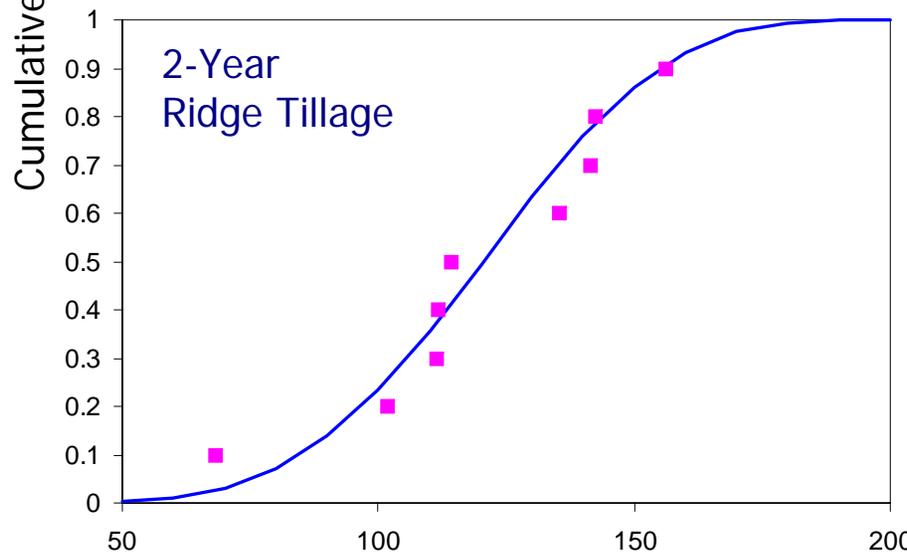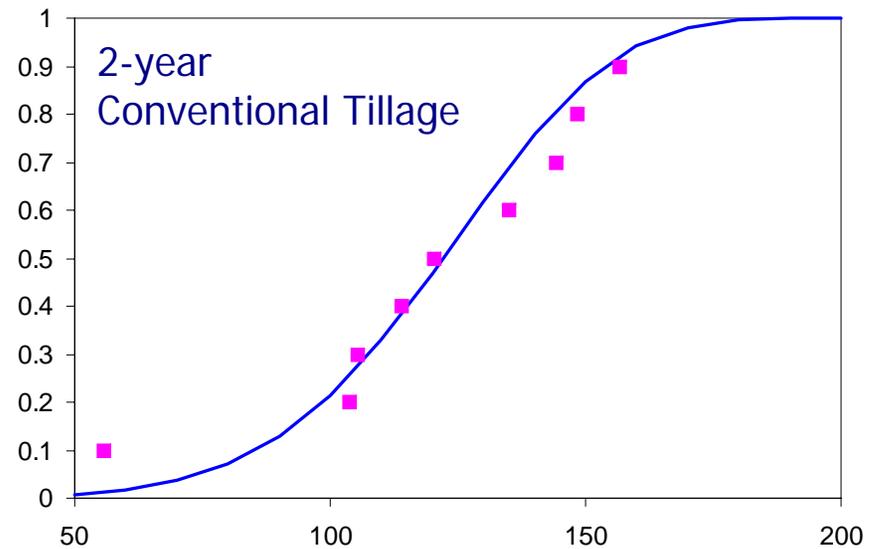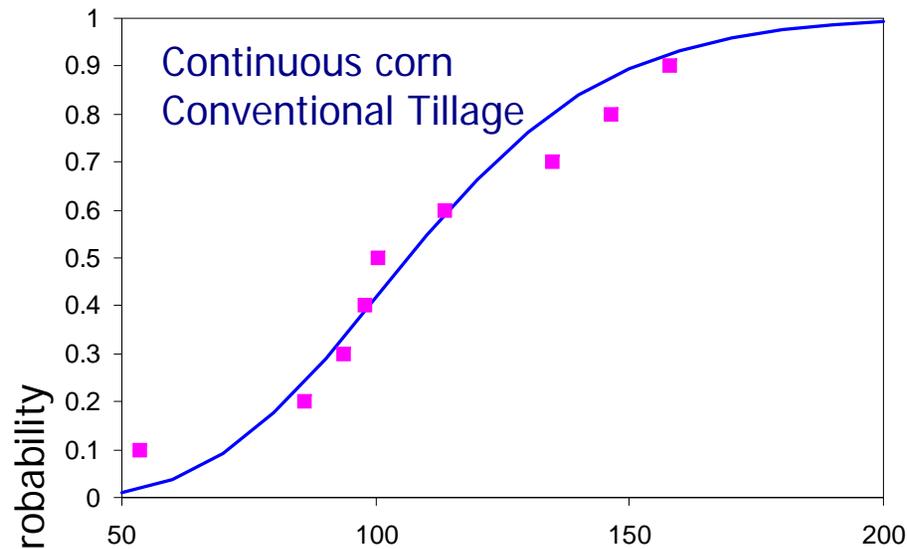
Simulation Process

2-Year, Conventional Tillage

Corn Price	$	2.13	/bu	← Stochastic
Corn Yield		120.6	/ac	← Stochastic
Soybean Price	$	5.64	/bu
Soybean Yield		34.6	/ac
Corn Production Cost	$	227.54	/ac	← Fixed
Soybean Production Cost	$	204.86	/ac
Corn Net Returns	$	29.38	/ac
Soybean Net Returns	$	(9.55)	/ac
Rotation Average Net Returns	$	9.92	/ac

Distribution of Net Returns
without government payments or crop insurance
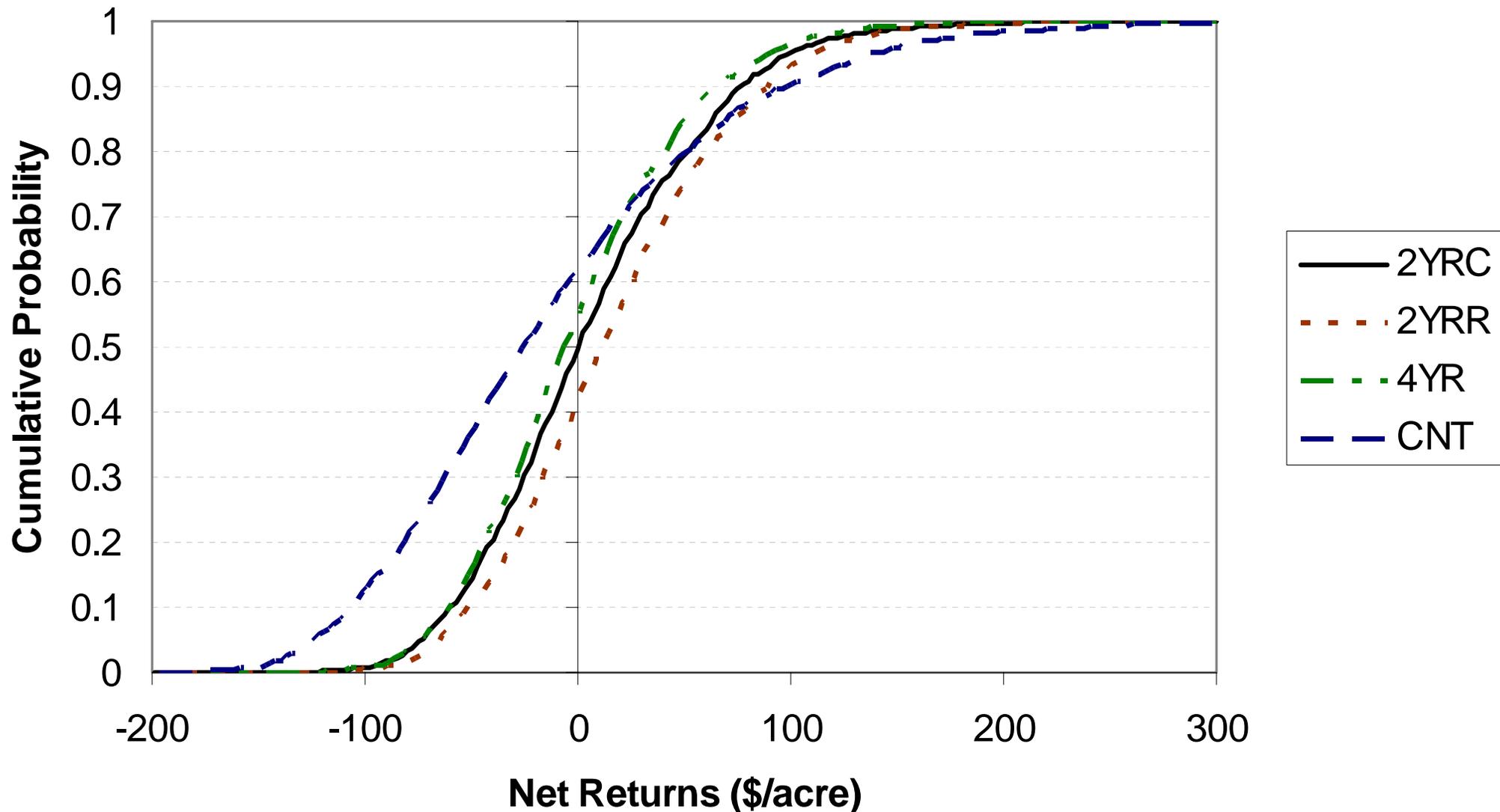
Government Payments

- 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

Stochastic

2-Year, Conventional Tillage

|					
Corn Price	$ 2.13	/bu	Corn program price		2.13
Corn Yield	120.6	/ac	Soybean program price		5.64
Soybean Price	$ 5.64	/bu			
Soybean Yield	34.6	/ac	Corn base CCP & Direct	$	22.35
Corn Production Cost	$ 227.54	/ac	Soybean base CCP & Direct	$	10.10
Soybean Production Cost	$ 204.86	/ac	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			
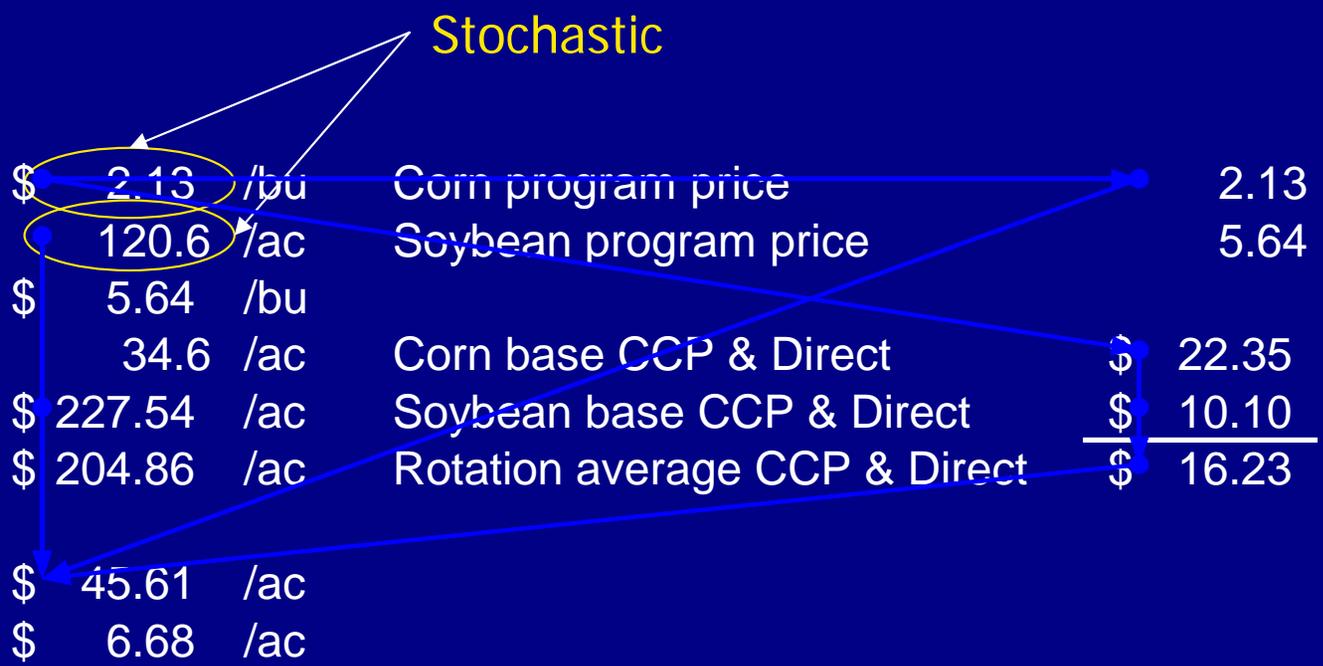
Crop Insurance

- 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
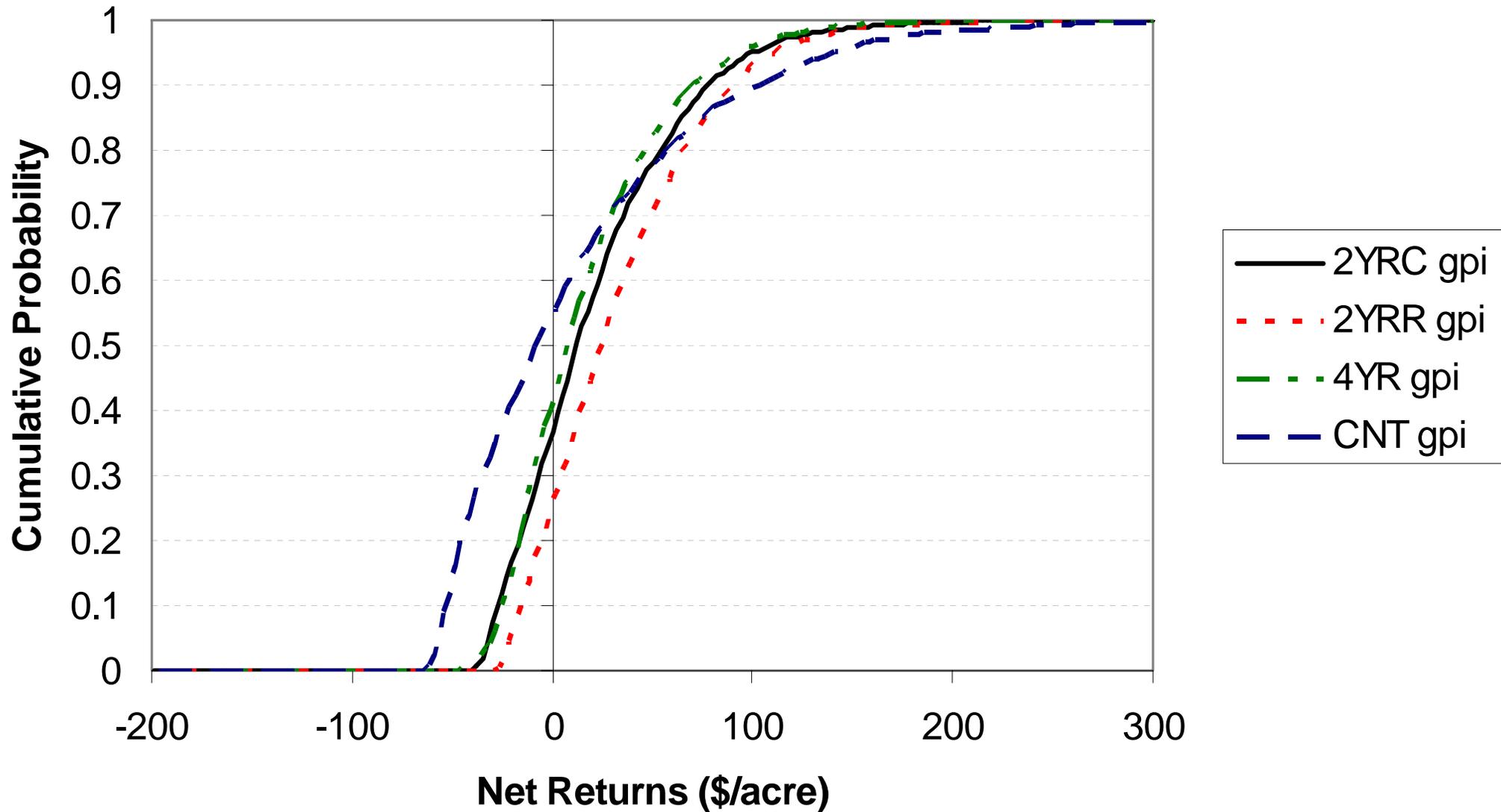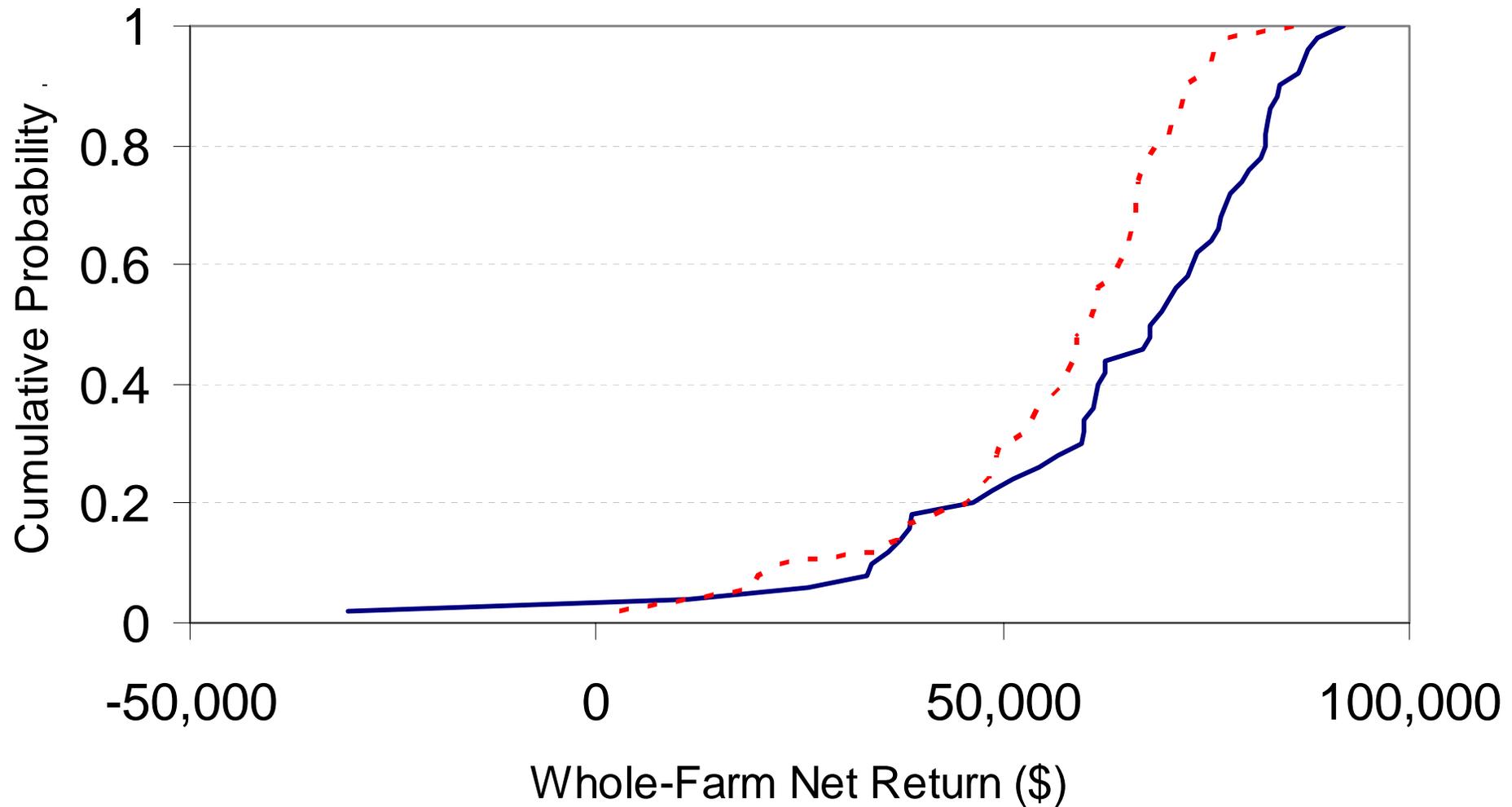
Effect of Alternative Risk Management Tools
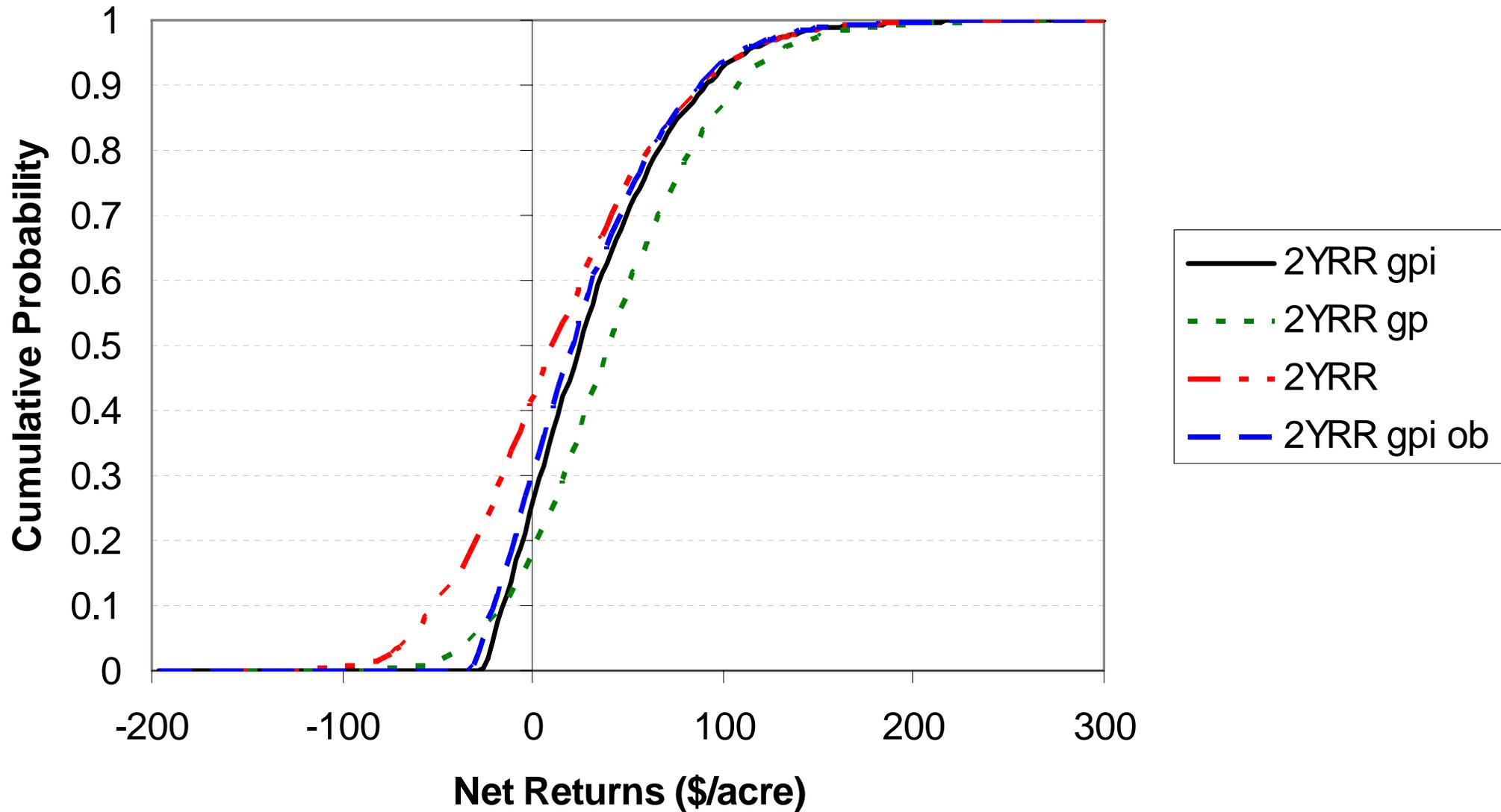
Timeliness Risk

- 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
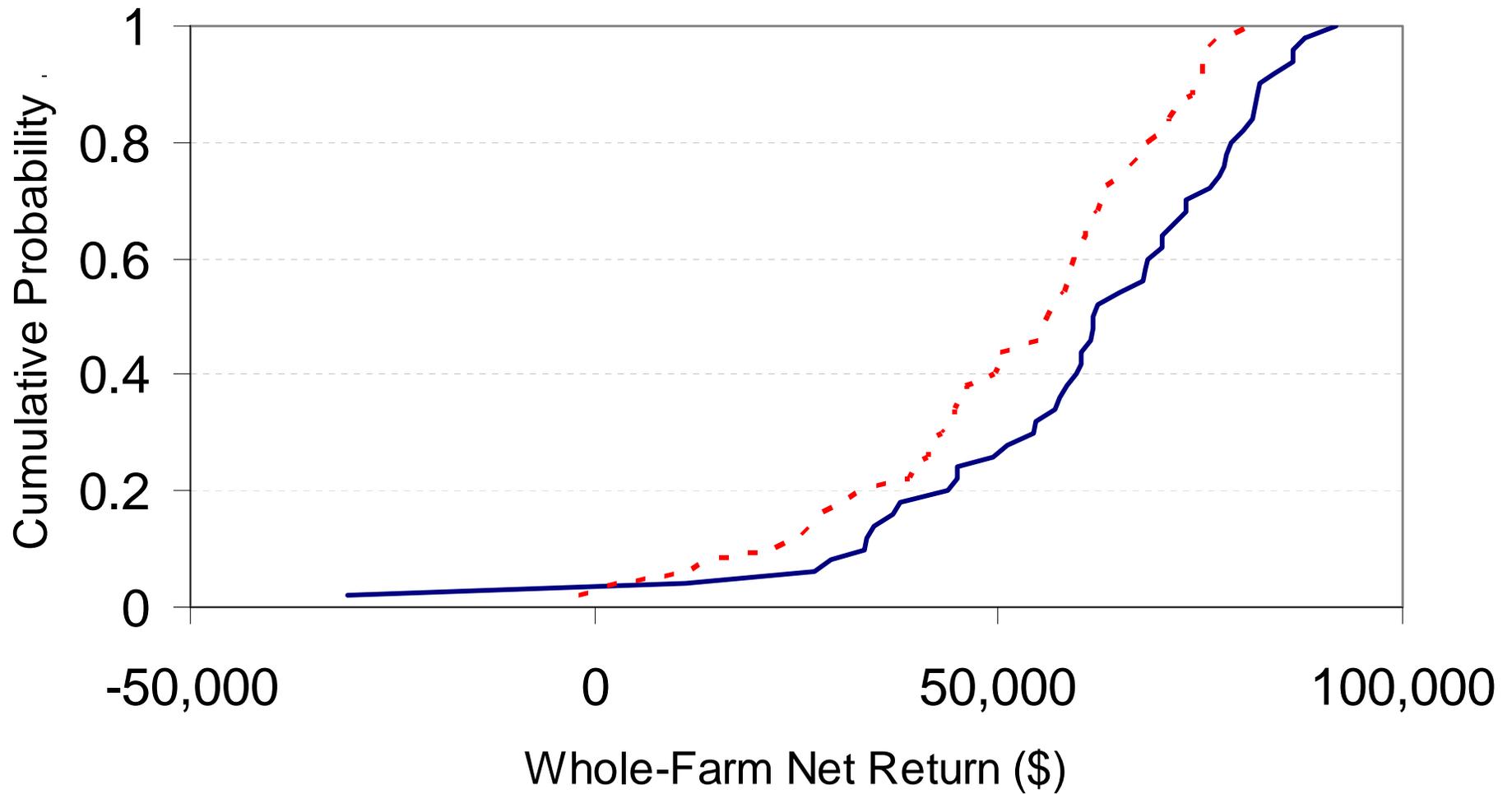
Analysis of Timeliness Risk

- 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
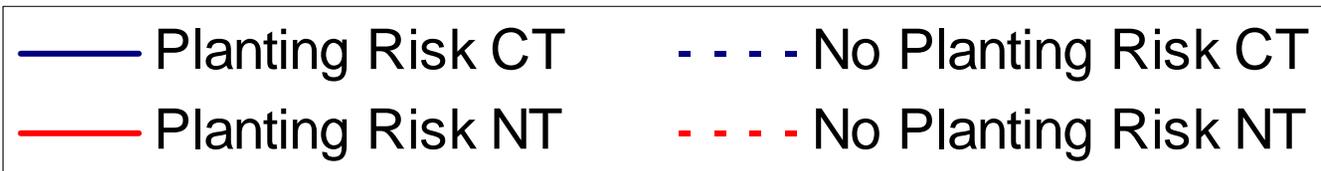
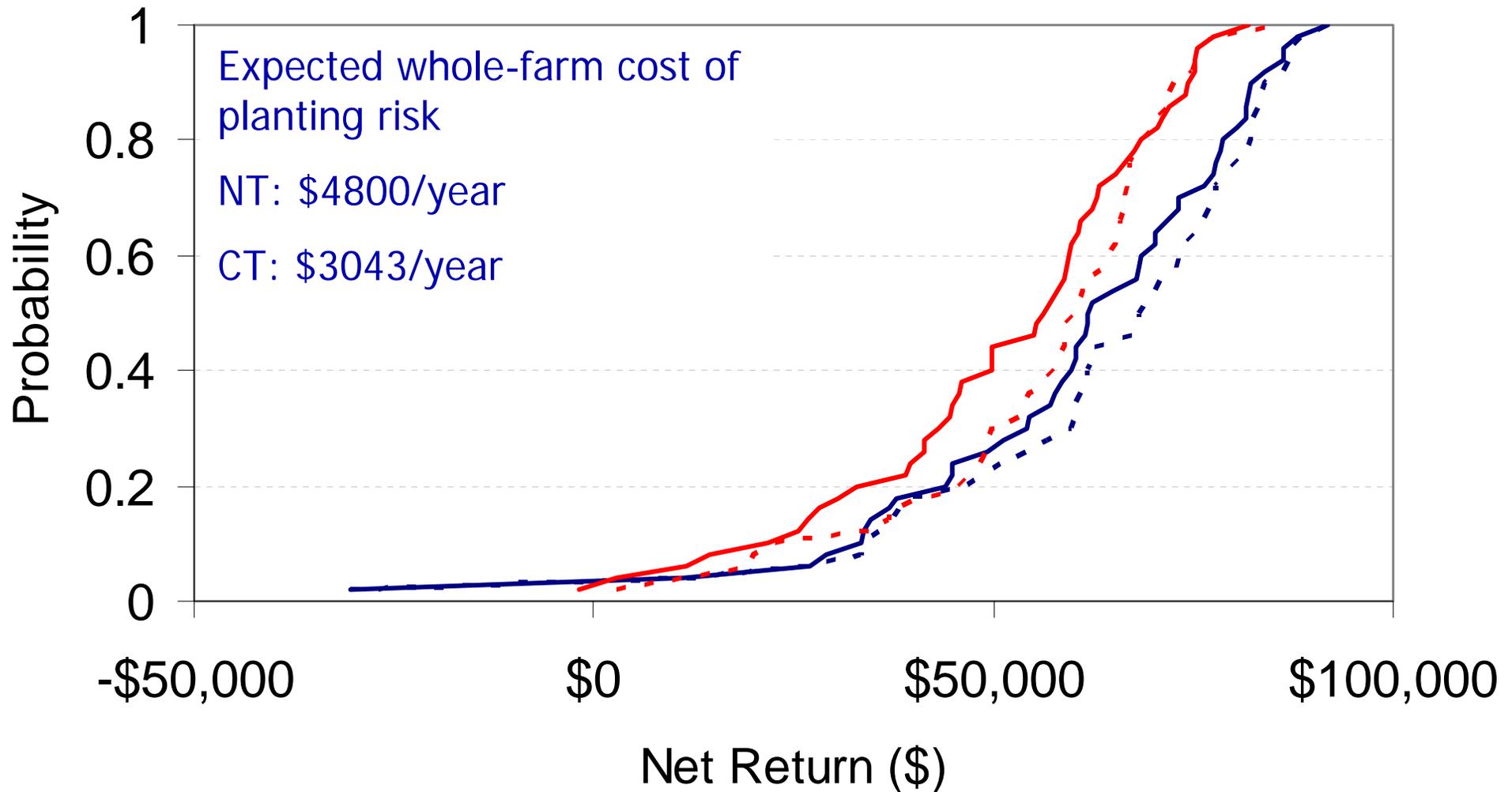# Distribution of Net Returns without Planting Risk

Distribution of Net Returns with Planting Risk

Effect of Planting Risk

Expected whole-farm cost of planting risk

NT: $4800/year

CT: $3043/year

Probability

Net Return ($)

—— Planting Risk CT   - - - - No Planting Risk CT
—— Planting Risk NT   - - - - No Planting Risk NT

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