



Economics of Resistance Management

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Economic Analysis


- **Main goal:** Evaluate cost-effectiveness of alternative interventions to manage pest resistance
- **Requires:**
 - Understanding of status quo practices in each pilot project
 - Short- and long-term assessment of potential PRM practices and resistance development specific to each pilot project

→ **Both rely heavily on local stakeholder input!**


General Approach

- 1. Identify current practices**
- 2. Develop baseline enterprise budgets**
- 3. Identify “what if” scenarios and incorporate them into enterprise budgets**
- 4. Project budgets to compare status quo and “what if” scenarios**

→ Spreadsheet budgeting tool to evaluate alternative approaches




Harrison County - Baseline Budget Development (Steps 1 & 2)

- **Initial input** – current practices and budgets
 - Farmers, crop advisors, agricultural retailers, seed and chemical dealers, lenders, university extension
 - **Developed initial baseline enterprise budgets**
 - Flexible spreadsheet-based model for the enterprise budgets (3 levels of ‘weed pressure’)
 - Parameterized baseline scenarios specific to Harrison County (15 scenarios – soil, tillage, rotation)
 - **Multiple rounds of feedback & adjustments to get finalized baseline budgets**
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Harrison County - “What if” Scenarios & Budgeting Tool

(Steps 3 & 4)


- **Input from team on potential “what-if” scenarios**
 - **Tweaks** – small pre-season adjustments
 - **Band-Aids**- small in-season adjustments
 - **Deep (structural) changes** – adjustments that alter the way they grow crops
 - **Expanded spreadsheet-based model to incorporate “what-if” scenarios**
 - Total cost, total revenue, and net returns per acre by year
 - Simulates 10-year impact of alternative changes on weed pressure, costs, and profits (present value of net returns)
 - **Feedback & modifications to improve spreadsheet usability**
 - Meeting with full team
 - One-on-one feedback meetings
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Budgeting Tool - Example

Farmer: **Barry Luss**

- Farm size: 700 acres
- Plot evaluating: 40 acres
- Land type: Upland
- Own/rent: Owned
- Year might change: 2023
- Crop in 2023: Soybeans
- Crop in 2022: Corn
- Tillage: Conventional
- Weed pressure: High (9-10% yield loss)

Other information:

- All equipment owned (only exception: fungicide aerial application)
 - Long term: 2-year Corn-Soybean rotation
 - Default values for costs, yields, rates, long-term prices (except higher fertilizer cost)
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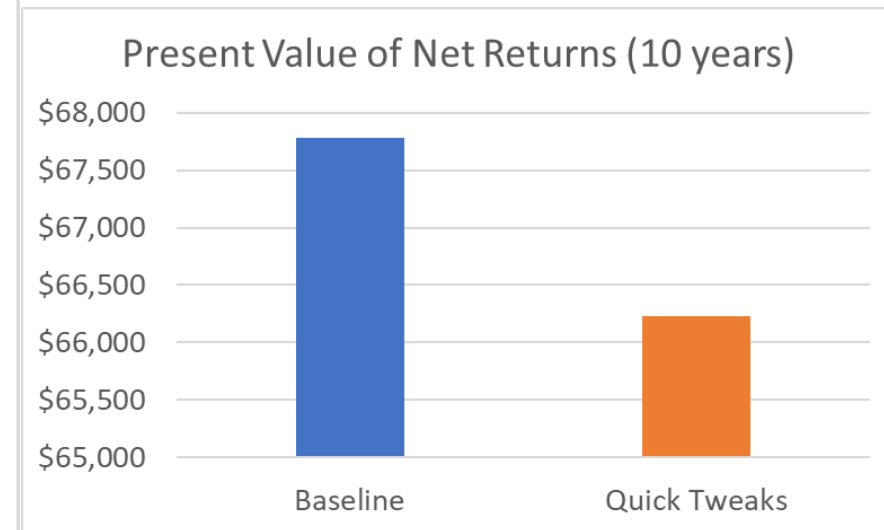
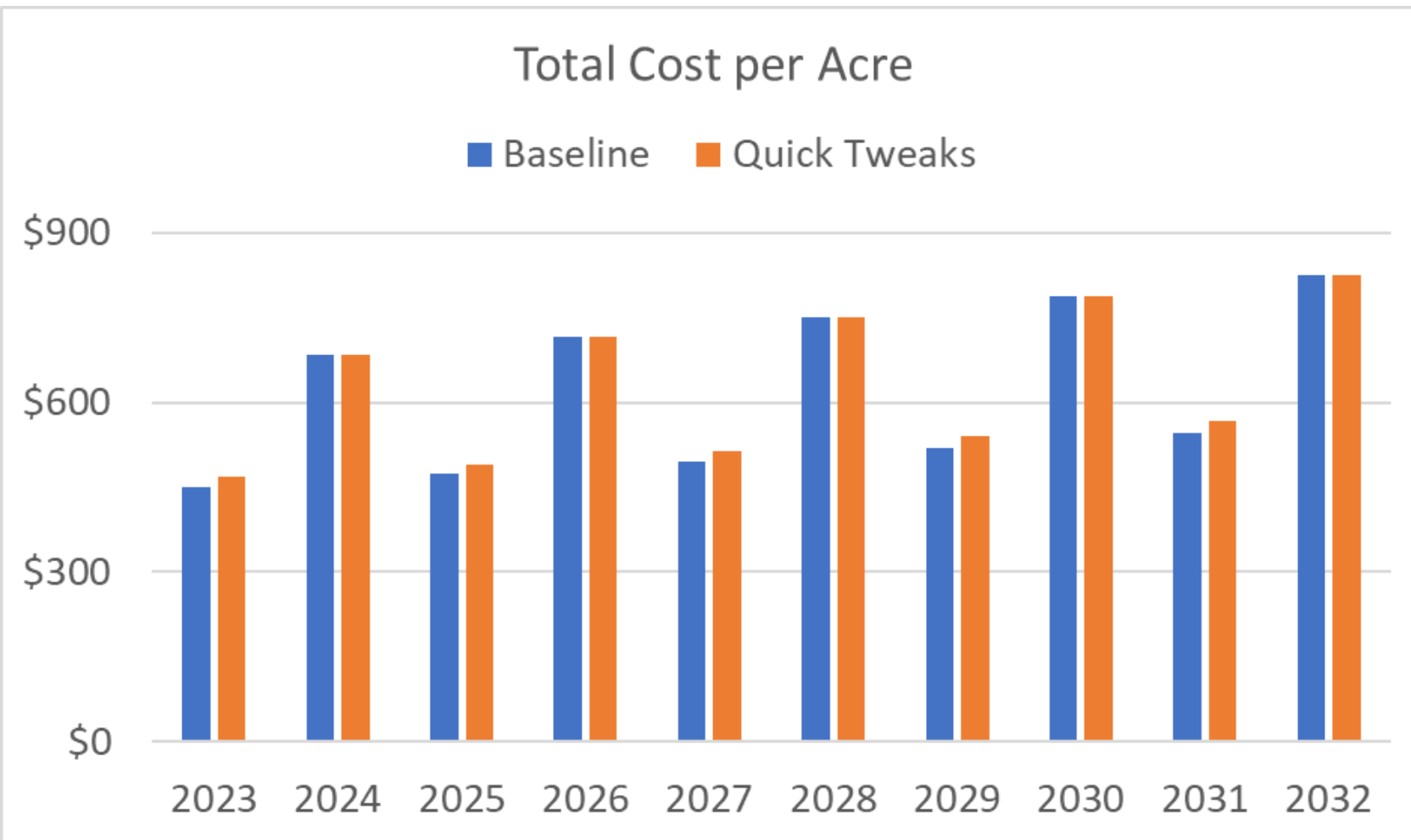
Scenario 1: Barry considers using a new burndown mix that is 25% higher cost than the baseline mix → soybean yields 1 bu/a higher than in baseline

- “Quick Tweak” in soybean years (years 1, 3, 5, 7, 9)

	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026
Baseline Crop Rotation	Soybeans	Corn	Soybeans	Corn
Baseline Weed Pressure	High	High	High	High
Yield before Quick Tweaks	63.0	227.0	64.2	231.3
Quick Tweak 1	New burndown mix, +25% cost		New burndown mix, +25% cost	
Quick Tweak 2				
Quick Tweak 3				
Quick Tweak 4				
Quick Tweak 5				
Crop Rotation after QT	Soybeans	Corn	Soybeans	Corn
Weed Pressure after QT	High	High	High	High
Yield after Quick Tweaks	63.0	227.0	64.2	231.3
Adjust Yield (+/- bushels)**	1.0		1.0	
Adjusted Yield after QT	64.0	227.0	65.2	231.3
Extra Variable Costs per acre	\$17.50	\$0.00	\$18.35	\$0.00
Extra Fixed Costs per acre	\$0.00	\$0.00	\$0.00	\$0.00
Total Extra Costs per acre	\$17.50	\$0.00	\$18.35	\$0.00
New Total Cost per acre	\$468.43	\$683.63	\$491.10	\$716.70
New Total Cost per bushel	\$7.32	\$3.01	\$7.53	\$3.10
New Net Returns per Acre	\$187.57	\$306.09	\$177.20	\$291.77

Baseline vs. Scenario 1:

Selected Quick Tweaks reduce the Present Value of Net Returns by \$1,560 (40 acres)



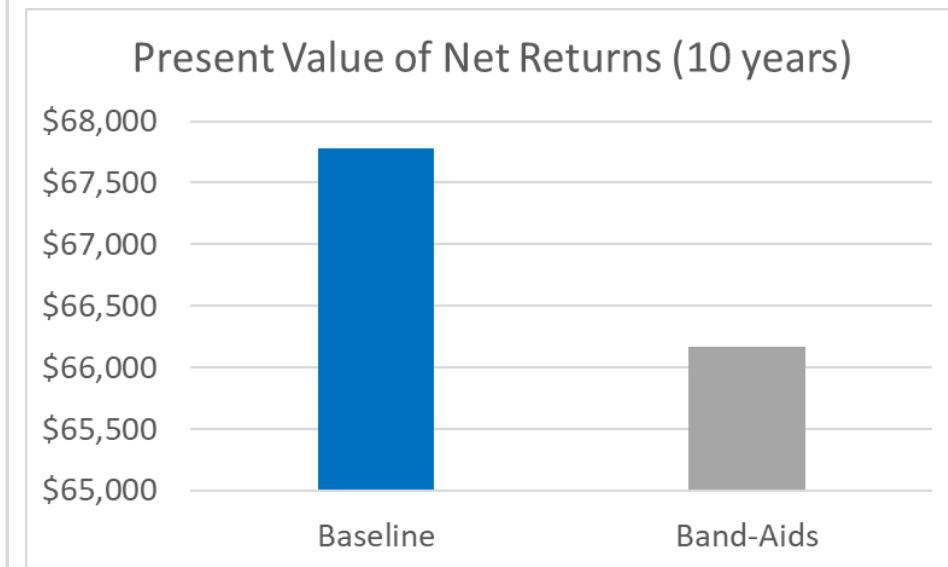
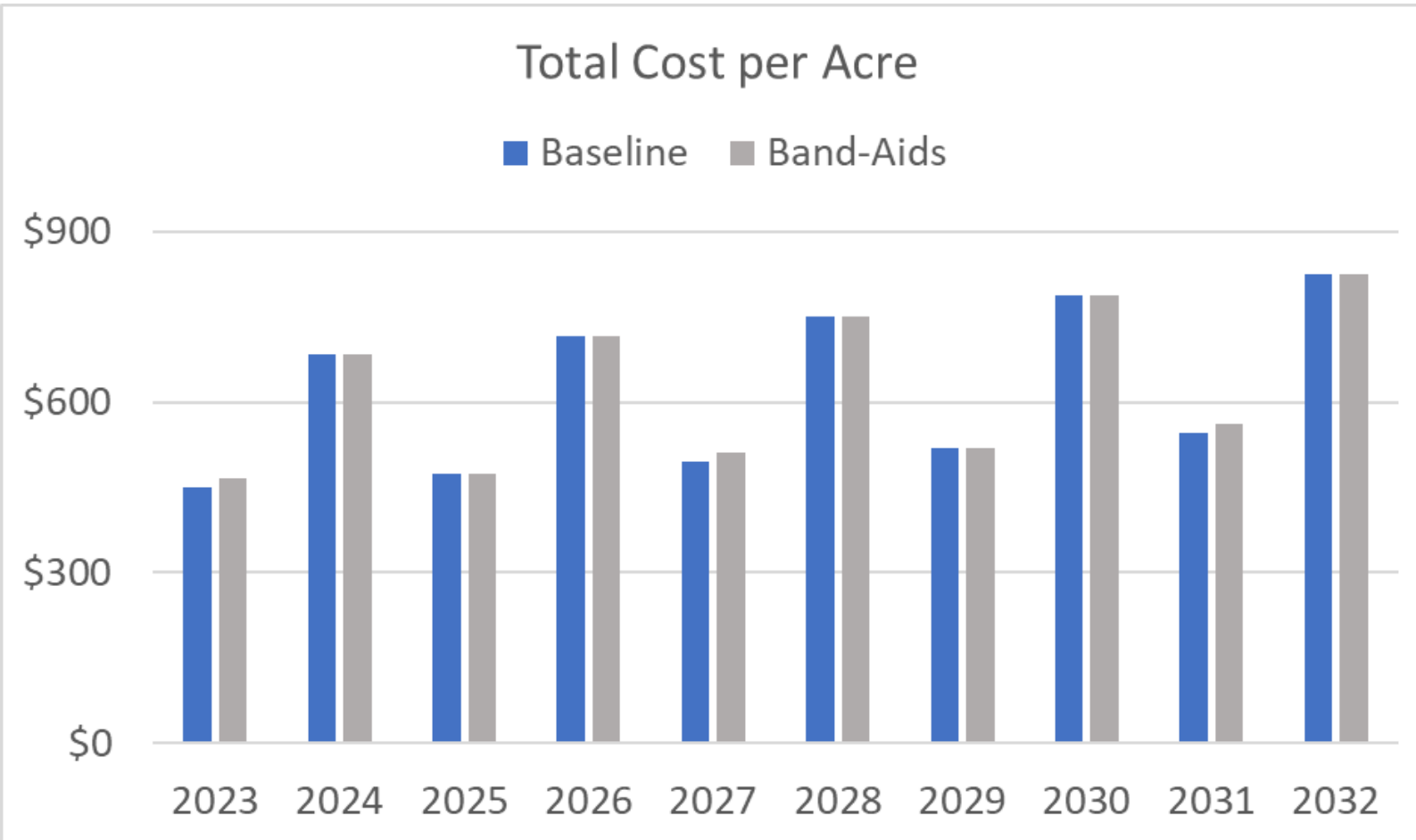
Scenario 2: Barry considers an alternative approach to managing high weed pressure – rescue sprays in every other soybean year

- “Band Aid” in soybean years 1, 5, 9

	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
Crop Rotation before BAs	Soybeans	Corn	Soybeans	Corn	Soybeans
Weed Pressure before BAs	High	High	High	High	High
Yield before BAs	63.0	227.0	64.2	231.3	65.4
Band-Aid 1	Rescue Spray				Rescue Spray
Band-Aid 2					
Band-Aid 3					
Band-Aid 4					
Band-Aid 5					
Adjust Yield (+/- bushels)**					
Yield after BAs	63.0	227.0	64.2	231.3	65.4
Extra Variable Costs per acre	\$15.00	\$0.00	\$0.00	\$0.00	\$15.61
Extra Fixed Costs per acre	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total Extra Costs per acre	\$15.00	\$0.00	\$0.00	\$0.00	\$15.61
New Total Cost per acre	\$465.93	\$683.63	\$472.75	\$716.70	\$511.22
New Total Cost per bushel	\$7.40	\$3.01	\$7.36	\$3.10	\$7.82
New Net Returns per Acre	\$179.82	\$306.09	\$185.30	\$291.77	\$159.13

Baseline vs. Scenario 2:

Selected Band Aids reduce the Present Value of Net Returns by \$1,619 (40 acres).



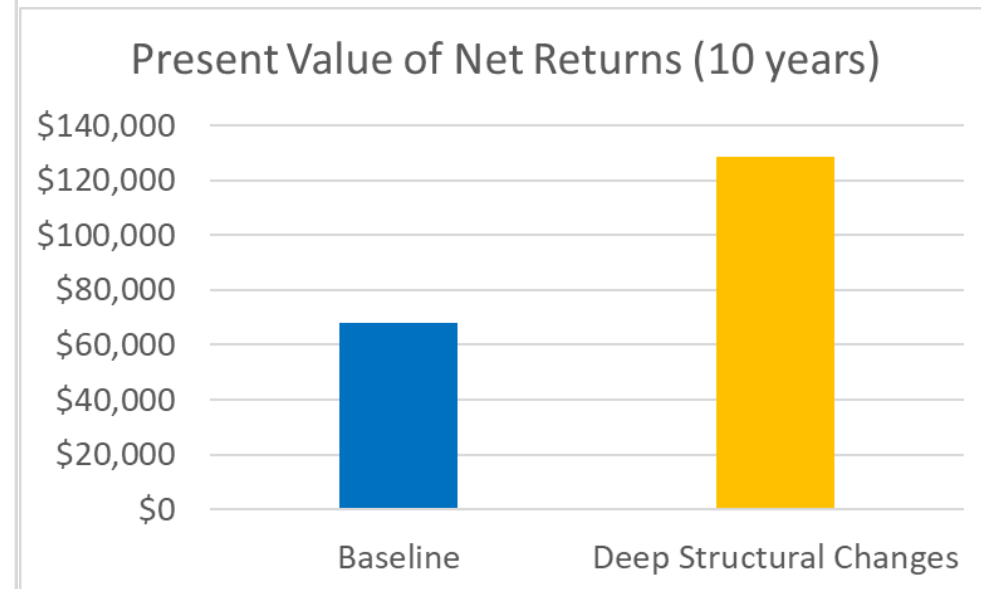
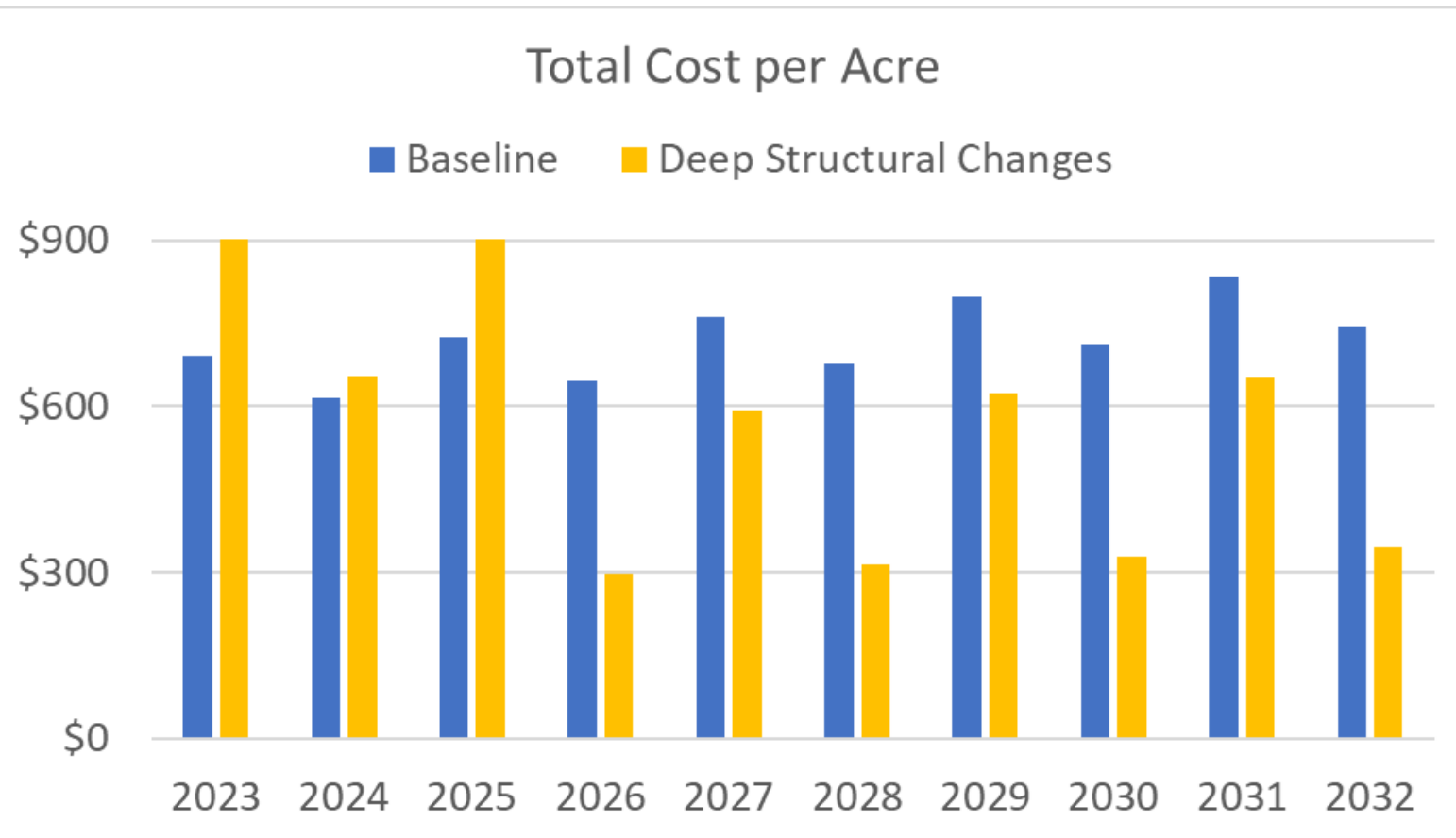
Scenario 3: Barry considers alternative weed management strategy – Change in rotation to 4 years of corn-on-corn (“Deep structural change”)

- Note: since Barry had corn the previous year, this implies corn in years 1 - 3 and returning to CS rotation in year 4
- With lower weed pressure, yields increase for soybeans and corn

	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027
Crop Rotation in Baseline	Soybeans	Corn	Soybeans	Corn	Soybeans
Weed Pressure in Baseline	High	High	High	High	High
Yield in Baseline	63.0	227.0	64.2	231.3	65.4
New Crop Rotation after DC	Corn	Corn	Corn	Soybeans	Corn
Weed Pressure after DC	High	High	High	Medium	Medium
Yield after Deep Changes	198.0	199.7	201.6	68.4	246.4
Adjust Yield (+/- bushels)**					
Manually Adjusted Yields	198.0	199.7	201.6	68.4	246.4
Extra Variable Costs per acre	\$269.78	\$44.78	\$282.83	(\$385.61)	(\$188.82)
Extra Fixed Costs per acre	\$17.82	\$27.78	\$18.68	\$9.99	(\$10.23)
Total Extra Costs per acre	\$287.60	\$72.56	\$301.51	(\$375.62)	(\$199.05)
New Total Cost per acre	\$738.53	\$756.19	\$774.26	\$341.08	\$296.56
New Total Cost per bu or ton	\$3.73	\$3.79	\$3.84	\$4.99	\$1.20
New Net Returns per Acre	\$124.75	\$114.50	\$104.72	\$360.02	\$777.74

Baseline vs. Scenario 3:

Selected Deep Structural Changes increase the Present Value of Net Returns by \$60,749 (40 acres).



Considerations Moving Forward

- **Importance and value of “ground truthing”**
 - **Manageable number of scenarios** (baseline & “what if”)
 - **Discussing “what if” scenarios**
 - Nobody *wants* to have to implement adjustments
 - **Shifting priorities**
 - **Maintaining long-run perspective**
 - **Developing tool that is realistic and usable**
 - Range of technological skills
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