USER GUIDE: Budgeting Tool to Evaluate Alternative Approaches to Weed Management

Ag Decision Maker
extension.iastate.edu/agdm

File A1-87

The following USER GUIDE accompanies the Ag Decision Maker Decision Tool (electronic spreadsheet), Budgeting Tool to Evaluate Alternative Approaches to Weed Management, www.extension.iastate.edu/agdm/crops/xls/a1-87weedmanagementalternatives_harrison.xlsx.

Introduction and Background

The purpose of the budgeting tool is to evaluate the long-run costs of farming practice changes to manage weed resistance. The tool allows the user to identify the current or "baseline" scenario for a given farm and then simulate the 10-year impact of alternative changes on weed pressure, costs, and profits.[1]

The tool incorporates extensive feedback from the Harrison County Pest Resistance Management Project Team, www.ipm.iastate.edu/harrison-county-pest-resistance-management-project-overview, on current practices, costs, and potential farming practice changes specific to Harrison County, Iowa. While the user has the ability to change some of the underlying parameter values, default values were generated in consultation with the Harrison team.

This tool is not meant to be prescriptive or predictive. Instead, the tool is meant to aid users in comparing short- and long-term weed management strategies, evaluating potential tradeoffs, and providing insight for further discussion.

For full functionality, the tool needs to be downloaded to a computer and opened in Microsoft Excel. Do **not** attempt to access the tool via cell phone or use an alternative program (such as GoogleSheets) because functionality will be severely limited.

[1] Users interested in a single-year enterprise budget rather than a 10-year weed resistance analysis are encouraged to utilize the decision tools associated with **Ag Decision Maker File A1-20**, www.extension.iastate.edu/agdm/crops/html/a1-20.html.

Iowa State University does **not** collect any information entered into or saved in the spreadsheet by the user.

Downloading Tips and Instructions

- Download the spreadsheet file to your computer and open it in Microsoft Excel.
- Due to file size, initial download time may require several minutes; please be patient.
- Once downloaded, save the file to your hard drive for faster reference.
- Open spreadsheet to the "Introduction" tab.
- See Figure 1 for an example of a completed "Introduction" tab.
- Before making changes, we recommend resaving the file to your computer using an alternative name to the original downloaded file. This will allow you to return to (or reference) the original file as needed, and analyze multiple scenarios without having to download the original file from Ag Decision Maker each time.

Steps and Instructions to Use the Tool

General notes:

- Warning messages will appear in **red text** if you select combinations that are not allowed, if you enter values that violate required conditions, or to explain underlying relationships assumed/imposed by the tool.
- Dropdown options, default values, and names/headers in other areas of the spreadsheet will update automatically based on selected drop-down menu choices and text entries.

Step 1. Provide Farm Information to Develop a Baseline Scenario

Type in the orange cells and use drop-down menu selections for blue cells. Your selections will carry over to the entire spreadsheet.

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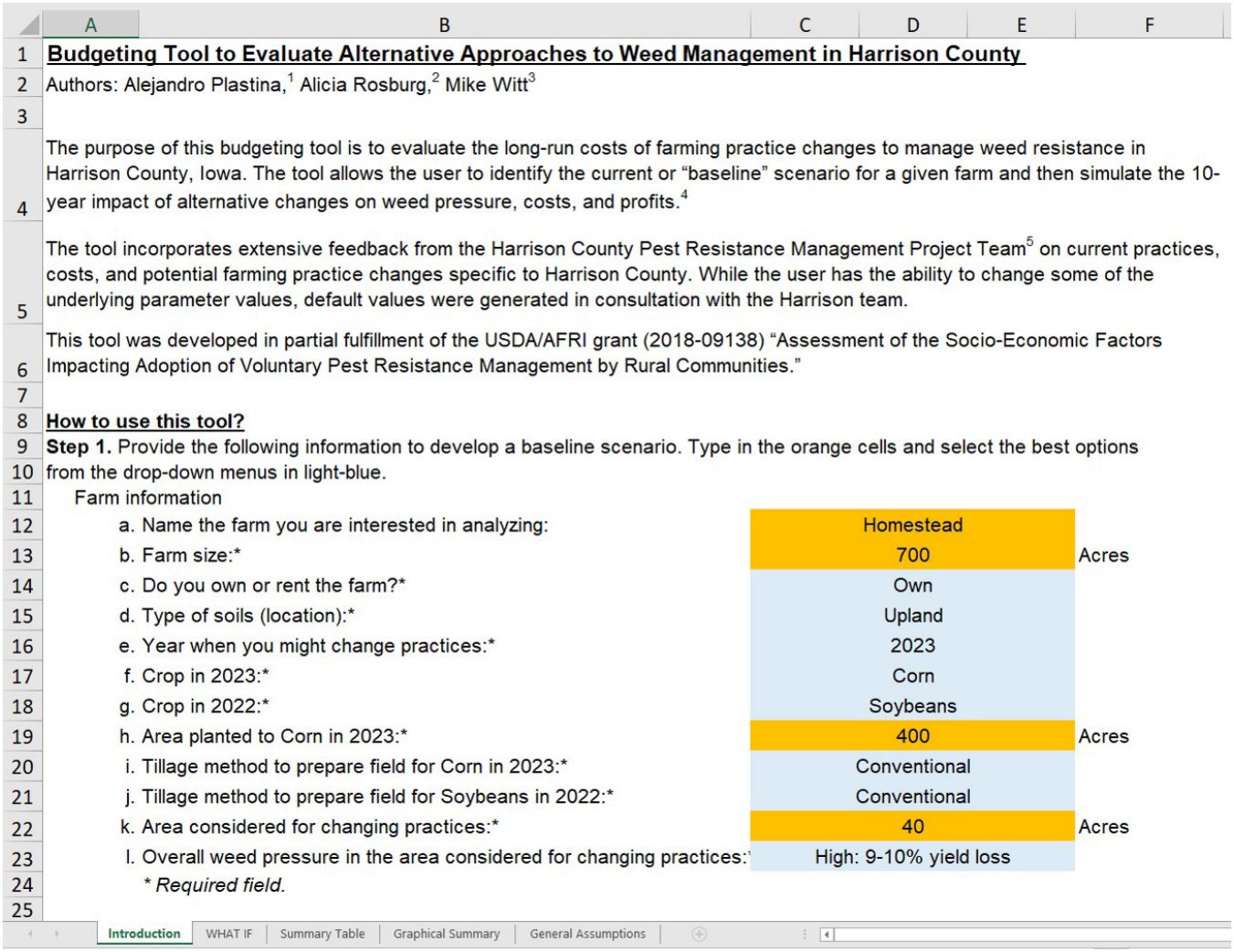
Figure 1. Example of Completed "Introduction" Tab



Budgeting Tool to Evaluate Alternative Approaches to Weed Management in Harrison County

Authors: Alejandro Plastina,[1] Alicia Rosburg,[2] Mike Witt[3]

The purpose of this budgeting tool is to evaluate the long-run costs of farming practice changes to manage weed resistance in Harrison County, Iowa. The tool allows the user to identify the current or "baseline" scenario for a given farm and then simulate the 10-year impact of alternative changes on weed pressure, costs, and profits.[4]

The tool incorporates extensive feedback from the Harrison County Pest Resistance Management Project Team[5] on current practices, costs, and potential farming practice changes specific to Harrison County. While the user has the ability to change some of the underlying parameter values, default values were generated in consultation with the Harrison team.

This tool was developed in partial fulfillment of the USDA/AFRI grant (2018-09138) "Assessment of the Socio-Economic Factors Impacting Adoption of Voluntary Pest Resistance Management by Rural Communities."

How to use this tool?

Step 1. Provide the following information to develop a baseline scenario. Type in the orange cells and select the best options from the drop-down menus in light-blue.

Farm information

a. Name the farm you are interested in analyzing:	Homestead	
b. Farm size:*	700	Acres
c. Do you own or rent the farm?*	Own	
d. Type of soils (location):*	Upland	
e. Year when you might change practices:*	2023	
f. Crop in 2023:*	Corn	
g. Crop in 2022:*	Soybeans	
h. Area planted to Corn in 2023:*	400	Acres
i. Tillage method to prepare field for Corn in 2023:*	Conventional	
j. Tillage method to prepare field for Soybeans in 2022:*	Conventional	
k. Area considered for changing practices:*	40	Acres
l. Overall weed pressure in the area considered for changing practices:	High: 9-10% yield loss	

** Required field.*

Introduction | WHAT IF | Summary Table | Graphical Summary | General Assumptions

a. **Name of the farm you are analyzing** (cell C12) – type the name of your farm

b. **Farm size** (cell C13) – type the **TOTAL** farm size in acres using numbers only.
   i. Please indicate total farm size. You will enter the area planted to the specific crop of interest as well as the area that you want to consider for changing practices later in the spreadsheet (both of which must be less than or equal to the total farm size you indicate here).

c. **Do you own or rent the farm?** (cell C14) – select from: own, rent

d. **Types of soils (location)** (cell C15) – select from: Hills, River Bottom, Upland

e. **Year when you might change practices** (cell C16) – select from: 2023 - 2027

f. **Crop in …*(year from e)*** (cell C17) – select from: corn, soybeans
   i. Identify the crop that you intend to plant for the year you might consider changing practices.

g. **Crop in…*(year before e)*** (cell C18) – select from: corn, soybeans
   i. Identify the crop that you planted or intend to plant in the year before you might consider changing practices.

ii. A red text warning will appear if you attempt to select soybeans multiple years in a row, since continued soybeans was not identified as a common practice by the Harrison County Team.

h. **Area planted to *(crop from f)* in *(year from e)*** (cell C19) - type the number of acres that will be planted to the intended crop in the year of a potential practice change (note: cannot exceed Farm Size).

i. **Tillage method to prepare field for…*(year from e)*** (cell C20) – select from: conventional, no-till
   i. A red text warning will appear if you attempt to select a tillage method that was not considered typical for the type of soil (location) selected in part d (cell C15) by the Harrison County Team.

j. **Tillage method to prepare field for…*(year from e)*** (cell C21) – select from: conventional, no-till
   i. A red text warning will appear if you attempt to select a tillage method that was not considered typical for the type of soil (location) selected in part d (cell C15) by the Harrison County Team.

k. **Area considered for changing practices** (cell C22) – type the acreage on which you want to evaluate changing practices using numbers only (note: cannot exceed acres planted).
   i. This entry provides you the flexibility to evaluate changes to only part of the planted acreage.

l. **Overall weed pressure in the area considered for changing practices** (cell C23) - select from: low (no expected yield loss), medium (4-5% expected yield loss), high (9-10% expected yield loss). Expected yield losses are reported in comparison to a low weed pressure scenario.

Step 2. Describe Your Crop Management and Machinery Use

For each practice listed, select whether the practice is implemented with owned machinery, custom hired, or not implemented on your farm (rows 29 - 39).

- The spreadsheet will automatically generate the estimated machinery costs per acre (row 41) based on your selections.
- Fixed costs account for depreciation, interest, insurance, and housing
- Variable costs account for fuel, oil, and repairs
- If the total cost automatically generated (E41) does not align with your expectations, type your desired value in the yellow box (cell F41) under '*Your Machinery Cost*' to override the default cost value.

Step 3. Review and Edit Assumptions

Cells C40 - C61 provide default values for a number of assumptions within the spreadsheet. Type an alternative value in the corresponding yellow box to override a default value.

- Please read descriptions and units carefully when considering a modified value

Step 4. Review and Revise Projected Costs Per Acre and Target Yields

The '*Default value*' costs and yields (D73 - D78) reflect choices and entries above. Use the corresponding yellow box to override a default value.

Note: We strongly recommend that you save the spreadsheet after you are done making changes to the Introduction Tab and before you start Step 5.

Step 5. Evaluate How Changes in Practices Affect Weed Pressure, Costs, and Net Returns Over a 10-year Period

- Go to the "**WHAT IF**" tab by clicking on the tab directly, or using the link within Step 5 of the Introduction tab.

  Selections in this tab will allow you to compare short-term against long-term weed management strategies. The short-term and long-term strategies are grouped into the following categories:

  - **Quick Tweaks**: short-term pre-season adjustments (section B)
  - **Band-Aids**: short-term in-season adjustments (section C)
  - **Deep (Structural) Changes**: long-term adjustments that alter the way you grow crops (section D)

The specific strategies or adjustments within each of these groups for the current tool were developed in consultation with the Harrison County Team.

Before you can evaluate these potential strategies, however, you need to create a **long-term baseline scenario** in section A.

- Below provides guidance on steps A - E to select and assess changes in management practices for the 10-year period. A few notes:

  - You will only be able to modify cells highlighted in light-blue (drop-down menus) and orange (type-in cells).
  - Weed pressure cells are not adjustable; they will automatically update (both in color and text) based on practice and rotation combinations.

5A. Create a Long-term Baseline Scenario

Use the dropdown menu (cell B11) to choose one of the following baseline crop rotations for the area under consideration for changing practices: 2-year corn-soybean, 3-year corn-corn-soy, or continuous corn.

Figure 2a. Screenshot of a Long-term Baseline Scenario (zoomed into years 1 - 4 only)

A. Create a long-term baseline scenario for 2023-2032:

1. Choose a crop rotation **2-year Corn-Soybean rotation**

	Year 1	Year 2	Year 3	Year 4
	2023	2024	2025	2026
Crop	Corn	Soybeans	Corn	Soybeans
Weed Pressure	High	High	High	High
Variable Cost per acre	$512.54	$290.91	$512.54	$290.91
Fixed Cost per acre	$155.69	$150.63	$155.69	$150.63
Total Cost per acre^	$668.23	$441.54	$668.23	$441.54
Actual Yield, bu/a*	225.0	62.9	224.6	62.8
Cost per bushel^	$2.97	$7.02	$2.98	$7.03
Net Returns per Acre~	$569.27	$376.16	$567.07	$374.86

^ Costs are calculated at farm gate (excluding drying, hauling, and storage costs) and are adjusted for inflation (see section E below). Fixed costs include owned m
* Adjusted for yield trend increase (see section E below)
~ Prices for corn and soybeans are obtained from USDA Long-Term Projections (see section E below).

Total Production for 40 acres over 10 years:	Corn	Soybeans	
	44,836	12,536	bushels

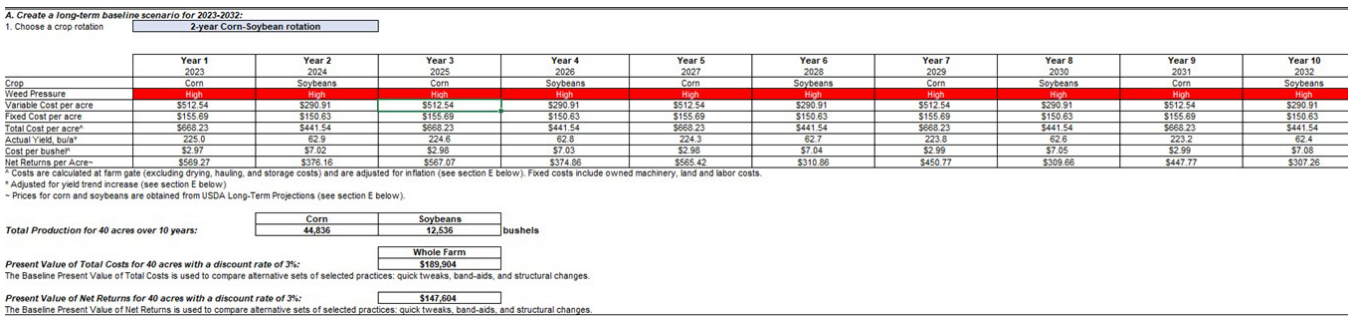
Present Value of Total Costs for 40 acres with a discount rate of 3%:	Whole Farm
	$189,904

The Baseline Present Value of Total Costs is used to compare alternative sets of selected practices: quick tweaks, band-aids, and structural changes.

Present Value of Net Returns for 40 acres with a discount rate of 3%:	
	$147,604

The Baseline Present Value of Net Returns is used to compare alternative sets of selected practices: quick tweaks, band-aids, and structural changes.

Figure 2b. Full Screenshot of a Long-term Baseline Scenario



A. Create a long-term baseline scenario for 2023-2032:

1. Choose a crop rotation **2-year Corn-Soybean rotation**

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Crop	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans
Weed Pressure	High	High	High	High	High	High	High	High	High	High
Variable Cost per acre	$512.54	$290.91	$512.54	$290.91	$512.54	$290.91	$512.54	$290.91	$512.54	$290.91
Fixed Cost per acre	$155.69	$150.63	$155.69	$150.63	$155.69	$150.63	$155.69	$150.63	$155.69	$150.63
Total Cost per acre^	$668.23	$441.54	$668.23	$441.54	$668.23	$441.54	$668.23	$441.54	$668.23	$441.54
Actual Yield, bu/a*	225.0	62.9	224.6	62.8	224.3	62.7	223.8	62.6	223.2	62.4
Cost per bushel^	$2.97	$7.02	$2.98	$7.03	$2.98	$7.04	$2.99	$7.05	$2.99	$7.08
Net Returns per Acre~	$569.27	$376.16	$567.07	$374.86	$565.42	$310.86	$450.77	$309.66	$447.77	$307.26

^ Costs are calculated at farm gate (excluding drying, hauling, and storage costs) and are adjusted for inflation (see section E below). Fixed costs include owned machinery, land and labor costs.
* Adjusted for yield trend increase (see section E below)
~ Prices for corn and soybeans are obtained from USDA Long-Term Projections (see section E below).

Total Production for 40 acres over 10 years:	Corn	Soybeans	
	44,836	12,536	bushels

Present Value of Total Costs for 40 acres with a discount rate of 3%:	Whole Farm
	$189,904

The Baseline Present Value of Total Costs is used to compare alternative sets of selected practices: quick tweaks, band-aids, and structural changes.

Present Value of Net Returns for 40 acres with a discount rate of 3%:	
	$147,604

The Baseline Present Value of Net Returns is used to compare alternative sets of selected practices: quick tweaks, band-aids, and structural changes.

The long-run baseline scenario will automatically update based on the rotation selected and the assumptions selected or inputted in the Introduction tab. Please note that there will be information for each of the **10 years**. Depending on your default computer monitor settings (i.e., zoom level), you may need to scroll to the right to see all 10 years. See Figure 2 for snapshots of a 2-year corn-soybean rotation example shown at different zoom levels.

5B. Select Quick Tweaks to Evaluate

If you would like to consider changes to **pre-season** practices, use section B to identify up to 5 Quick Tweaks (QTs) in each year. If multiple QTs are implemented in a given year, the dropdown menu options will adjust to avoid unrealistic combinations. The output reported below your selections, including differences with the long-run baseline scenario, will automatically update as QTs are selected. The QTs currently available in the tool are:

- Added tillage pass
- New burndown mix (+25%, +50%, +75%, or +100% cost)
- Added herbicide pass
- New seed-herbicide technology (+15%, +30%, or +45% cost)
- 1 year change from soybeans to corn

Important:

- Selected QTs are **NOT** assumed to be repeated annually by default and need to be selected ***every year*** in which they would be implemented.
- The spreadsheet assumes that selected QTs do NOT provide any yield recovery. That is, the QTs maintain the baseline yield trend. If you anticipate that the selected QTs will affect yields (higher or lower than the baseline trend), type the adjustment value in the yellow '*Adjust yields (+/-) bushels*' cells (row 60).
- To **remove** a selected QT, click on the cell and then use the "backspace" or "delete" button on your keyboard.

Figure 3 shows a partial screenshot for QT selections of a "New burndown mix, +25% cost" in each soybean year (years 2, 4, 6, 8, 10) and a corresponding yield adjustment of 1 bushel per acre higher than the baseline trend.

5C. Select Band-Aids to Evaluate

If you would like to consider **in-season** practice changes, use section C to identify up to 5 Band-Aids (BAs) in each year. If multiple BAs are implemented in a given year, the options will adjust to avoid unrealistic combinations. The output reported

Figure 3. Screenshot of Quick Tweak selections (zoomed into years 1 - 4 only)

	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026
Baseline Crop Rotation	Corn	Soybeans	Corn	Soybeans
Baseline Weed Pressure	High	High	High	High
Yield before Quick Tweaks	225.0	62.9	224.6	62.8
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	Corn	Soybeans	Corn	Soybeans
Weed Pressure after QT	High	High	High	High
Yield after Quick Tweaks	225.0	62.9	224.6	62.8
Adjust Yield (+/- bushels)**		1.0		1.0
Adjusted Yield after QT	225.0	63.9	224.6	63.8
Extra Variable Costs per acre	$0.00	$17.50	$0.00	$17.50
Extra Fixed Costs per acre	$0.00	$0.00	$0.00	$0.00
Total Extra Costs per acre	$0.00	$17.50	$0.00	$17.50
New Total Cost per acre	$668.23	$459.04	$668.23	$459.04
New Total Cost per bushel	$2.97	$7.18	$2.98	$7.20
New Net Returns per Acre	$569.27	$371.66	$567.07	$370.36

below your selections, including differences with the long-run baseline scenario and with QTs, will automatically update as BAs are selected. The BAs currently available in the tool are:

- Rescue spray
- Running diagnostics
- Hiring help to hand weed ($10, $20, $30, $40, or $50 per acre)
- Extra cultivation with own equipment

Important (same as for QT):

- Selected BAs are **NOT** assumed to be repeated annually by default and need to be selected ***every* year** in which they would be implemented.
- The spreadsheet assumes that selected BAs do **NOT** provide any yield recovery. That is, the BAs maintain the baseline yield trend. If you anticipate that the selected BAs will affect yields (higher or lower than the baseline trend), type the adjustment value in the yellow '*Adjust yields (+/-) bushels*' cells (row 99).
- To **remove** a selected BA, click on the cell and then use the "backspace" or "delete" button on your keyboard.

Figure 4 shows a partial screenshot for BA selections of a "Rescue spray" in years 2 and 4.

5D. Select a Deep (Structural) Change to Evaluate

Use section D to evaluate **one** Deep Change (DC). The output reported below your selection, including differences with the long-run baseline scenario and with QTs and BAs, will automatically update. The DCs currently available in the tool are:

- 4 years of corn-on-corn before soybeans
- 2 years of alfalfa before soybeans

Important:

- The first two rows (133 - 135) report the **baseline** crop, weed pressure, and yield for visual comparison. These will not change based on your DC selection.
- If you anticipate a higher or lower yield adjustment than reflected, type the adjustment value in the yellow '*Adjust yields (+/-) bushels*' cells (row 139).

Figure 5 shows a partial screenshot (years 1 - 4) for a DC from a 2 year corn-soybean rotation to 2 years of alfalfa before soybeans.

Figure 6 shows a partial screenshot (years 1 - 6) for a DC from a 2 year corn-soybean rotation to 4 years of corn before soybeans.

Figure 4. Screenshot of Band-Aid Selections (zoomed into years 1 - 4 only)

	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026
Crop Rotation before BAs	Corn	Soybeans	Corn	Soybeans
Weed Pressure before BAs	High	High	High	High
Yield before BAs	225.0	63.9	224.6	63.8
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	225.0	63.9	224.6	63.8
Extra Variable Costs per acre	$0.00	$25.00	$0.00	$25.00
Extra Fixed Costs per acre	$0.00	$0.00	$0.00	$0.00
Total Extra Costs per acre	$0.00	$25.00	$0.00	$25.00
New Total Cost per acre	$668.23	$484.04	$668.23	$484.04
New Total Cost per bushel	$2.97	$7.57	$2.98	$7.59
New Net Returns per Acre	$569.27	$346.66	$567.07	$345.36

Figure 5. Partial Screenshot of Deep Change (2 years of alfalfa)

Choose one Deep Change (DC) from the drop-down menu: **2 years of alfalfa before soybeans**

Note that costs and practices described in this Section are compared against the those from the baseline in Section A above (excluding Quick Tweaks and Band-A

	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026
Crop Rotation in Baseline	Corn	Soybeans	Corn	Soybeans
Weed Pressure in Baseline	High	High	High	High
Yield in Baseline	225.0	62.9	224.6	62.8
New Crop Rotation after DC	Corn	Alfalfa	Alfalfa	Soybeans
Weed Pressure after DC	High	Medium	Low	Low
Yield after Deep Changes	225.0	2.5	4.0	69.8
Adjust Yield (+/- bushels)**				
Manually Adjusted Yields	225.0	2.5	4.0	69.8
Extra Variable Costs per acre	$0.00	$25.21	($156.54)	($30.00)
Extra Fixed Costs per acre	$0.00	($70.43)	($83.89)	$0.00
Total Extra Costs per acre	$0.00	($45.22)	($240.43)	($30.00)
New Total Cost per acre	$668.23	$396.32	$427.80	$411.54
New Total Cost per bu or ton	$2.97	$158.53	$106.95	$5.90
New Net Returns per Acre	$569.27	-$71.32	$92.20	$495.86

** Enter minus sign before the number to indicate a yield decline

Figure 6. Screenshot of Deep Change (4 years of corn before soybeans)

Choose one Deep Change (DC) from the drop-down menu: **4 years of corn on corn before soybeans**

Note that costs and practices described in this Section are compared against the those from the baseline in Section A above (excluding Quick Tweaks and Band-Aids).

	Year 1 2023	Year 2 2024	Year 3 2025	Year 4 2026	Year 5 2027	Year 6 2028
Crop Rotation in Baseline	Corn	Soybeans	Corn	Soybeans	Corn	Soybeans
Weed Pressure in Baseline	High	High	High	High	High	High
Yield in Baseline	225.0	62.9	224.6	62.8	224.3	62.7
New Crop Rotation after DC	Corn	Corn	Corn	Corn	Soybeans	Corn
Weed Pressure after DC	High	High	High	High	Medium	Medium
Yield after Deep Changes	225.0	197.8	197.6	197.5	66.3	236.5
Adjust Yield (+/- bushels)**						
Manually Adjusted Yields	225.0	197.8	197.6	197.5	66.3	236.5
Extra Variable Costs per acre	$0.00	$269.77	$48.14	$269.77	($231.63)	$211.63
Extra Fixed Costs per acre	$0.00	$17.82	$12.76	$17.82	($5.06)	$5.06
Total Extra Costs per acre	$0.00	$287.59	$60.90	$287.59	($236.69)	$216.69
New Total Cost per acre	$668.23	$729.13	$729.13	$729.13	$431.54	$658.23
New Total Cost per bu or ton	$2.97	$3.69	$3.69	$3.69	$6.51	$2.78
New Net Returns per Acre	$569.27	$358.77	$357.67	$357.12	$430.36	$524.27

** Enter minus sign before the number to indicate a yield decline

5E. Advanced Customization

Section E allows you to customize your analysis by adjusting several "advanced" parameters and other "general assumptions".

- **Rates of change, yield drag from weed pressure, average long-run crop prices** (rows 172 - 189)
  - Use the corresponding yellow box to enter an alternative desired value.

- **Discount rate** (rows 191 - 194)
  - The discount rate is used to compare costs and revenues over time (i.e., for the present value calculations).
  - Use the blue dropdown menu (cell C194) to adjust the default discount rate.

- **General assumptions** used for baseline budgets (input rates, variable input costs, machinery assumptions, management time, etc.).
  - Go to the "General Assumptions" tab by clicking directly on the tab or using the link in row 196 of the "WHAT IF" tab.
  - If you want to use a different value than the default, enter your desired value in the corresponding orange "*Your value*" cell.

Note: We strongly recommend that you save the spreadsheet after you are done making any "Advanced Customization" changes.

Step 6. View, Print, or Save Summaries of Your Analysis

After you have identified all of the potential changes you want to evaluate simultaneously and made the appropriate customizations, you can view, print, or save the summary tables and graphs.

Summary Tables

- Go to the "Summary Table" tab by clicking on the tab directly, using the "View Summary Table" link at the bottom of the WHAT IF tab (row 197), or using the "Summary Table" link at the bottom of the Introduction tab (row 87).
- The summary tables allow comparison of the weed pressure, costs, and profits (present value of net returns) between the baseline, short-term, and long-term weed management strategies identified in Step 5.

Graphical Summaries

- Go to the "Graphical Summary" tab by clicking on the tab directly, using the "View Graphical Summary" link at the bottom of the WHAT IF tab (row 198), or using the "Graphical Summary" link at the bottom of the Introduction tab (row 88).
- The graphical summaries compare the costs by year, revenue by year, net returns by year (nominal), and present value of net returns over the 10-year period between the baseline, after Quick-Tweaks only, after Quick-Tweaks and Band-Aids, and after Deep Changes only.

We recommend that you save the file using an alternative file name each time you complete an evaluation of alternative approaches to weed management. Further, we recommend that you print a physical copy or print a digital (PDF) file of the Summary Table and Graphical Summary tabs each time you complete an evaluation. See instructions at the top of the corresponding tab for saving or printing.

Step 7. Readjust and Reassess Alternative Strategies

Repeat steps 5 and 6 to reassess and compare alternative changes to management practices on the selected farm.

Decision Tool: Budgeting Tool to Evaluate Alternative Approaches to Weed Management, www.extension.iastate.edu/agdm/crops/xls/a1-87weedmanagementalternatives_harrison.xlsx.

Funding and other acknowledgements: This tool was developed in partial fulfillment of the USDA/AFRI grant (2018-09138): "Assessment of the Socio-Economic Factors Impacting Adoption of Voluntary Pest Resistance Management by Rural Communities."

Prepared by **Alejandro Plastina**, plastina@iastate.edu
Extension Economist, Iowa State University
Alicia Rosburg, alicia.rosburg@uni.edu
Associate Professor of Economics,
University of Northern Iowa
Michael Witt, witt@iastate.edu
Field Agronomist, Iowa State University
extension.iastate.edu/agdm