



RETROSPECTIVE Soil Health Economic Calculator (R-SHEC)

Technical Manual

for Row Crop & Tree Nut versions

June 3, 2024

The research team:

Lia Raz, Case Study Author & Conservation Agronomist, AFT Water Initiative
Jen Tillman, Case Study Author & Research Scientist, AFT Water Initiative
Robert Ellis, Lead Tool Developer & Agricultural Economist, AFT Water Initiative
Ellen Yeatman, Team Leader & Agricultural Economist, AFT Water Initiative
Ben Wiercinski, Tool Advisor, Agricultural Economist, AFT Water Initiative
Michelle Perez, Toolkit Founder & Advisor, Director of AFT Water Initiative

For trouble-shooting assistance, please contact Robert Ellis at rellis@farmland.org.

Preferred citation: Yeatman, E., Ellis, R.E., Raz, L., Tillman, J., Perez, M., Wiercinski, B. (2024). *Retrospective Soil Health Calculator Technical Manual*. American Farmland Trust.

Contents

- 1. R-SHEC Tools Introduction..... 4
 - Purpose 4
 - Partial Budget Analysis Defined 4
 - Soil Health Practices Defined 5
 - Background 6
 - 2024 Row Crop Version Overview..... 6
 - 2022 Row Crop Version Overview..... 7
 - 2024 Tree Nut Version Overview 8
- 2. Row Crop R-SHEC Manual (2024)..... 9
 - Instructions & Data Entry (ReadMe tab)..... 9
 - Results & Editable PBA Tabs..... 13
 - Study Area Overview..... 16
 - Machinery 18
 - Cash Crop Inputs 20
 - Cover Crops 22
 - Other Benefits and Costs 24
 - Yield..... 25
 - Prices (2023) 26
 - Machinery Costs..... 26
 - Lists 27
 - Matrix..... 27
- 3. Tree Nut R-SHEC Manual..... 28
 - Instructions & Data Entry (ReadMe tab)..... 28
 - Orchard Info tab..... 31
 - Nutrient Mgt 31
 - Cover Crops 33
 - Mulching 34
 - Compost Application..... 35
 - Combined Practice Effects..... 35
- 4. 2022 Row Crop R-SHEC information 36
 - ReadMe tab..... 36
- 5. References..... 40

6.	Appendix	41
A.	List of data inputs for 2024 row crop R-SHEC	41
B.	List of data inputs for Tree Nut R-SHEC.....	45
C.	List of data inputs for 2022 Row Crop R-SHEC	47
D.	2024 Updates to the R-SHEC Tool	49

1. R-SHEC Tools Introduction

Purpose

The purpose of all of our Excel-based Retrospective Soil Health Economic Calculator (SHEC) tools is to use the power of Excel to produce a partial budget analysis table that presents an estimate of the annual economic effects of adopting soil health practices for you. Specifically, we developed these R-SHEC tools for ag conservation professionals, such as ourselves, to quantify the costs and benefits of soil health practice adoption experienced by already “soil health successful” row crop farmers and tree nut growers. AFT uses these R-SHEC tools to develop the partial budget analysis tables featured in the [Retrospective Soil Health Case Economic Studies](#). We currently provide the public with three SHEC Tools:

- 1) 2024 Row Crop R-SHEC
- 2) 2024 Tree Nut R-SHEC
- 3) 2022 Row Crop R-SHEC

Please see [Appendix D](#) for a description of the various 2024 updates. The accuracy of the results from all three SHEC tools relies on the user entering accurate data and in the correct location. The purpose of this user manual is intended to guide users on how to do just that for each R-SHEC tool. Access the three R-SHEC tools in our Soil Health Economic Case Study Toolkit: <https://farmlandinfo.org/rshec-toolkit/>

Partial Budget Analysis Defined

Generally speaking, a partial budget analysis is a method that “systematically displays the benefits and costs of an alternative where only changes from the baseline condition are considered” (Gordon, 2013). A PBA focuses only on variables that change. **There are two benefit subcategories: increased income and reduced costs.** Increased income may include increased crop yields, forage production, livestock production, hunting fees, tax exemptions, etc. Reduced costs may include fewer equipment passes over the field, less labor, less fertilizer, less erosion, etc. **There are two cost subcategories: decreased income and increased costs.** Decreased income may include decreased crop yields, land taken out of production, decreased crop value. Increased costs may include more expensive equipment, more passes over the field, more herbicide, etc. Importantly, once the changes from the baseline are identified, they must be converted to the **same units over the same time period**. A partial budget analysis systematically displays these four benefit and cost categories in a table, totaling the net impact as the final result. In the R-SHEC Tools, the partial budget analysis table (example pictured below) includes, for the Study Area, the annual change in total net income (\$/yr), per acre net income (\$/ac/yr), and the percent return on investment (%). Return on investment is the ratio of the total change in net income (i.e., total benefits – total costs) to decrease in income (i.e., total cost of change.)

In the R-SHEC Tools, the baseline condition is field operations under conventional management (i.e., before adoption of one or more soil health practices being analyzed), while **the alternative condition is field operations under soil health management**. In the R-SHEC Tool, we use the term “benchmark” to refer to the baseline management and “current” to refer to soil health management. In our R-SHEC Tools and the associated questionnaires used to collect the data, we ask specifically for changes in these field operations: tillage and other machinery, fertilizer, chemicals, yield, erosion, learning costs, etc. There are variations in the way we ask the questions and what data we require between the three R-SHEC Tools.

ECONOMIC EFFECTS OF SOIL HEALTH PRACTICES ON PIEDMONT AG (2023 PRICES)⁵							
Increases in Net Income				Decreases in Net Income			
Increase in Income				Decrease in Income			
ITEM	PER ACRE	ACRES	TOTAL	ITEM	PER ACRE	ACRES	TOTAL
Yield improvements by 33% for corn & 37% for soybeans due to soil health practices	\$174	500	\$86,970	None identified			
Total Increased Income			\$86,970	Total Decreased Income			\$0
Decrease in Cost				Increase in Cost			
ITEM	PER ACRE	ACRES	TOTAL	ITEM	PER ACRE	ACRES	TOTAL
Machinery cost savings due to no-till	\$43	500	\$21,743	Added chicken litter application to corn (4 tons/ac once every 3 years)	\$67	125	\$8,333
Reduced phosphorus applied by 69 lbs/acre on average due to soil health practices	\$42	500	\$21,206	Added chicken litter application to soybeans (2 tons/ac once every 3 years)	\$33	375	\$12,499
Herbicide (-26%) & insecticide (-100%) savings due to soil health practices	\$26	500	\$13,175	Rye cover crop establishment & termination costs	\$53	500	\$26,621
Lime reduction due to cover crops	\$5	500	\$2,640	Added zinc due to soil health practices	\$5	500	\$2,500
Value of decreased erosion due to soil health practices (7.3 tons soil/ac/yr)	\$19	500	\$9,558	No-till and cover crop learning activities (16 hrs/yr)			\$459
Total Decreased Cost			\$68,321	Total Increased Cost			\$50,411
Annual Total Increased Net Income			\$155,081	Annual Total Decreased Net Income			\$50,411
Total Acres In this Study Area			500	Total Acres In this Study Area			500
Annual Per Acre Increased Net Income			\$310	Annual Per Acre Decreased Net Income			\$101
Annual Change in Total Net Income = \$104,670							
Annual Change in Per Acre Net Income = \$209							
Return on Investment = 208%							

Image: Partial budget analysis table from AFT Soil Health Economic Case Study featuring Piedmont Ag of Virginia (2024.)

Soil Health Practices Defined

The table below provides the Natural Resources Conservation Service (NRCS) definitions of the soil health practices included across all three tools, along with an example of each practice (Natural Resources Conservation Service, n.d.)

Practice	NRCS Conservation Practice Standard Definition¹	NRCS Practice Code	Example
No-till	Limiting soil disturbance to manage the amount, orientation and distribution of crop/plant residue on soil surface year round.	329	Using a no-till drill to plant cash crop seed
Reduced tillage	Managing the amount, orientation, and distribution of crop/plant residue on soil surface year-round while limiting soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting	345	Disking no more than 3-inches or using vertical tillage in contrast to harrowing 1-3 times 6 to 12 inches
Conservation cover	Establishing and maintaining permanent vegetative cover.	327	Allowing native grass to grow in the alleys of tree nut orchards. Can be mowed, but not terminated.
Cover crops	Growing a crop of grasses, small grains, &/or legumes for seasonal vegetative cover and soil improvement. Note: cannot be harvested as cash crop, but can be grazed &/or hayed for forage.	340	Planting a cereal rye cover crop after corn harvest; grows through the winter; does not harvest as a cash crop.

Nutrient management (NM)	Manage rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts.	590	Adopting soil sampling, adjusting rate of N, P, K synthetic fertilizer based on soil sample results, no longer applying nutrients in the fall, applying fertilizer at planting and during the growing season (split application instead of only at planting), banding fertilizer at planting, supplementing with soil amendments and micronutrients
Mulching	Applying plant residues or other suitable materials to the land surface.	484	Using tree prunings to create mulch then spread
Compost Application	Under Soil Carbon Amendment CPS: Application of carbon-based amendments derived from plants or animal byproducts.	336	Replacing a portion of synthetic fertilizer with composted chicken litter and green waste compost
Conservation crop rotation (CCR)	Growing a planned sequence of various crops on the same ground over a period of time (i.e. the rotation cycle) for conservation purposes; thus, a CCR must be a minimum of two different crops (not including cover crops).	328	Adding cereal rye and wheat cash crops to a corn-soy rotation, so going from a 2-crop to 4-crop rotation

Background

Between 2018 and 2021, AFT’s Consulting Economist (retired NRCS-NY Economist) Florence Swartz, in collaboration with AFT’s Project Leader Michelle Perez, AFT Water Initiative Director, developed the first version of the R-SHEC tools – an almond version and a row crop (limited to barley, corn grain, corn silage, grain sorghum, hay, oats, soybean & wheat) version – building off of the NRCS Cover Crop tool developed by Lauren Cartwright and Bryon Kirwan. This initial work was supported by NRCS through a Conservation Innovation Grant. Between 2021 through 2024, NRCS continued funding this work (e.g., improving the tools and producing case studies) through a cooperative agreement. We hired three new employees to work specifically on producing more case studies and releasing 2024 versions of these tools. The almond version was expanded to work for pistachios and walnuts. The row crop version was majorly upgraded to include a lot more crops, streamline data entry, and improve the analysis of one soil health practice in particular, adoption of a conservation crop rotation (i.e., diversification of one’s crop rotation.)

Below is a high-level summary of the three publicly available R-SHEC tools to highlight the differences between the three tools, then we dive into the ins-and-outs of each tool in their respective chapters.

2024 Row Crop Version Overview

Why use this version?

If you want to use the most up-to-date values for the default cost and prices. As of 5/30/24, the default costs and prices are 2023 values.

If you want to analyze the adoption of a conservation crop rotation using your own cost and production values to estimate the change in net income. We encourage using this version of the row crop R-SHEC to analyze a conservation crop rotation, especially alongside other soil health practices.

Soil health practices

One or more or all of the following practices: conservation crop rotation, cover crops, no-till, reduced tillage, nutrient management.

Crops

Includes the crop prices and appropriate machinery options for the following crops: alfalfa, barley, canola, corn grain, corn silage, ensilage, flaxseed, grain sorghum, grass hay, millet, mustard seed, oats, rapeseed, rye, safflower, soybeans, sugar beets, sunflower seed, &/or triticale as grain.

Format

The most streamlined format of the three tools, organizing data entry by field operations, so the six data entry tabs are: Study Area Overview, Machinery, Cash Crop Inputs, Cover Crops, Other Costs & Benefits, and Yields. This format helps prevent you from duplicating data entries (compared to the previous version of the R-SHEC.)

Price Year

2023 (as of 5/30/24)

Limitations

This version uses 2023 values for the default cost and prices. Thus, any farmer-provided data must be converted into 2023 values to make sure all cost and prices are consistent.

The list of machinery and associated costs are from the University of Illinois, Urbana-Champaign FarmDoc database and Iowa State University's custom-rate survey (University of Illinois at Urbana-Champaign, 2023; Iowa State University, 2023). This is the most comprehensive cost list we could find. Because these costs are from the Midwest, they are most appropriate for use in that region.

2022 Row Crop Version Overview

Why use this version?

Great for analyzing three of the four soil health practices: cover crops, no-till, reduced tillage, and/or nutrient management. If you're ok using 2021 values for the default costs and prices.

If you want to solely analyze the adoption of a conservation crop rotation and you're okay with using the Economic Research Service (ERS) national average crop net income values to estimate the change in net income, versus using your own calculated net income (as done in the 2024 tool).

Soil health practices

Any combination of cover crops, no-till, reduced tillage, and nutrient management. This version of the tool can also analyze the adoption of a conservation crop rotation, but we advise analyzing this practice on its own NOT alongside the other soil health practices due to data discrepancies.

Crops

Includes the crop prices and appropriate machinery options for the following crops: barley, corn grain, corn silage, grain sorghum (milo), oats, soybeans, wheat, and/or hay.

Format

Not as streamlined as the new version of the row crop R-SHEC. Matches the format of the Tree Nut R-SHEC. Data entry is organized by soil health practice. There are six data entry tabs: Farm Info, Tillage, Nutrient Management, Cover Crops, Combined Practice Effects, and “ONLY CCR.” Within each soil health practice tab, the user is asked for changes in one or more of the following economic effect categories: machinery, nutrient inputs, chemical inputs, cover crops, erosion, other benefits & costs, and yields. This format results in less streamlined data entry, and risk of duplicating entries.

Price Year

2021

Limitations

This version uses 2021 values for the default cost and prices. Thus, any farmer-provided data must be converted into 2021 values to make sure all cost and prices are consistent (or vice versa.)

We discourage using this version to analyze the adoption a conservation crop rotation because it is unclear if the ERS net income values are under- or over-estimating net income by crop (Economic Research Service, 2022). Also, there is no net income estimate for corn silage, so you are unable to analyze the adoption or removal of corn silage in the crop rotation.

The list of machinery and associated costs are from the University of Illinois, Urbana-Champaign FarmDoc database and Iowa State University’s custom-rate survey (University of Illinois at Urbana-Champaign, 2021). This is the most comprehensive cost list we could find. Because these costs are from the Midwest, they are most appropriate for use in that region.

2024 Tree Nut Version Overview

Why use this version?

To analyze soil health practice adoption on almond, pistachio, and/or walnut orchards!

Soil health practices

Any combination of composting, conservation cover, cover crops, mulching, and nutrient management.

Crops

Includes the crop prices for almonds, pistachios, &/or walnuts.

Format

Same as the 2022 row crop R-SHEC version, the Tree Nut R-SHEC is organized by soil health practice. There are six data entry tabs: Orchard Info, Nutrient Management, Cover Crop, Mulching, Compost Application, and Combined Practice Effects. Within each soil health practice tab, the user is asked for changes in one or more of the following economic effect categories: machinery, nutrient inputs, chemical inputs, cover crops, erosion, other benefits & costs, and yields. With this format, you must be careful to not duplicate entries.

Price Year

2023 (as of 5/30/24)

Limitations

This version uses 2023 values for the default cost and prices. Thus, any farmer-provided data must be converted into 2023 values to make sure all cost and prices are consistent.

The list of nutrient management machinery and associated costs are from the University of Illinois, Urbana-Champaign FarmDoc database and Iowa State University's custom-rate survey (University of Illinois at Urbana-Champaign, 2023; Iowa State University, 2023). Please reach out if you have a more appropriate database for us to use for tree nut operation machinery. Currently, there is no default costs in the Tree Nut R-SHEC relating to irrigation, irrigation management, or fertigation. We do provide University of California Davis almond budgets for reference in the tool, and a link to their commodity crop budgets online to reference (University of California Davis, n.d.)

2. Row Crop R-SHEC Manual (2024)

Read the [R-SHEC Tools Introduction \(chapter 1\)](#) if you have not already done so. The majority of the following information can be found throughout the row crop R-SHEC tool (an Excel workbook) and Questionnaire (a Word document.) Examples are provided in this manual. We encourage you to watch the 30-minute training video provided in the [Soil Health Economic Case Study Toolkit](#) as well. The manual is organized by tab in the tool, describing how to use the tab and including examples as needed. There are 13 tabs in the 2024 row crop R-SHEC (listed in order): ReadMe, Results, Editable PBA, Study Area Overview, Machinery, Cash Crop Inputs, Cover Crops, Other Costs & Benefits, Yields, Prices, Machinery Costs, Lists, and Matrix. Data is collected by crop in the rotation in the 'Machinery', 'Cash Crop Inputs,' and 'Yields' tabs. **For each crop in the rotation, the farmer must have a clear understanding of average benchmark versus current field operations, including input amounts and, in some cases, costs as well.**

Instructions & Data Entry (ReadMe tab)

The row crop R-SHEC can be used with "soil health successful" row crop farmers that have adopted any combination of conservation crop rotation, cover crops, no-till, reduced till, &/or nutrient management for four or more years and within the last 15 years, on fields growing barley, canola, corn grain, corn silage, ensilage, flaxseed, forage, grain sorghum (milo), hay, millet (proso), mustard seed, oats, rapeseed, rye, safflower, soybeans, sugar beets, sunflower seed, triticale grain, and/or wheat. **The data requirements vary depending on what soil health practices are being analyzed, particularly if a conservation crop rotation is being analyzed or not.** We denote these differences more so in the sections by tab, but we do provide a table in [Appendix A](#) giving a high-level overview of what data is required versus provided.

Make sure to read the 'ReadMe' tab in its entirety. It includes general instructions, a description of each tab, and a list of data sources for the various default costs and prices used by the tool. **Here we highlight below the most important general instructions:**

- **The workbook is protected in order to protect formulas throughout the workbook.** Follow the instructions provided in the "Instructions" section on the 'Read Me' tab to unprotect individual worksheets. This is a commonly used function in Excel, so guidance is readily available online.

- Robert Ellis developed code in the Visual Basic developer tool in Excel (herein referred to as a macro) to hide tables based on the cash crop and cover crops in the rotation and if a conservation crop rotation is being analyzed or not. Thus, it is extremely important to not add or remove rows or columns because it will break the macro.
- If you are curious to learn about the formulas that Robert used throughout the workbook, particularly those using the 'Matrix' and 'Yields' tabs, you are encouraged to reach out to Robert directly: rellis@farmland.org.
- **Data entry is allowed in yellow-shaded cells.** Some data tables require data entry, which is indicated in the section titles or headers. Always read the guidance provided for each table. Alternatively, see [Appendix A](#) for a table of the data required throughout the workbook.
 - **Example:** The screenshot below is an example of a table that requires completion as indicated by the required text in the table title; however, note that one of the three variables, "crops under practice," is noted as optional in the column header.

Soil Health Practices (required)

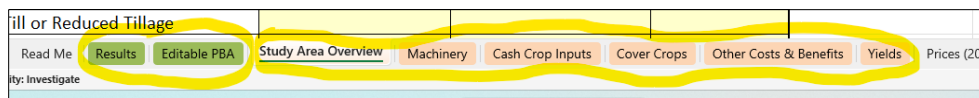
The table below controls a macro in the R-SHEC Tool that hides sections of the 'Machinery' tab based on if required if analyzing CCR.) That said, you may experience a slight delay when you select CCR as that initiates

Tips:

- (1) The definition of each soil health practice is found on the ReadMe tab.
- (2) Crops under practice is optional as this information is not used substantively in the tool.
- (3) Initial year of practice is only used by the 'Yield' tab to guide users on what timeframe to use to compare

Soil Health Practice	If analyzing, select "X" from dropdown	Crops under practice (optional)	Initial Year of Practice
No-Till or Reduced Tillage			
Nutrient Management			
Cover Crops			
Conservation Crop Rotation (CCR)			

- **Data entry occurs in the orange tabs, and the results (the PBA table) are presented in the green tabs.** See the screenshot below.
 - The orange tabs are all "protected" to ensure that users do not break the formulas used to calculate the per acre costs and benefits auto populated into the 'Results' tabs.
 - The two green tabs, 'Results' and 'Editable PBA' are identical. The 'Results' tab is protected and should not be messed with. While the 'Editable PBA' tab is for the user to clean up their PBA table for publication.



- **Blue highlighted sections indicate the "benchmark" scenario. Green highlighted sections indicate the "current" scenario.** See screenshot below.
 - As described in the introduction, the R-SHEC estimates changes in field operation costs and benefits with the adoption of soil health practice(s) on average comparing:
 - "benchmark" operations = before adoption of soil health practices
 - "current" operations = after adoption of soil health practices.

Benchmark Fertilizer Applied by Crop	
Nitrogen (Lbs/Ac)	
Phosphorus (Lbs/Ac)	
Potassium (Lbs/Ac)	
Other Fertilizer (\$/Ac)	
Fertilizer forms used <i>(optional)</i>	
Benchmark Fertilizer Cost (\$/Ac)	\$
Current Fertilizer Applied by Crop	
Nitrogen (Lbs/Ac)	
Phosphorus (Lbs/Ac)	
Potassium (Lbs/Ac)	
Other Fertilizer (\$/Ac)	
Fertilizer forms used <i>(optional)</i>	
Current Fertilizer Cost (\$/Ac)	\$
Benchmark Manure/Compost Applied by Crop	
Manure Type <i>(optional)</i>	
Manure (Tons/Ac)	
Compost Type <i>(optional)</i>	
Compost (Tons/Ac)	
Benchmark Manure/Compost Cost (\$/Ac)	\$
Current Manure/Compost Applied by Crop	
Manure Type <i>(optional)</i>	

- We encourage users to review and, ideally, **complete the row crop R-SHEC Questionnaire** provided in the Toolkit so that data needed to conduct an accurate partial budget analysis in the R-SHEC is organized and at-hand for data entry. **For each crop in the rotation, the farmer must have a clear understanding of average benchmark versus current field operations, including input amounts and, in some cases, costs as well.**
- **The R-SHEC uses a combination of farmer-provided data and standardized cost and price data built into the tool.** Whenever possible, national prices or costs are used to avoid biasing the results in cases where the farmer's prices may not be representative of typical prices. However, the user does have the option to use the farmer's own prices for fertilizer, crops, custom-hire operations, and machinery type & per acre cost. The R-SHEC relies on the farmer to provide chemical prices as we do not provide national average default chemical costs due to the variety and wide spectrum. Default prices and their sources are listed on the 'Prices' and 'Machinery Costs' tabs (see table below with [list of data sources](#)) and [Appendix A](#) provides a list of all the data entry in the R-SHEC, identifying the units and what is required versus optional.

About Individual Worksheets (aka 'Tabs')

- 1. Results & Editable PBA:** Identical tabs presenting the results of the partial budget analysis. The PBA table will auto-populate as the orange data-entry tabs are completed. The 'Results' tab is protected and should not be edited, while the 'Editable PBA' tab is for the user to edit the PBA table for sharing.
- 2. Study Area Overview:** The foundational information used throughout the tool is captured here. The Study Area should only include farm acres following the same crop rotation and field operations on average.
- 3. Machinery:** Captures difference in machinery costs by per acre cost and number of passes over the field "before" versus "after" (benchmark versus current) soil health practice adoption. Number of tables automatically adjusts to the current rotation detailed on the 'Study Area Overview' tab. If

there is a change in the benchmark and current crop rotation (i.e., a conservation crop rotation), user has to enter all benchmark and current machinery. If there is no change in crop rotation, user only enters machinery for operations that changed.

4. **Cash Crop Inputs:** Captures by crop changes in inputs, excluding the associated machinery costs as equipment costs are captured on the "Machinery" tab. If there is a change in the benchmark and current crop rotation (i.e., a CCR), user has to enter all benchmark and current inputs by crop. If there is no change in crop rotation, user only enters inputs for operations that changed.
5. **Cover Crops:** Captures costs of cover crops, including inputs and machinery. Captures benefits of cover crops via haying for forage or grazing practices.
6. **Other Costs & Benefits:** Captures the value of reduced erosion, educational activities, financial assistance received for soil health practices, and a catch-all "other" costs and benefits table. **Note: Any financial assistance payments listed are not included in the results because cost-share is temporary and not received by all.**
7. **Prices:** Contains prices used throughout the workbook and relevant Producer Prices Paid and Received Index (PPI & PRI) for updating prices as needed. Provides references to all price data sources in more detail than as listed on the 'ReadMe' tab.
8. **Machinery Costs:** Contains per acre machinery costs used in 'Machinery', 'Cover Crops', and 'Yields' tabs.
9. **Lists:** This worksheet contains lists used in drop-down menus throughout the workbook.

Data sources for default values

This table is provided on the 'ReadMe' tab. It is a compilation of the data sources for the default values used throughout the 2024 row crop R-SHEC.

Item	Release Date	Source
Crop Prices, Non-organic	February	USDA NASS. (February 26, 2024). <i>Crop Values: 2023 Summary</i> . Retrieved on March 20, 2024 from https://usda.library.cornell.edu/concern/publications/k35694332
Crop Prices, Organic	Biennially (or less)	USDA NASS. (2022, December 15). <i>Certified Organic Survey 2021 Summary: Table 13. Certified Organic Field Crops and Hay Harvested and Value of Sales: 2021 Organic Survey</i> . Retrieved April 16, 2024, from https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Organic_Production/index.php
Fertilizer Prices	January	Iowa State University Extension and Outreach. (2020-2024). <i>Ag Decision Maker: Estimated Costs of Crop Production in Iowa (File A1-20)</i> . Retrieved on February 6, 2024 from https://www.extension.iastate.edu/agdm/crops/html/a1-20.html
Labor Rate, Farm Manager	April	U.S. Bureau of Labor Statistics. (April 3, 2024). 45-1011 First-Line Supervisors of Farming, Fishing, and Forestry Workers - Occupational Employment and Wages, May 2023. Retrieved May 8, 2024, from https://www.bls.gov/oes/current/oes451011.htm
Machinery Cost Estimates	Biennially	University of Illinois at Urbana-Champaign Department of Ag and Consumer Economics. (September 2023). <i>Farm Business Management Machinery Cost Estimates: Field Operations</i> . Retrieved on November 28, 2023 from https://farmdoc.illinois.edu/management#handbook
Machinery Costs for Fertilizer Applications	March	Iowa State University Extension and Outreach. (March 2023). <i>Ag Decision Maker: 2023 Iowa Farm Custom Rate Survey (File A3-10)</i> . Retrieved on November 28, 2023 from https://www.extension.iastate.edu/agdm/crops/html/a3-10.html

Machinery Cost Estimates for Harvest	Biennially	University of Illinois at Urbana-Champaign Department of Ag and Consumer Economics. (Sept 2023). Farm Business Management Machinery Cost Estimates: Forage Field Operations. Retrieved on March 28, 2024 from https://farmdoc.illinois.edu/handbook/forage-operations
Prices Paid Index	Monthly	USDA NASS. (Ongoing). <i>Prices Paid: Indexes for All Items and Production Items by Month - United States</i> . Retrieved February 6, 2024, from https://www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/index.php
Prices Received Index	Monthly	USDA NASS. (Ongoing). <i>Prices Received: Indexes for Ag, Crop, and Livestock Production by Month - United States</i> . Retrieved February 6, 2024, from https://www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/index.php
Drying, Storage, and Trucking Cost	March	University of Kentucky Department of Agricultural Economics. (March 2024). Corn and Soybean Budgets - 2024. Retrieved on April 14, 2024 from https://agecon.ca.uky.edu/budgets
Drying, Storage, and Trucking Cost	February	North Dakota State University Extension. (February 2024). Projected 2024 Crop Budgets. Retrieved on April 14, 2024 from https://www.ndsu.edu/agriculture/sites/default/files/2024-02/2024%20North%20Central%20ND%20Projected%20Crop%20Budget%20-%20PDF.pdf
Drying, Storage, and Trucking Cost	October	University of Missouri Extension. (October 2023). Missouri Forage Budget. Retrieved on April 14, 2024 from https://extension.missouri.edu/programs/agricultural-business-and-policy-extension/missouri-crop-and-livestock-enterprise-budgets
Drying, Storage, and Trucking Cost	Indeterminant	University of Idaho Extension. (2022). 2022 Sugarbeet Enterprise Budget: Southwestern Idaho. Retrieved on April 14, 2024 from https://www.uidaho.edu/-/media/uidaho-responsive/files/cals/programs/idaho-agbiz/crop-budgets/southwest/2022-sugarbeet-budget-southwestern-idaho.pdf?la=en&rev=7d4ad1906ef84c7eb6796e9c8d81f1f0

Results & Editable PBA Tabs

The 'Results' and 'Editable PBA' tabs are identical. Both tabs present the partial budget analysis (PBA) results using data from each input tab (orange) and placing them in the correct quadrant of the PBA table to determine annual total and per acre change in net income weighted average and return on investment. If there are errors (e.g., "#DIV/0!"), you most likely need to complete data entry on respective orange tab relating to the the NRCS CPS number in columns A and K on the 'Results' tab. Reference the [R-SHEC Tools Introduction – PBA Defined section](#) for a description of the PBA. The 'Results' tab should never be unprotected to save results to reference. DO NOT attempt to edit the table as it contains complex formulas. The user risks losing the calculated effect information if the formulas are broken. The 'Editable PBA' tab is identical to the 'Results' tab and can be used for viewing the formulas to interpret the results and producing a version of the table for publication. If any mistakes are made on the 'Editable PBA' tab, you have the 'Results' tab to copy again. Follow the instructions on the 'Editable PBA' tab to edit the PBA table for sharing. Also, watch our training video provided in the [Toolkit](#), using the timestamps to skip to the end where we show you how to edit the PBA.

Interpretation of Results

Interpretation of the results can be tricky. The per acre economic effects are weighted averages. Generally speaking, a weighted average is the average of values which are scaled by impact. In this case, the weighted average is the sum of each per acre change multiplied by the acres impacted, then divided by the sum of all acres. The weighted averages are calculated at the end of applicable orange tabs. When there is a change in crop rotation, acres are divided between acres that stayed in one crop and acres that switched, according to the annual acres breakdown provided in the 'Study Area Overview' tab for the

benchmark and current crop rotation(s). When the changes in field operations and resulting economic effects due to soil health practice adoption vary between crops (as they usually do), the acres will be limited to the acres in that crop consistent between the benchmark and current crop rotation. Below we review two examples; these examples will be used throughout the manual.

1) **Example 1:** In this example, which we will refer to as “Demo Farm NO CCR,” the benchmark and current crop rotation is 3-years corn grain and 2-years soybeans on 500-acres. Thus, on average 300 acres are in corn and 200 acres are in soybeans annually. This is calculated based on the number of years in rotation, a calculation we explain in the ‘Study Area Overview’ tab. The soil health practices analyzed are the adoption of no-till from conventional till on corn and soybeans, a change in nutrient management, and the adoption of cover crops across all acres (planted every fall after both corn and soybean harvest.)

- Explanation of results for Example 1:** For increase in income, there is a corn yield increase attributed to soil health practices resulting in a \$109.81 increase in per acre income. This is then multiplied across 300 acres - the annual average acres in corn. For machinery cost savings, \$39.36/ac is a weighted average savings considering the different corn and soybean per acre cost savings of \$42.68/ac and \$34.38/ac, respectively, then applied to all 500 acres. This breakdown is presented at the end of the ‘Machinery’ tab. For other decreases in cost, fertilizer cost savings only occurred on corn, and pesticide cost savings only occurred on soybeans; hence the variation in acres that these savings are applied to. For cover crop costs, \$112.72/ac is a weighted average cost considering the different cover crop costs as different cover crops were planted after corn versus after soybeans (\$104.69/ac and \$124.76/ac.) We encourage all users to reference the associated tabs to help interpret the results.

Economic Effects of Soil Health Practices on Demo Farm NO CCR (2023 Prices)							
Increases in Net Income				Decreases in Net Income			
Increase in Income				Decrease in Income			
Item	Per Acre	Acres	Total	Item	Per Acre	Acres	Total
Yield increase due to all practices except CCR	\$109.81	300	\$32,944	None identified			
Total Increased Income			\$32,944	Total Decreased Income			\$0
Decrease in Cost				Increase in Cost			
Item	Per Acre	Acres	Total	Item	Per Acre	Acres	Total
Machinery cost savings due to reduced tillage and nutrient management	\$39.36	500	\$19,678	Soil health practices learning activities (24 hrs/yr)			\$702
Fertilizer cost decrease due to nutrient management	\$12.55	300	\$3,765	Cover crop cost	\$112.72	500	\$56,359
Pesticide cost savings due to adopting cover crops	\$20.00	200	\$4,000				
Decrease in soil erosion due to soil health practices	\$2.66	500	\$1,328				
Total Decreased Cost			\$28,771	Total Increased Cost			\$57,061

2) **Example 2:** In this example, which we will refer to as “Demo WITH CCR,” there is a change in crop rotation, which we consider an adoption of a conservation crop rotation. The benchmark crop rotation is 3-years corn grain and 2-years soybeans on 500-acres. The current crop rotation includes the addition of 1-year spring wheat. To account for the annual impact with a longer rotation, the acres per year in corn and soybean changes, reducing from 300 and 250 to 250 and

167 acres, respectively – a difference of 83 acres, the calculated annual average acres in wheat. These calculations are explained in the ‘Study Area Overview’ tab. See screenshot below.

Benchmark Rotation-Cash Crop						
Crop <i>(select from dropdown)</i>	# Years in Rotation	Acres Per Year	Planting Date	Harvest Date	Tillage Method <i>(select from dropdown)</i>	If double crop, select "X" from dropdown
Corn Grain	3	300	5/1	9/15	Conventional	
Soybeans	2	200	5/28	10/1	Conventional	
Total (Study Area)	5	500				
Current Rotation-Cash Crop						
Crop <i>(select from dropdown)</i>	# Years in Rotation	Acres Per Year	Planting Date	Harvest Date	Tillage Method <i>(select from dropdown)</i>	If double crop, select "X" from dropdown
Corn Grain	3	250	5/1	9/15	No-Till	
Soybeans	2	167	5/28	10/1	No-Till	
Wheat, other spring	1	83	10/15	4/25	No-Till	
Total (Study Area)	6	500				

- Explanation of results for Example 2:** Alongside adding no-till wheat to the crop rotation, the soil health practices analyzed are the adoption of no-till from conventional till on corn and soybeans, a change in nutrient management, and the adoption of cover crops across all acres. **The results are slightly different from Example 1 due to the addition of wheat to the rotation.** For increase in income, the corn yield increase attributed to soil health practices is now multiplied across just 250 acres as this yield increase only benefits the current acres in corn. For machinery cost savings, the per acre weighted average savings is the same, but now applied to just 417 acres (the sum of 250 and 167 acres) as this machinery cost savings only benefits the current acres in corn and soybean. The same acreage adjustment goes for the fertilizer cost decrease and pesticide cost savings.

The increase in net income due to the conservation crop rotation is the difference between the per acre net income of wheat compared to benchmark corn and soybean per acre net incomes as a weighted average, considering 50 acres of corn shifted to wheat and 33 acres of soybeans shifted to wheat. Interpreting the results of more complicated changes in crop rotation can be difficult. **We encourage you to reference the output tables on the ‘Yields’ tab to compare current and benchmark per acre net income calculations.**

Economic Effects of Soil Health Practices on Demo WITH CCR (2023 Prices)							
Increases in Net Income				Decreases in Net Income			
Increase in Income				Decrease in Income			
Item	Per Acre	Acres	Total	Item	Per Acre	Acres	Total
Yield increase due to all practices except CCR	\$109.81	250	\$27,453	NA	NA	NA	NA
Increase in net income due to the conservation crop rotation	\$128.83	83	\$10,732	NA	NA	NA	NA
Total Increased Income			\$38,185	Total Decreased Income			\$0
Decrease in Cost				Increase in Cost			
Item	Per Acre	Acres	Total	Item	Per Acre	Acres	Total
Machinery cost savings due to reduced tillage and nutrient management	\$39.35	417	\$16,399	Soil health practices learning activities (24 hrs/yr)			\$702
Fertilizer cost decrease due to nutrient management	\$12.55	250	\$3,138	Cover crop cost	\$112.72	500	\$56,359
Pesticide cost savings due to adopting cover crops	\$20.00	167	\$3,334	Soil sampling cost increase due to all soil health practices except CCR	\$2.50	417	\$1,042
Decrease in soil erosion due to soil health practices	\$2.66	500	\$1,328				
Total Decreased Cost			\$24,199	Total Increased Cost			\$58,102

Footnotes:

Footnotes are provided in both the 'Results' and 'Editable PBA' tabs, but should only be edited in the 'Editable PBA' tab. If any errors are made on the 'Editable PBA' tabs, the user can copy the template preserved on the 'Results' tab. The footnotes should be included with the final PBA table for sharing. Follow the instructions highlighted in yellow next to the footnotes.

Study Area Overview

The 'Study Area Overview' tab records the farmer name, name of farm, location, study area acres, organic Y/N (required; default is non-organic), soil health practices (required), benchmark and current crop rotations (required), and farmer's nutrient costs, crop prices, & custom-hire costs. See [Appendix A](#) for information by variable.

Soil Health Practice Table

The purpose of this table is three-fold: (1) it controls a macro in the R-SHEC Tool that hides sections of the 'Machinery' tab based on if a CCR is being analyzed or not (e.g., harvest machinery is only required if analyzing CCR; details on this provided in 'Machinery' section); (2) provides a place for the user to note what soil health practices (on what crops) are being analyzed in the R-SHEC; and (3) forces the user to consider the year(s) of practice adoption, as this comes into play on the 'Yields' tab to guide users on what timeframe to use to compare benchmark and current crop yields.

Study Area Crop Rotation Table

Complete both the Benchmark and Current crop rotation tables, even if the crop rotation did not change. This table controls the majority of the macros in the R-SHEC Tool, matching the number of rows/columns based on the number of crops. That said, you will experience slower processing (the "thinking" circle) as you complete the below table, particularly the acres by crop and when the rotation includes more than three crops. Tips are provided in the tool to guide you. Below are these tips with some additional information:

- The crop rotation information should reflect the Study Area acres. The Study Area should only include farm acres following the same crop rotation and field operations on average.

- If there is no conservation crop rotation being analyzed, enter identical crop rotation information for Benchmark and Current tables.
- Double cropping is the establishment and harvest of a second crop the same season that a first crop is harvested. Mark “X” next to the two crops harvested in the same year. The formulas are set up to adjust the total acres sum formula to not double-count acres with a double crop. If the user forgets to mark “X” next to both crops, the formula should still work when “X” marks at least one of the two crops harvested in the same year.
- We provide calculated acres per year by crop in the Acres Calculators to the right of these tables for your reference. To annualize the crop rotation, you can calculate average annual acres of each crop in the rotation by dividing the total acres in the rotation by the number of years in rotation, then multiply by the number of years that a specific crop is in rotation: e.g., if the Study Area is 400 acres with a 4-year crop rotation (2-corn, 1-wheat, 1-soybeans), then user enters 200 acres for corn $[(400/4) * 2]$, 100 acres in wheat, and 100 acres in soybeans $[(400/4)*1]$.
- Only enter a crop once per rotation and adjust the number of years and acres appropriately. However, you can enter a crop more than once in a rotation IF that crop is managed differently. For example, some farmers grow small grains as both a cash crop and a silage crop, so you would treat those different.
 - Sometimes a crop grown doesn’t fit into the cash crop or cover crop categories. For example, if a small grain is interseeded into hay after the 3rd cutting, this is an additional cost and yield bump. There are various ways to enter this information into the tool, such as adding it to the cover crop information table and capturing additional revenue in the haying of cover crops table on the ‘Cover Crops’ tab and any additional costs alongside the hay costs captured in the ‘Machinery’ tab or in the haying of cover crops table.

Study Area Cover Crop Information

If analyzing the adoption of cover crops, the user MUST complete the table below as this information is used on the 'Cover Crops' tab. The R-SHEC is setup to only analyze the adoption of cover crops (assumes no cover crop in benchmark); it cannot analyze changes to cover crop management, including switching cover crop species, establishment methods, termination methods, etc. unless the change is calculated outside of the tool and you input just the change in costs and benefits.

Tips are provided in the tool to guide you. Below are these tips with some additional information:

- The user may enter the same cover crop twice if it is used before/after different crops in the crop rotation. Review the 'Cover Crops' tab to understand what data is required by cover crop species.
- Enter the average acreage planted by cover crop species (e.g., if farmer only plants every other row in certain cover crop, enter half the cash crop acreage).
- You may experience slower processing as you complete this table as a macro is activated to adjust the number of cover crop tables on the 'Cover Crops' tab.

Farmer-Provided Prices and Costs

First, assess the default prices and costs in the tool by visiting the ‘Prices’ and ‘Machinery Costs’ tabs, or better yet downloading the PDF copy of the ‘Prices’ and ‘Machinery Costs’ provided in the [Toolkit](#). If you want to use farmer-provided values instead of the default prices and crops in the tool, you enter those values in this table, and they will be used throughout the workbook. If no values are entered in this

table, national average prices and costs will be used throughout the workbook. For the value of cover crop as forage, the default value is the price of grass hay. Note that if manure or compost is part of the field operations being analyzed, farmer-provided cost per ton is required. This cost per ton can include the spreading cost. Alternatively, there are fertilizer and manure machinery and associated costs to choose from on the 'Machinery' tab.

Machinery

The 'Machinery' tab calculates the increases and decreases in tillage, planting, chemical, nutrient, &/or harvest machinery costs. **Make sure to read the 'Machinery' tab in its entirety before beginning data entry.** Users select from a dropdown list of machinery and enter the number of passes per year. The number of tables shown will correspond to the number of crops in the crop rotation provided in the 'Study Area Overview' tab. Presented in the 'Summary of Changes in Machinery Costs' table at the end of this tab is the calculated changes in machinery cost on an annual per acre basis and for the entire Study Area, by crop and as a weighted average for the Study Area. If analyzing a conservation crop rotation (CCR), you must provide all benchmark and current machinery - even if there is no difference - because when acreage shifts from one crop to another crop, we need to estimate a per acre net income for each crop impacted. This allows the RSHEC to quantify the change in Study Area net income due to a CCR. However, if a new crop is being introduced as part of a CCR, then just list the "current" machinery as there is no benchmark. If NOT analyzing a CCR, the harvest machinery rows are hidden and you only need to provide benchmark and current machinery operations that changed due to the adoption of the other soil health practices. Here are some examples of when to enter all benchmark and current machinery versus only what changed:

1. **Example 1:** As before, this example has no change in crop rotation. The before and after is a 3-year corn and 2-year soybean rotation across 500 acres. Harvest machinery is not required because that is assumed to have not changed due to soil health practices. With the adoption of no-till and cover crops though, the farmer has switched tillage and planting machinery types and is doing one less herbicide spray pass due to cover crop providing weed suppression. See how the data has been entered for Corn Grain in the screenshot below.

Benchmark Cash Crop 1: Corn Grain				Current Cash Crop 1: Corn Grain			
Benchmark Tillage:		Conventional		Current Tillage:		No-Till	
Benchmark Years in Rotation:		3		Current Years in Rotation:		3	
Benchmark Acres:		300.0		Current Acres:		300.0	
Cash Crop 1 Benchmark Tillage Machinery <i>(select from dropdown)</i>	Cost/Ac	# Passes/Yr	Total Cost/Ac	Cash Crop 1 Current Tillage Machinery <i>(select from dropdown)</i>	Cost/Ac	# Passes/Yr	Total Cost/Ac
Chisel Plow, 15 ft	\$18.28	1.0	\$18.28		\$0.00		\$0.00
Tandem disk, 23 ft. 7 in.	\$19.30	1.0	\$19.30		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
			\$37.58				\$0.00
Cash Crop 1 Benchmark Planting Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac	Cash Crop 1 Current Planting Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac
Conventional planter, 8-row	\$22.00	1.0	\$22.00	No-till planter (30" rows), 8-row	\$22.60	1.0	\$22.60
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
			\$22.00				\$22.60
Cash Crop 1 Benchmark Chemical & Nutrient Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac	Cash Crop 1 Current Chemical & Nutrient Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac
Self-propelled sprayer (High-crop ready), 80 ft boom	\$5.70	3.0	\$17.10	Self-propelled sprayer (High-crop ready), 80 ft boom	\$5.70	2.0	\$11.40
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
			\$17.10				\$11.40
			Total \$/Ac				Total \$/Ac
			\$76.68				\$34.00

2. **Example 2:** As before, this example has a change in crop rotation, analyzing the adoption of a conservation crop rotation. The benchmark crop rotation is 3-years corn grain and 2-years soybeans on 500-acres. The current crop rotation adds 1-year spring wheat. The annual average acreage in corn reduces from 300 to 250 acres and in soybeans from 250 acres to 167 acres, resulting in 83 in wheat acres.

Benchmark Cash Crop 1: Corn Grain				Current Cash Crop 1: Corn Grain			
Benchmark Tillage: Conventional				Current Tillage: No-Till			
Benchmark Years in Rotation: 3				Current Years in Rotation: 3			
Benchmark Acres: 300.0				Current Acres: 250.0			
Cash Crop 1 Benchmark Tillage Machinery (select from dropdown)	Cost/Ac	# Passes/Yr	Total Cost/Ac	Cash Crop 1 Current Tillage Machinery (select from dropdown)	Cost/Ac	# Passes/Yr	Total Cost/Ac
Chisel Plow, 15 ft	\$18.28	1.0	\$18.28		\$0.00		\$0.00
Tandem disk, 23 ft, 7 in.	\$19.30	1.0	\$19.30		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
			\$37.58				\$0.00
Cash Crop 1 Benchmark Planting Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac	Cash Crop 1 Current Planting Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac
Conventional planter, 8-row	\$22.00	1.0	\$22.00	No-till planter (30" rows), 8-row	\$22.60	1.0	\$22.60
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
			\$22.00				\$22.60
Cash Crop 1 Benchmark Chemical & Nutrient Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac	Cash Crop 1 Current Chemical & Nutrient Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac
Self-propelled sprayer (High-crop ready), 80 ft boom	\$5.70	3.0	\$17.10	Self-propelled sprayer (High-crop ready), 80 ft boom	\$5.70	2.0	\$11.40
Fertilizer application, liquid, spraying	\$8.00	1.0	\$8.00	Fertilizer application, liquid, spraying	\$8.00	1.0	\$8.00
Cash Crop Chemical Application (custom-hire cost)	\$30.00	1.0	\$30.00	Cash Crop Chemical Application (custom-hire cost)	\$30.00	1.0	\$30.00
	\$0.00		\$0.00		\$0.00		\$0.00
			\$55.10				\$49.40
Cash Crop 1 Benchmark Harvest Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac	Cash Crop 1 Current Harvest Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac
Combine corn grain 8-row (30") head	\$55.30	1.0	\$55.30	Combine corn grain 8-row (30") head	\$55.30	1.0	\$55.30
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00		\$0.00
			\$55.30				\$55.30
			\$169.98				\$127.30

Now you have to provide harvest machinery and any additional machinery used even if it is the same in the before and after. This is because we want to accurately capture the impact on net income when 50 acres in corn grain is now in wheat, and 33 acres in soybeans is now in wheat. In order to calculate the change in net income, we need to estimate the benchmark corn grain and benchmark soybean per acre net income and current wheat per acre net income.

3. **Example 3:** What about adding a double crop? Adding a double crop is indeed a conservation crop rotation, but it is analyzed differently if the benchmark is winter fallow. For example, the benchmark crop rotation is 3-years corn grain and 2-years soybeans on 500-acres. The current crop rotation adds 1-year winter wheat after corn and before, now, double-cropped soybeans. The winter wheat is harvested in July and a soybean crop is planted and harvested later in the year. In this example, the data entry is exactly the same as in Example 1 for corn grain and soybean where only changes in machinery are entered. This is because the tool uses the matrix to indicate that all new costs and benefits for current wheat is compared no crop before, since it was winter fallow before and no corn or soybean acreage is taken out of production.

Interpretation of results

The 'Summary of Machinery Costs' table at the end of the 'Machinery' tab summarizes the benchmark and current total machinery cost by crop in per acre and per year (i.e., per acre multiplied by crop acres, taking into consideration if there is a change in crop rotation or double crop.) The per year values are summed to estimate the study area total. The last two rows present the total study area weighted average change in all machinery costs across all crops. Two categories of weighted averages are provided: the first being the weighted average considering only changes on acres with the same before/after crop, while the second being the weighted average considering only changes on acres with

different before/after crops. If not analyzing a CCR, only the first weighted average applies because there is no change in crop rotation analyzed.

If there is a CCR, the table below the summary table is for reference to help you understand the two weighted average changes in machinery costs. In **Example 2 (Demo WITH CCR)**, this table (screenshot below) shows the non-CCR acres are the 250 acres that stayed in corn and 167 acres that stay in soybeans between the benchmark and current scenarios. The “CCR Acres” are those acres that switched from one crop to another, so in this case 50 corn acres and 33 soybean acres went to wheat, which is considered in the weighted average. The weighted average formula in this case is:

FOR USER REFERENCE ONLY:
The tables below is simply for reference to help users understand the above weighted average change in machinery costs breakdown.

Crop	Non-CCR Acres	Non-CCR Change by Crop	Non-CCR Total Change
Corn Grain	250	\$ (42.68)	\$ (10,668.76)
Soybeans	167	\$ (34.38)	\$ (5,740.63)
Wheat, other spring	0	\$ -	\$ -
		-\$39.35	-\$16,409.39

Crop	CCR Acres	CCR Change by Crop	CCR Total Change
Corn Grain	0	\$ -	\$ -
Soybeans	0	\$ -	\$ -
Wheat, other spring	83	\$ (63.33)	\$ (5,256.23)
		-\$63.33	-\$5,256.23

$$\begin{aligned}
 & (\text{Wheat Current } \$/\text{Ac}, \$91.30 - \text{Corn Grain Benchmark } \$/\text{Ac}, \$169.98) * (\text{Switched acres}, 50) + (\text{Wheat Current } \$/\text{Ac}, \$91.30 - \text{Soybean Benchmark } \$/\text{Ac}, \$131.38) * (\text{Switched acres}, 33) / (\text{Sum of affected acres}, 83) \\
 & = \text{Weighted average change, } -\$63.33
 \end{aligned}$$

We encourage users to use the ‘Machinery’ tab on its own to analyze changes in machinery operations generally (with or without the adoption of soil health practices.)

Cash Crop Inputs

The ‘Cash Crop Inputs’ tab calculates the increases and decreases in seed, soil sampling, nitrogen, phosphorus, potassium, other fertilizer, manure, compost, herbicide, insecticide, & fungicide costs. **Make sure to read the tab in its entirety before beginning data entry.** The number of tables and columns shown will correspond to the number of crops in the crop rotation provided in the 'Study Area Overview' tab. If analyzing a conservation crop rotation (CCR), you must provide all benchmark and current input costs - even if there is no difference - because when acreage shifts from one crop to another crop, we need to estimate a per acre net income for each crop impacted. This allows the R-SHEC to quantify the change in Study Area net income due to a CCR. If NOT analyzing a CCR, you only need to provide benchmark and current input costs that changed due to the adoption of the other soil health practices. Presented in the 'Summary of Changes in Input Costs' table at the end of this tab is the calculated changes in input costs on an annual per acre basis by crop and as a weighted average for the Study Area. In this table, the user must select from the dropdown list which soil health practice(s) they attribute to the calculated changes as that feeds into the 'Results' partial budget analysis table.

We encourage users to use this tab on its own to analyze changes in inputs generally (with or without the adoption of soil health practices.)

Cash Crop Seed Costs

If you want to capture a change in cash crop seed costs, you must enter the per acre cost by crop. If analyzing a CCR, you must provide all benchmark and current seed costs as it is part of the crop net

income calculation. If NOT analyzing a CCR, you only need to provide benchmark and current seed costs that changed due to the adoption of the other soil health practices (e.g., increased seeding rate with switch to no-till.)

Soil Sampling Costs

If you want to capture a change in soil sampling costs, you must enter the average cost per sample(s) and average number of sample(s) per acre. If you know \$/yr soil sampling costs and # samples, you can back-calculate these values. If analyzing a CCR or not, you only need to provide benchmark and current soil sampling costs that changed due to the adoption of the soil health practices.

Nutrient Costs

The user is asked to input benchmark and current pounds per acre of nitrogen, phosphorus, &/or potassium applied by crop, which is then multiplied by N, P, & K prices per pound. Similarly, the user is asked to input benchmark and current tons per acre of manure &/or compost applied by crop, which is then multiplied by the farmer-provided price (required to be input on the 'Study Area Overview' tab.) Remember: if analyzing CCR, enter benchmark and current fertilizer applied to each crop. If not analyzing CCR, you only need to provide benchmark and current fertilizer costs that changed due to the adoption of the other soil health practices. **Below we've included and made some additions to the tips section:**

- Do not include the machinery cost for applying fertilizer, manure, or compost, as that should be captured on the 'Machinery' or 'Cover Crops' tabs.
- If the user does not want to use the default national 5-year average N, P, & K prices per pound, the user must provide their preferred price(s) on the 'Study Area Overview' farmer-provided prices table.
- In addition to entering benchmark and current pounds per acre of N, P, &/or K applied by crop, the user could enter a \$/ac fertilizer cost by crop. This could be useful if the farmer does not know their N, P, K lbs/acre on average by crop, but they do know total fertilizer input cost by crop; or they apply a micronutrient blend in addition to N, P, &/or K.
- If the user applies manure &/or compost, it is required to provide manure/compost prices (\$/ton) in the 'Study Area Overview' farmer-provided prices table as there are no national averages in this tool. This cost per ton can include the spreading cost. Alternatively, there are fertilizer and manure machinery and associated costs to choose from on the 'Machinery' tab.
 - Farmer-provided manure and compost prices auto-populate in rows 94 and 97, but they are hidden just to save room.
- If the user is analyzing the adoption of cover crops, do not include additions of fertilizer inputs applied to cover crops here. They must only be on the 'Cover Crops' tab. Be careful not to double-count fertilizer inputs.
- The 'Nutrient Prices Used' table auto-updates to show farmer-provided prices if applicable, otherwise the default values are shown for reference.

Chemical Costs by Crop

The user is asked to input benchmark and current per acre costs of herbicide, insecticide, &/or fungicide by crop. This is because we do not have default prices for these chemicals as they are so wide-ranging and diverse. It is optional to provide chemical type &/or purpose and amount applied per acre as it is not information used by the tool, but space for the user to keep notes. Remember, if you are analyzing a CCR, enter benchmark and current chemicals applied to each crop. If you're not analyzing CCR, you only need to provide benchmark and current chemical costs that changed due to the adoption of the other soil health practices. The following notes are the tips in the tool:

- You could enter a total per acre chemical cost by crop in one of the three categories in the below table instead of by herbicide, fungicide, and insecticide categories.
- Do not include the machinery cost for applying herbicide, fungicide, or insecticide, as that is captured on the 'Machinery' or 'Cover Crops' tabs.
- If the user is analyzing the adoption of cover crops, do not include any additions of chemical inputs applied to cover crops here. They must only be on the 'Cover Crops' tab. Be careful not to double-count chemical inputs.

Interpretation of results

Similar to the summary of machinery cost changes, the “Summary of Changes in Input Costs” summarizes the change in input costs by cash crop by subtracting the benchmark from current cash crop input costs by category by crop. However, unlike the summary of machinery cost changes table, these results are presented per acre only; you can find total change per year on the 'Yields' tab. The last two columns present the study area weighted average change for all inputs costs across all crops. Two categories of weighted averages are provided: the first being the weighted average considering only changes on acres with the same before/after crop, while the second being the weighted average considering only changes on acres with different before/after crops. If not analyzing a CCR, only the first weighted average applies because there is no change in crop rotation analyzed. If analyzing a CCR, these results can be difficult to interpret. See the *Interpretation of Results* section within the 'Machinery' tab section above as that description applies to the interpretation of these results as well.

Unique to this tab and table, there is a dropdown list where the user must choose which soil health practice(s) they attribute to the input cost changes as that feeds into the 'Results' partial budget analysis table. Below is a screenshot of an example.

into the 'Results' partial budget analysis table.

Change in Input Costs by Cash Crop	Corn Grain	Soybeans	Winter wheat	Weighted Average Change, No CCR (\$/Ac)	Weighted Average Change, CCR only (\$/Ac)	
Seed Cost Change by Crop (\$/Ac)	\$ -	\$ -	\$ 56.00	\$ 0.00	\$ 56.00	
Study Area Seed Cost Per Acre Change (Weighted Average, \$/Ac)						
Soil Sampling Change by Crop (\$/Ac)	\$ 2.50	\$ 2.50	\$ 5.00	\$ 2.50	\$ 5.00	
Study Area Soil Sampling Cost Per Acre Change (Weighted Average, \$/Ac)						
Fertilizer Cost Change by Crop (\$/Ac)	\$ (12.55)	\$ -	\$ 43.54	\$ -12.55	\$ 43.54	What soil health practice do you attribute your change in nutrients to?
Study Area Fertilizer Per Acre Change (Weighted Average, \$/Ac)						Change in fertilizer (choose from dropdown)
Manure/Compost Cost Change by Crop (\$/Ac)	\$ -	\$ -	\$ -	\$ 0.00	\$ 0.00	Combination of practices
Study Area Manure/Compost Per Acre Change (Weighted Average, \$/Ac)						Change in manure (choose from dropdown)
Chemical Cost Change by Crop (\$/Ac)	\$ -	\$ (20.00)	\$ -	\$ -20.00	\$ 0.00	Nutrient management
Study Area Chemical Per Acre Change (Weighted Average, \$/Ac)						Change in chemical (choose from dropdown)
						Cover crops

Cover Crops

The 'Cover Crops' tab calculates the costs and benefits due to adopting cover crops. Costs can include cover crop seed, additional nutrient &/or termination inputs, additional machinery operations costs, and grazing &/or haying costs. Benefits can include the added value of haying &/or grazing. This tab is set up to only analyze the adoption of cover crops (assumes no cover crop in benchmark); it cannot analyze changes to cover crop management, including switching cover crop species, establishment methods, termination methods, etc.

The first set of tables, under Cover Crop Costs, captures cover crop costs. The number of tables shown will correspond to the cover crops in the crop rotation as provided in the cover crop information table on

the 'Study Area Overview' tab. Presented in the 'Summary of Cover Crop Costs' table is the calculated cover crop cost on an annual per acre basis by cover crop and as a weighted average for the Study Area.

The second set of tables, under 'Cover Crop Grazing &/or Haying Benefits', allows you to calculate the effects of grazing and/or harvesting cover crop as hay, resulting in a net per acre grazing &/or haying benefit. We encourage users to use this tab on its own to analyze cover crop economic effects generally (with or without the adoption of soil health practices.)

Cover Crop Costs

Each table corresponds to the list of cover crops provided in the the 'Study Area Overview' tab, so that must be completed first. The cover crop species, cash crop before and after, acres of cover, and termination method are auto-populated. By cover crop, you should provide cover crop seed cost. If the farmer grows their own cover crop seed, ideally you can calculate the on-farm per acre production cost of that seed; otherwise, you can use a local cover crop dealer seed cost that most closely correlates. Then you have the option to provide per acre costs for additional nutrient inputs, termination inputs, or other inputs. Make sure to only include additional costs (e.g., if the farmer previously sprayed herbicide before cash crop planting, and now that spray kills the cover crop, do not include the cost.) Next you are asked to select from the list of related machinery your cover crop planting and termination machinery and associated number of passes. Again, make sure to not double count inputs or machinery with the previous 'Machinery' and 'Cash Crop Inputs' tabs (e.g., if cash crop tillage practices terminate the cover crop, only include this on the 'Machinery' tab) OR with the second set of tables at the end of this tab for cost of grazing &/or haying of cover crops. You can review the list of machinery and associated costs on the 'Machinery Costs' tab to determine the machinery that most closely matches your machinery costs. Alternatively, follow directions on the 'Machinery Costs' tab to add machinery costs to the list as identified by the yellow-shaded cells; OR add farmer-provided custom-hire cover crop planting or termination operations costs to the 'Study Area Overview' tab. These additions will then be made available to select from in the dropdown list.

Cover Crop Grazing &/or Haying Benefits

Complete the following tables considering all cover crops grazed &/or hayed. Make sure to only include additional costs (e.g., new fencing for grazing.) Also, make sure you do not double count inputs or machinery with the previous tables. The value of the cover crop as forage is the default grass hay national average price (organic if noted on 'Study Area Overview' tab), unless a farmer-provided forage value is given on Overview tab. Below are the tips given in the tool:

- Per acre grazing benefit is calculated by multiplying # days grazed per year, stocking rate (animal unit per acre), and daily forage demand (pounds per animal unit), then dividing by 2,000lbs to estimate tons per acre grazed, which can then be multiplied by the value per ton. Alternatively, user can enter their estimated \$/ac grazing benefit (e.g., if the farmer charges others to graze.)
- Per acre grazing costs are a sum of the annualized infrastructure costs, additional labor and management, and/or other annual costs. The grazing infrastructure costs are annualized using the planning horizon (i.e., lifespan of fence &/or watering facilities) and interest rate. The default provided is 15 years and 3%.
- Per acre hay benefit is the yield (ton/ac) multiplied by the appropriate hay value (\$/ton).
- Per acre hay cost is the estimated cost to harvest the cover crop. User can reference the 'Machinery Costs' tab for a list of harvest equipment per acre costs.

Other Benefits and Costs

The Other Costs & Benefits tab calculates the value of decreased erosion, cost of educational activities, annual financial assistance payments, and any other benefits and costs not otherwise accounted for on the previous tabs of the Tool. See below for guidance and tips related to each of these sections.

Value of Decreased Erosion due to Soil Health Practices

The value of nitrogen (N) and phosphorus (P) per ton of soil is based on the 5-year rolling average price of N and P and an assumption on the amount of N and P per ton eroded soil. See the 'Prices' tab for more information.

- Number of Acres is the area where the reduction in erosion was observed. This could be the entire area where the farmer switched to no-till or reduced tillage in cases where slopes are relatively uniform throughout. If the area is comprised of a combination of relatively flat areas and steeper ground, the acreage could be the portion encompassed by only the steeper ground. Do not enter a number greater than the total number of acres in the study area.
- Enter tons of reduced erosion results (Tons/Acre/Year) modeled using any sediment reduction tool, such as the Nutrient Tracking Tool, the erosion reduction value from RUSLE-2 analysis, or any reasonable value based on soil type.
- If the user does not wish to ascribe an economic value to the reduction in erosion, simply leave these fields blank
- Total Annual Change in Repair Cost should only include changes in costs for repairs (e.g., fixing gullies) that occur within the Study Area due to the adoption of soil health practices.

Time Spent on Educational Activities

Educational activities should reflect the average yearly amount of time spent learning the soil health practices, such as attending conferences and farmer meetings, reading magazines, etc. The hourly rate used to calculate the total education expense per year can be found on the 'Prices' tab.

- Do not enter hours for individual soil health practices if using Combined Practice Learning Activities.
- Use Combined Practice Learning Activities when the farmer cannot separate hours spent by practice.
- Total \$/Yr is calculated using the default hourly labor rate, unless a farmer-provided hourly rate given on 'Study Area Overview' tab, multiplied by the number of learning activity hours by practice.

Other Benefits and Costs

Be sure these benefits and costs are not being captured anywhere else in the tool already.

- Descriptions should detail the benefits, costs, or changes in activities experienced and responsible for change as these descriptions will be used in the 'Results' partial budget analysis table to describe the associated increase/decrease in \$/Ac.
- The \$/Ac should be positive for BOTH positive effects/decreased Costs and negative effects/increased costs.
- Acres should not exceed study area acreage. The user can enter the full study area, or a portion of the study area.

Financial Assistance

Any financial assistance payments listed are not included in the partial budget analysis because cost-share is temporary and not received by all, but they can be noted in the footnote of PBA table.

Yield

The 'Yields' tab calculates revenue effects attributed to crop yield changes from adopting soil health practices. The only data entry on this tab is benchmark and current yields by crop.

Yield Impacts due to Soil Health Practices

The user is asked to input benchmark and current yield per acre by crop. If there is a yield increase or decrease, the user has the option to attribute a portion of that yield change to adoption of soil health practices. For reference, soil health successful farmers featured in AFT's soil health economic case studies have attributed between 1% and 60% of yield increases (19% average) to soil health practices. It is up to the farmer to estimate what portion of their yield change can be attributed to improved soil health. To guide this decision, we encourage users to compare the farmers benchmark and current average yields to their county average yields for the same benchmark and current time frame. While these county averages are not necessary for the partial budget analysis, we think they help reveal what yield changes may be due to other things beyond soil health practices, such as technological improvements, weather impacts, or time management improvements. Reference the R-SHEC User Manual for more guidance. If analyzing a conservation crop rotation (CCR), you must provide benchmark and current yields for all crops – even if there is no difference between benchmark and current yields – because when acreage shifts from one crop to another, we need to estimate a per acre net income for each crop impacted. This allows the R-SHEC to quantify the change in Study Area net income due to a CCR. If NOT analyzing a CCR, you only need to provide benchmark and current yields if you want to capture a yield change due to the adoption of soil health practices.

- Benchmark and current county averages are not required. It does provide a place to note county average yield change to assist in accurately estimating the percent yield change attributed to soil health practices by comparing the average increase in yield for the county over the same timeframe that the practices were adopted.
- For county average yields, we suggest using the National Agricultural Statistics Service's QuickStats database to pull this information: <https://quickstats.nass.usda.gov/>
- User must enter the "Farmer-provided: Benchmark Average Yield per Acre," "Farmer-provided: Current Average Yield per Acre," and "Farmer-provided % Yield Change Attributed to Soil Health Practices."
- Benchmark average yield should reflect the average yield under benchmark practices before soil health practice adoption.
- Current average yield should reflect the average yield since the soil health practice(s) were successfully adopted.
- Percent Yield Change Attributed to Soil Health Practices should reflect the estimated amount of the yield change solely due to the adoption of soil health practices. Users should use the county reference as guidance for the estimated yield change due to non-soil health practices (such as technology or other industry changes.)

Output Tables

The Output Tables (located below the yellow disclaimer) do not require any data entry. These tables are used by the 'Results' tab. They are great to reference as we present by crop the benchmark, current, and

change in costs and benefits. We've included results by crop for user reference only -- they are supplemental to the total Study Area weighted average results presented in the partial budget analysis table on the 'Results' green tabs. The Output tables show results broken out by crop by revenue and each category of costs for both benchmark and current scenarios as well as a table of the changes (the difference between benchmark and current.) Users can use these tables to compare the various practice change impacts by category on each crop at both the per acre and total acreage amounts. All numbers and calculations in the output tables are automatically calculated within the tool; any changes to the Output tables must be made in the yield table or previous tabs, at which point these output tables will automatically update.

Interpretation of Results

These results are supplementary to the 'Results' tab, compiling the benchmark, current, and difference between the two by crop into one place is a great way to understand the condensed weighted average results in the PBA table on the green results tabs.

Prices (2023)

This tab is the source for price information used throughout the workbook. The prices and costs appearing below are linked to the preceding tabs to calculate costs and savings as data is entered. Users should evaluate the prices for relevancy in their area and adjust as needed using the 'Study Area Overview' tab in the tool using the farmer-provided prices tables or make changes to values on this tab. Changes to values on this tab will automatically update the costs or savings calculated throughout the workbook.

Machinery Costs

This tab is the source for machinery costs (expressed on a per acre basis) used throughout the workbook, primarily on the 'Machinery' and 'Cover Crops' tabs, specifically for calculating the change in machinery costs due to adoption of one or more soil health practices. Machinery costs include overhead (depreciation, interest, insurance, housing, and repair charges), fuel and lubrication charges, and labor costs for both the tractor and the implement it is pulling. The machinery lists are grouped into three categories: Tillage and Planting, Fertilizer, and Harvest. Nearly all costs shown below are from the University of Illinois Farmdoc website. The fertilizer application costs are from the Iowa State Custom Rate Survey as they were not available from the University of Illinois. We chose the University of Illinois as a source for machinery costs because their dataset appeared to be the most comprehensive. Because these costs are from the Midwest, they are most appropriate for use in that region. AFT has used these machinery costs for farms outside the Midwest -- using national prices or costs to avoid biasing the results in cases where the farmer's prices may not be representative of typical prices. Users should evaluate the costs shown for relevancy in their area and adjust as needed, being careful to document all changes.

Note: If a user needs to add their own equipment and per acre cost, you can add to this list as needed in the clearly identified, yellow-shaded cells with instructions, but we encourage using published prices as those include depreciation, labor, fuel, interest, storage, insurance, etc. Most farmers will undervalue their per acre machinery costs.

Lists

The Lists tab contains lists of items used by Excel's Data Validation function. Items contained in each list below are available for selection from drop down menus on various tabs.

Matrix

This worksheet contains a table that turns the benchmark and current crop rotation information entered on the 'Study Area Overview' tab into a matrix. This matrix is used to determine acreage change between benchmark and current scenarios by crop. DO NOT EDIT THIS TAB. The matrix is a form of linear programming. Throughout the tool, the matrix is used to determine the correct acres by crop to calculate per acre and total per year weighted average economic effects for the Study Area.

If you have any questions about the matrix or need help using the 2024 row crop R-SHEC Tool, email Robert Ellis (as of 6/3/24) at rellis@farmland.org.

3. Tree Nut R-SHEC Manual

Read the [R-SHEC Tools Introduction \(chapter 1\)](#) if you have not already done so. The majority of the following information can be found throughout the tree nut R-SHEC and Questionnaire. We encourage you to watch the Tree Nut R-SHEC training video provided in the [Soil Health Economic Case Study Toolkit](#), specifically starting at the 35-minute mark (through the 1 hour and 12 minute mark) wherein the original tool developer, Flo Swartz, walks the audience through the R-SHEC. The manual is organized by tab in the tool, describing how to use the tab and including examples as needed. There are 13 tabs in the 2024 tree nut R-SHEC (listed in order): ReadMe, Orchard Info, Nutrient Management, Cover Crop, Mulching, Compost Application, Combined Practice Effects, Partial Budget Analysis, Editable PBA, Prices, Machinery Costs, Ref 1 – UCDavis SJV North Budget, and Ref 2 – UCDavis SJV South Budget. **For the Study Area identified, the farmer must have a clear understanding of average benchmark versus current field operations, including input amounts and, in some cases, costs as well.**

Instructions & Data Entry (ReadMe tab)

The Tree Nut R-SHEC Tool can be used with "soil health successful" growers of almonds, pistachios, &/or walnuts. The tree nut R-SHEC can be used with growers that have adopted any combination of compost application, conservation cover, cover crops, mulching, &/or nutrient management for four or more years and within the last 15 years. Additionally, the orchard trees must have been at least 5-7 years old (i.e., full-bearing age) before the grower adopted these soil health practices in order to separate natural tree growth and those soil health practice benefits on tree health. **The data requirements vary depending on what soil health practices are being analyzed.** We denote these differences more so in the sections by tab, but we do provide a table in [Appendix B](#) giving a high-level overview of what data is required versus provided.

Make sure to read the ‘ReadMe’ tab in its entirety. It includes general instructions, a description of each tab, and a list of data sources for the various default costs and prices used by the tool. **Here we highlight below the most important general instructions:**

- **The workbook is protected in order to protect formulas throughout the workbook.** Follow the instructions provided in the “Instructions” section on the ‘Read Me’ tab to unprotect individual worksheets. This is a commonly used function in Excel, so guidance is readily available online.
- **Data entry is allowed in yellow-shaded cells.** Some data tables require data entry, which is indicated in the section titles or headers. Always read the guidance provided for each table. Alternatively, see [Appendix B](#) for a table of the data required throughout the workbook.
 - **Example:** The screenshot below is an example of a table that requires completion as indicated by the asterisk. This indicates that ‘Total Orchard Acres’ and ‘Study Area Planting Year’ are optional.

Total Orchard Acres	
Study Area Acres*	
Study Area Planting Year	
Is this an organic farm? (Y/N)*	
<i>*Required</i>	

- **Data entry occurs in the multi-colored tabs, beginning with ‘Orchard Info’ and ending with ‘Combined Practice Effects,’ and the results are presented in the yellow tabs.** The remaining tabs are for reference. See the screenshot below.
 - The tabs are all “protected” to ensure that users do not break the formulas used to calculate the per acre costs and benefits auto populated into the ‘PBA’ tabs. If you’d like to view the formulas or make changes to the tool, follow the instructions provided on the ‘ReadMe’ tab to unprotect tabs.
 - The two yellow tabs, ‘Partial Budget Analysis’ and ‘Editable PBA’ are identical. The ‘Partial Budget Analysis’ tab is protected and should not be messed with. While the ‘Editable PBA’ tab is for the user to clean up their PBA table for publication.



- As described in the introduction, the R-SHEC estimates changes in field operation costs and benefits with the adoption of soil health practice(s) on average comparing:
 - **“benchmark” operations = before adoption of soil health practices,** versus
 - **“current” operations = after adoption of soil health practices.**
- **A PBA focuses only on variables that change.**
- The user has the opportunity to enter changes in yield, erosion, nutrient use, and pesticide use on each practice tab. The user must be extra careful to not double count data entries due to this formatting.
 - **Depending on which tab the user enters these changes, the PBA table will attribute those changes to their respective soil health practices based on which soil health practice tab the data is entered on:** Nutrient Mgt., Cover Crops, Mulching, Compost Application, or Combined Practice Effects. We advise users to use the ‘Combined Practice Effects’ tab when one or more practices have been adopted (completing required data by practice tab as necessary.)
- We encourage users to review and, ideally, **complete the tree nut R-SHEC Questionnaire** provided in the Toolkit so that data needed to conduct an accurate partial budget analysis in the R-SHEC is organized and at-hand for data entry. **The grower must have a clear understanding of average benchmark versus current field operations, including input amounts and, in some cases, costs as well.**
- **The R-SHEC uses a combination of grower-provided data and standardized cost and price data built into the tool.** Whenever possible, national prices or costs are used to avoid biasing the results in cases where the grower’s prices may not be representative of typical prices. However, the user does have the option to use the grower’s own prices for nitrogen, phosphorus, potassium, micronutrient cocktail, almonds, pistachios, and walnuts (provided on the ‘Orchard Info’ tab) while farmer’s manure/compost prices are entered on the ‘Nutrient Management’ tab. The R-SHEC relies on the grower to provide chemical prices, as well as compost and manure prices and costs, as we do not provide national average default due to the variety and wide spectrum. Default prices and their sources are listed on the ‘Prices’ and ‘Machinery Costs’ tabs (see table below with [list of data sources](#)) and [Appendix B](#) provides a list of all the data entry in the R-SHEC, identifying the units and what is required versus optional.
- **Calculations of costs and benefits for the individual practices (or ‘Combined Practice Effects’) tabs occur within each of the worksheets.**

About Individual Worksheets (aka 'Tabs')

Below is a list of the tabs in order presented in the R-SHEC. This information comes directly from the 'ReadMe' tab.

- 1. Orchard Info:** Records information used throughout the workbook. Be careful as the "Clear All Data" button will clear all data entered in yellow-shaded cells.
- 2. Nutrient Management:** Calculates how changes in nutrient management affects machinery used, yield, costs of nutrients, and costs of pesticides.
- 3. Cover:** Captures costs of cover crop or conservation cover and any effects on yield, costs of nutrients, costs of pesticides, and soil erosion.
- 4. Mulching:** Captures changes in mulching costs and how these changes affect yield, costs of nutrients, costs of pesticides, and soil erosion.
- 5. Compost Application:** Captures changes in compost application cost and how these changes affect yield, costs of nutrients, costs of pesticides, and soil erosion.
- 6. Combined Practice Effects:** Provides a place to record benefits or costs that cannot be attributed to a single soil health practice.
- 7. Partial Budget Analysis & Editable PBA tabs:** These are identical tabs presenting the results of the partial budget analysis. The PBA table will auto-populate as data is entered in the tool. The PBA tab performs a partial budget analysis using calculations from the five soil health practice worksheet and placing them in the correct quadrant of the PBA table to determine per acre and total change in net income for the Study Area. The 'Partial Budget Analysis' tab is protected and should not be edited, while the 'Editable PBA' tab is for the user to edit the PBA table for sharing.
- 8. Prices:** Contains prices used throughout the workbook as well as relevant Producer Prices Paid and Received Indexes (PPI & PRI) values for updating prices as needed. Lists the data sources for the prices in more detail than as listed on the 'ReadMe' tab.
- 9. Machinery Costs:** Contains per acre fertilizer application machinery costs used by the 'Nutrient Management' tab. You can add to this list as needed, but we encourage only using published prices as they include depreciation, labor, fuel, interest, discount value, salvage cost, etc. Most farmers will undervalue their per acre machinery costs.
- 10. Ref 1 - UC Davis SJV North Budget:** This is a table of various costs associated with producing almonds from the UC Davis San Joaquin Valley North Almond Production Budget (micro-sprinkler irrigation system). We encourage users to reference these costs and use as needed in the tool.
- 11. Ref 2 - UC Davis SJV South Budget:** This is a table of various costs associated with producing almonds from the UC Davis San Joaquin Valley South Almond Production Budget (double-line drip irrigation system). We encourage users to reference these costs and use as needed in the tool.

Data Sources for default values

This table is provided on the 'ReadMe' tab. It is a compilation of the data sources for the default values used throughout the 2024 tree nut R-SHEC.

Item	Release Date	Source
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Crop Prices, Non-organic	February	USDA NASS. (2010-2023). <i>Survey - Commodity Price Received: Price Received Measured in \$/lb (California only)</i> . QuickStats. Retrieved May 10, 2024, from https://quickstats.nass.usda.gov/results/1EE7EA82-BF2D-3153-A98A-49AE038F23EE
Crop Prices, Organic	Dec. 15, 2022	USDA NASS. (2022, December 15). <i>Certified Organic Survey 2021 Summary: Table 8. Certified Organic Tree Nuts Harvested and Value of Sales</i> . Retrieved May 10, 2024, from www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Organic_Production/index.php
Fertilizer Prices	January	Iowa State University Extension and Outreach. (2020-2024). <i>Ag Decision Maker: Estimated Costs of Crop Production in Iowa (File A1-20)</i> . Retrieved on February 6, 2024 from https://www.extension.iastate.edu/agdm/crops/html/a1-20.html
Labor Rate, Farm Manager	March 31	U.S. Bureau of Labor Statistics. (April 3, 2024). <i>45-1011 First-Line Supervisors of Farming, Fishing, and Forestry Workers. Occupational Employment and Wages, May 2023</i> . Retrieved May 10 2024, from https://www.bls.gov/oes/current/oes_nat.htm#45-0000
Machinery Costs for Anhydrous Ammonia Applicators & Sprayers	Biennially	University of Illinois at Urbana-Champaign Department of Ag and Consumer Economics. (September 2023). <i>Farm Business Management Machinery Cost Estimates: Field Operations</i> . Retrieved on November 28, 2023 from https://farmdoc.illinois.edu/management#handbook
Machinery Costs for Fertilizer Applications	March	Iowa State University Extension and Outreach. (March 2023). <i>Ag Decision Maker: 2023 Iowa Farm Custom Rate Survey (File A3-10)</i> . Retrieved on November 28, 2023 from https://www.extension.iastate.edu/agdm/crops/html/a3-10.html
Prices Paid Index	Monthly	USDA NASS. (Ongoing). <i>Prices Paid: Indexes for All Items and Production Items by Month - United States</i> . Retrieved February 6, 2024, from https://www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/index.php
Prices Received Index	Monthly	USDA NASS. (Ongoing). <i>Prices Received: Indexes for Ag, Crop, and Livestock Production by Month - United States</i> . Retrieved February 6, 2024, from https://www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/index.php

Orchard Info tab

The 'Orchard Info' tab records very general information including grower name, farm name, location, watershed, total orchard acres, study area acres (*required*), tree planting year, soil health practices, time spent on educational activities, and grower-provided fertilizer and crop prices. The majority of this information is optional to complete, but the user **MUST** provide the study area acres as that information is used throughout the tool. Also, the user must answer "Is this an organic farm? (Y/N)" on this tab in order for the tool to know to use non-organic or organic tree nut price (the default is non-organic.)

Nutrient Mgt

The Nutrient Management (NM) tab calculates economic effects following a change in NM activities for soil health including changes in: (1) machinery costs associated with fertilizer application; (2) yield; (3) fertilizer use; (4) pesticide use; and (5) other benefits or costs as identified by the grower. If a particular effect cannot be attributed solely to a change in NM activities, the user can enter it on the Combined Effects tab. All effects are calculated on an annual basis per acre and for the entire Study Area.

Change in Machinery Costs due to Change in Nutrient Management Activities

If a change in machinery costs has occurred with adoption of soil health practices, capture here. Because the dropdown list of machinery to choose from is limited to the University of Illinois and Iowa State University fertilizer machinery list, we encourage you to visit the 'Machinery Costs' tab to add machinery relevant to your operation, specifically relevant to changes in nutrient management.

TIPS:

- Only enter benchmark and current machinery operations if there was a change in nutrient management activities for soil health. Make sure you are not double counting if additional soil health practices are being analyzed.
- Review the list of machinery and associated costs (included in the dropdown) on the 'Machinery Costs' tab to determine the machinery that most closely matches your equipment. Follow instructions on 'Machinery Costs' tab to add your own machinery description and cost.
- Benchmark NM Description should briefly describe the field operation(s) used to apply nutrients prior to change in NM activities for soil health. Select Benchmark NM Machinery from the dropdown list that best matches the machinery used to apply nutrients prior to change. Assess the cost/ac.
- Current NM Description should briefly describe the field operation(s) used to apply nutrients currently. Select Current NM Machinery from the dropdown list that best matches the machinery used to apply nutrients currently. Assess the cost/ac.
- User must enter Passes, Gallons, Hours per Year.
- User must adjust the number of passes accordingly if machinery costs do not apply to entire study area nor annually.

Yield Impacts due to Change in Nutrient Management Activities

At this point, we do not have a way to model or estimate changes in yield due to adoption of soil health practices, so we rely on your best judgment to determine how much, if any, yield change when comparing before and after soil health practice adoption can be attributed to soil health practices. Make sure to account for the age of the almond tree when assessing yield records. Consider yield values only after full-bearing age. We recommend comparing the farmer's yield records to county average yield records to help identify what portion of yield change could be attributed to general technological improvements or weather impacts.

We suggest only entering changes in yield on this tab if NM is the only soil health practice analyzed, otherwise enter yield impacts in the 'Combined Practice Effects' tab. Benchmark average yield should reflect the average yield under benchmark practices before changing NM for soil health.

*Impact of Change in Nutrient Management Activities on Primary Nutrients Used***TIPS:**

- (1) Only enter changes due to change in NM activities for soil health. Make sure you are not double counting if additional soil health practices are being analyzed.
- (2) Enter negative values to indicate savings and positive values to indicate an increase in cost.
- (3) If grower has changed the form of nitrogen or potassium, skip this table and use the next two tables (Impact of Changing Form of Nitrogen Applied and Impact of Changing Form of Potassium Applied) to record these changes rather than entering the changes in the table below.
- (4) User must enter a price for micronutrients on Orchard Info tab if quantity of micronutrient cocktail has changed.

*Impact of Changing Form of Nitrogen Applied***TIPS:**

- (1) Impact of Changing Form of Nitrogen Applied table is designed to calculate the cost difference between benchmark and current forms and amounts of Nitrogen.

(2) Enter a description of the Benchmark Form of Nitrogen along with \$/Lb and Lbs/Ac in the first row. Then enter a description of the Current Form of Nitrogen along with \$/Lb and Lbs/Ac in the second row.

Impact of Changing Form of Potassium Applied

TIPS:

- (1) Impact of Changing Form of Potassium Applied table is designed to calculate the cost difference between benchmark and current forms and amounts of Potassium.
- (2) Enter a description of the Benchmark Form of Potassium along with \$/Lb and Lbs/Acre in the first row. Then enter a description of the Current Form of Potassium along with \$/Lb, and Lbs/Acre in the second row."

Impact of Change in Nutrient Management Activities on Pesticides Used

TIPS:

- (1) User must enter Cost/Ac and % Change for calculations to work.
- (2) Enter negative values for % change values to indicate savings and positive values to indicate an increase in cost.
- (3) Only enter changes due to change in NM activities for soil health. Make sure you are not double counting if additional soil health practices are being analyzed.

Financial Assistance Payments for Nutrient Management Activities

Any financial assistance payments listed are not included in the partial budget analysis because cost-share is temporary and not received by all, but can be noted in the footnote of PBA table.

Other Benefits and Costs due to Change in Nutrient Management Activities

TIPS:

- (1) Description should detail the benefits, costs, or changes in activities experienced and responsible for change in Per Acre Value.
- (2) Per Acre Value should be positive for BOTH Positive Effects/Decreased Costs and Negative Effects/Increased Costs.
- (3) Acres should not exceed study area acreage. The default value is Study Area acreage.

Cover Crops

The 'Cover Crop' tab calculates the economic effects attributed to adopting cover crops or permanent conservation cover (i.e., resident vegetation.) Economic effects on this tab include changes in: (1) cover costs; (2) tree nut yield; (3) fertilizer applied; (4) pesticides used; and (5) soil erosion. Additional economic effects not already covered can be entered in the 'Other Cover Crop Benefits and Costs' tables. If a particular effect cannot be attributed solely to introducing a cover, the user can enter it on the Combined Effects tab. All effects are calculated on an annual basis per acre and for the Study Area.

Note: This Tool is setup to only analyze the switch from no cover crop to planting a cover crop. This Tool does not analyze switching of cover crop species, changes in establishment methods, nor changes in termination methods, etc.

Cover Crop Costs

Describe species planted. Enter the acreage currently planted in the specific cover crop. For example, if the cover is planted every other row, then enter half the Study Area acres. Acres planted cannot exceed

the Study Area acreage. Enter per acre cost of cover crop seed. Enter the number of years between seeding (e.g., seeding every other year = 2, every year = 1), the establishment interval. Include establishment costs such as seedbed preparation (e.g., disking) and planting costs on average. Seed, establishment, and termination costs are prorated over the establishment interval. Enter average termination cost if the cover does not winterkill, such as for disking, spraying (equipment and herbicide applied), or tilling. Provide maintenance costs, such as the average annual cost for mowing, spraying, or weed control. Finally, provide any other costs associated with growing cover crops.

Yield, Nutrient, Pesticide Changes due to Cover Crop

Same advice as under 'Nutrient Management' respective sections. Making sure to not double count any data entries.

Value of Decreased Erosion due to Cover Crop

Cover crops are well-known to reduce soil erosion due to maintaining cover. However, we suggest only entering changes in erosion and/or repair costs here if cover is the only soil health practice analyzed, otherwise enter erosion impacts in the 'Combined Practice Effects' tab because it is impossible to attribute reduced soil erosion to solely one soil health practice if multiple are being adopted. Number of Acres is the area where the reduction in erosion was observed. This could be the entire area where you're using a cover crop in cases where slopes are relatively uniform throughout or, if the area is comprised of a combination of relatively flat areas and steeper ground, the acreage could be the portion encompassed by the steeper ground. If possible, provide the tons of reduced erosion (Tons/Acre/Year) modeled using any sediment reduction tool, such as the Nutrient Tracking Tool or RUSLE-2. This can usually be done by your local conservation office. Additionally or alternatively, you can provide the changes in costs for repairs that occurred within the Study Area. Enter a negative value if cost of repairs has decreased and a positive value if cost of repairs increased.

Financial Assistance for Cover Crops

Any financial assistance payments listed are not included in the partial budget analysis because cost-share is temporary and not received by all, but can be noted in the footnote of PBA table.

Other Cover Crop Benefits and Costs

TIPS:

- (1) Description should detail the benefits, costs, or changes in activities experienced and responsible for change in Per Acre Value.
- (2) Per Acre Value should be positive for BOTH Positive Effects/Decreased Costs and Negative Effects/Increased Costs.
- (3) Acres should not exceed study area acreage (or possibly not to exceed the acres planted in cover depending on benefit/cost.) The default value is Study Area Acreage.

Mulching

The 'Mulching' tab calculates the economic effects attributed to recycling orchard prunings by chipping and leaving prunings on the orchard ground. Economic effects on this tab include changes in: (1) mulching costs; (2) yield; (3) fertilizer applied; (4) pesticides used; (5) and soil erosion. Additional economic effects (benefits and costs) not already covered can be entered in the "Other Cover Benefits and Costs" tables. If a particular effect cannot be attributed solely to introducing mulching, the user can enter it on the Combined Effects tab. All effects are calculated on an annual basis per acre.

Change in Costs due to Mulching

The user must provide their new or changes in mulching costs as there are no default values provided.

Yield, Nutrient, &/or Pesticide Changes due to Mulching

Same advice as under 'Nutrient Management' respective sections. Making sure to not double count any data entries.

Value of Decreased Erosion, FA, & Other Changes due to Mulching

Same advice as under 'Cover Crop' respective sections. Making sure to not double count any data entries.

Compost Application

The Compost Application tab calculates the economic effects attributed to applying compost to almond orchards. Economic effects on this tab include changes in: (1) compost costs; (2) almond yield; (3) fertilizer applied; (4) pesticides used; (5) and soil erosion. Additional economic effects (benefits and costs) not already covered can be entered in the 'Other Compost Benefits and Costs' tables. If a particular effect cannot be attributed solely to applying compost, the user can enter it on the Combined Effects tab. All effects are calculated on an annual basis per acre.

Compost Application Cost

The user must provide their new or changes in compost material and application costs as there are no default values provided.

TIPS:

- (1) User must enter Frequency, which means the number of years between applications. For example, enter 2 if compost is applied every other year, 1 for every year, and .5 for twice a year, etc.
- (2) % of Study Area Acreage that Compost Cost Applies is important to adjust for the making and purchasing of compost material. This column allows you to adjust your cost based on how you calculate them. For example, 100% would mean you think about per acre costs spread across the Study Area, whereas 50% means that your per acre costs are only applied to 50% of the Study Area acreage that needs mulching. Note: The spreading of compost cost applies to 100% of Study Area because the cost is the same no matter if compost is only applied to tree rows, alleys, or both.
- (3) User may enter additional compost costs in additional rows of yellow cells, providing a detailed description in Compost Material & Application column.

Yield, Nutrients, Pesticides, Erosion, FA, Other Impacts due to Compost Application

Same advice as under 'Nutrient Management' and 'Cover Crop' respective sections. Making sure to not double count any data entries.

Combined Practice Effects

Use this page to calculate effects that cannot be attributed to just one practice. The Combined Practice Effects tab calculates economic effects that are attributed to a combination of soil health practices. Economic effects on this tab include changes in: (1) yield; (2) fertilizer use; (3) pesticide use; (4) soil erosion; and (5) other benefits or costs as identified by the grower. To avoid double counting, DO NOT

enter any effect information that is already covered on the individual practice tabs. All effects are calculated on an annual basis per acre.

4. 2022 Row Crop R-SHEC information

Read the [R-SHEC Tools Introduction \(chapter 1\)](#) and the “2024 Updates to the R-SHEC” document provided in the Toolkit (also provided in Appendix D) if you have not already done so. We encourage you to watch the training videos provided in the [Soil Health Economic Case Study Toolkit](#) for this previous version of the row crop R-SHEC, particularly video 3 in the series associated with this 2022 version. Please follow the guidance found throughout the 2022 row crop R-SHEC and Questionnaire. Everything provided below is directly from the 2022 row crop R-SHEC. The information below is organized by tab in the tool, describing how to use the tab. There are 13 tabs in the 2022 row crop R-SHEC (listed in order): ReadMe, Farm Info, Tillage, Nutrient Management, Cover Crops, Combined Practice Effects, ONLY CCR, Partial Budget Analysis, Editable PBA, Prices, Machinery Costs, Net Income Values by Crop, and Lists. **For each crop in the rotation, the farmer must have a clear understanding of average benchmark versus current field operations, including input amounts and, in some cases, costs as well.**

ReadMe tab

The 2022 row crop R-SHEC is designed to estimate the economic effects, retrospectively, of soil health practices adopted by "soil health successful" farmers. The R-SHEC can be used with farmers that have adopted any combination of No-till or Reduced Tillage, Cover Cropping, and Nutrient Management, OR Conservation Crop Rotation for four or more years and within the last 15 years, on fields growing barley, corn grain, corn silage, grain sorghum (milo), soybeans, oats, wheat, and/or hay. **The data requirements vary depending on what soil health practices are being analyzed, particularly if a conservation crop rotation is being analyzed or not.** We denote these differences more so in the sections by tab, but we do provide a table in [Appendix C](#) giving a high-level overview of what data is required versus provided.

Make sure to read the ‘ReadMe’ tab in its entirety. It includes general instructions, a description of each tab, and a list of data sources for the various default costs and prices used by the tool. **Here we highlight below the most important general instructions:**

- **The workbook is protected in order to protect formulas throughout the workbook.** Follow the instructions provided in the “Instructions” section on the ‘Read Me’ tab to unprotect individual worksheets. This is a commonly used function in Excel, so guidance is readily available online.
- **Data entry is allowed in yellow-shaded cells.** Always read the guidance provided for each table. Alternatively, see [Appendix B](#) for a table of the data required throughout the workbook.
 - **Example:** The screenshot below is an example in the ‘Tillage’ tab indicating the user needs to select the crop, machinery type, and the benchmark and current tillage description, machinery, and associated number of passes.

Crop 1:			
Benchmark Tillage:			
Benchmark Acres:		0	
Benchmark Years in Rotation:		0	
Crop 1 Benchmark Tillage Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac
	\$0.00		\$0.00
	\$0.00		\$0.00
	\$0.00		\$0.00
	\$0.00		\$0.00
Total			\$0.00
Current Tillage:			
Current Acreage:		0	
Current Years in Rotation:		0	
Crop 1 Current Tillage Machinery	Cost/Ac	# Passes/Yr	Total Cost/Ac
	\$0.00		\$0.00
	\$0.00		\$0.00
	\$0.00		\$0.00
	\$0.00		\$0.00
Total			\$0.00

- **Data entry occurs in the multi-colored tabs, beginning with ‘Farm Info’ and ending with ‘Combined Practice Effects,’ and the results are presented in the yellow tabs.** The remaining tabs are for reference. See the screenshot below.
 - The tabs are all “protected” to ensure that users do not break the formulas used to calculate the per acre costs and benefits auto populated into the ‘PBA’ tabs. If you’d like to view the formulas or make changes to the tool, follow the instructions provided on the ‘ReadMe’ tab to unprotect tabs.
 - The two yellow tabs, ‘Partial Budget Analysis’ and ‘Editable PBA’ are identical. The ‘Partial Budget Analysis’ tab is protected and should not be messed with. While the ‘Editable PBA’ tab is for the user to clean up their PBA table for publication.



- As described in the introduction, the R-SHEC estimates changes in field operation costs and benefits with the adoption of soil health practice(s) on average comparing:
 - **“benchmark” operations = before adoption of soil health practices,** versus
 - **“current” operations = after adoption of soil health practices.**
- **A PBA focuses only on variables that change.**
- The user has the opportunity to enter changes in yield, erosion, nutrient use, and pesticide use on each practice tab. The user must be extra careful to not double count data entries due to this formatting.
 - **Depending on which tab the user enters these changes, the PBA table will attribute those changes to their respective soil health practices based on which soil health practice tab the data is entered on:** Tillage, Nutrient Mgt., Cover Crops, or Combined Practice Effects. We advise users to use the ‘Combined Practice Effects’ tab when one or more practices have been adopted (completing required data by practice tab as necessary.)

- We encourage users to review and, ideally, **complete the 2022 row crop R-SHEC Questionnaire** provided in the Toolkit so that data needed to conduct an accurate partial budget analysis in the R-SHEC is organized and at-hand for data entry. **The farmer must have a clear understanding of average benchmark versus current field operations, including input amounts and, in some cases, costs as well.**
- **The R-SHEC uses a combination of farmer-provided data and standardized cost and price data built into the tool.** Whenever possible, national prices or costs are used to avoid biasing the results in cases where the farmer's prices may not be representative of typical prices. However, the user does have the option to use the farmer's own prices for nitrogen, phosphorus, potassium, and crops (provided on the 'Farm Info' tab) while farmer's manure/compost prices are entered on the 'Nutrient Management' tab. The R-SHEC relies on the farmer to provide chemical prices, as well as compost and manure prices and costs, as we do not provide national average default due to the variety and wide spectrum. Default prices and their sources are listed on the 'Prices' and 'Machinery Costs' tabs (see table below with [list of data sources](#)) and [Appendix C](#) provides a list of all the data entry in the R-SHEC, identifying the units and what is required versus optional.
- **Calculations of costs and benefits for the individual practices (or 'Combined Practice Effects') tabs occur within each of the worksheets.**

About Individual Worksheets (aka 'Tabs')

Below is a list of the tabs in order presented in the R-SHEC. This information comes directly from the 'ReadMe' tab. Visit each tab and read each tab thoroughly to complete this version of the row crop R-SHEC correctly.

1. **Farm Info:** Records information used throughout the workbook. User must complete "Benchmark Rotation" and "Current Rotation" tables even if farmer did not change their rotation (in that case fill in both tables with identical information.) Be careful of the "Clear All Data" button as it will clear all data entered in yellow-shaded cells.
2. **Tillage:** Machinery costs associated with hay establishment is prorated by the number of years of hay in the rotation. Acres and years in rotation populate automatically once user selects a crop. Captures difference in tillage costs by equipment cost and number of passes over the field "before" versus "after" adoption of reduced tillage soil health practices. Calculates how changes in tillage affects yield, costs of nutrients, costs of pesticides, and soil erosion.
3. **Nutrient Management:** This worksheet is set up like the Tillage worksheet. User selects equipment that comes closest to what the farmer is using and costs are calculated automatically. Machinery costs are for equipment ONLY and do not include costs for fertilizer (that is included in "change in nutrients used" tables.)
4. **Cover Crops:** Captures costs of cover crop and any effects on cash crop yield, costs of nutrients, and costs of pesticides.
5. **Combined Practice Effects:** This worksheet provides a place to record benefits or costs that cannot be attributed to a single soil health practice.
6. **ONLY CCR:** Captures net income change with conservation crop rotation (CCR) and any additional effects on yield, costs of nutrients, and costs of pesticides. Users can only analyze a Conservation Crop Rotation as a sole soil health practice; it cannot be analyzed with other soil health practices due to data discrepancies. Also, there is no data to analyze corn silage in a conservation crop rotation analysis. Net income values for establishing, growing, fertilizing, and harvesting crops are

loaded from the "Prices" and "Net Income Values by Crop" tabs and used to automatically calculate changes in costs and production with a change in crop rotation.

7. **Partial Budget Analysis & Editable PBA tabs:** These are identical tabs presenting the results of the partial budget analysis. The PBA table will auto-populate as data is entered in the tool. The PBA tab performs a partial budget analysis using calculations from the five soil health practice worksheet and placing them in the correct quadrant of the PBA table to determine per acre and total change in net income for the Study Area. The 'Partial Budget Analysis' tab is protected and should not be edited, while the 'Editable PBA' tab is for the user to edit the PBA table for sharing.
8. **Prices:** Contains prices used throughout the workbook as well as relevant Producer Prices Paid and Received Indexes (PPI & PRI) values for updating prices as needed. Lists the data sources for the prices in more detail than as listed on the 'ReadMe' tab.
9. **Machinery Costs:** Contains per acre fertilizer application machinery costs used by the 'Nutrient Management' tab. You can add to this list as needed, but we encourage only using published prices as they include depreciation, labor, fuel, interest, discount value, salvage cost, etc. Most farmers will undervalue their per acre machinery costs.
10. **Net Income Values by Crop:** For reference, this worksheet provides the 2020 and 2021 commodity costs and returns values by crop compiled by USDA Economic Research Service collected through the Agricultural Resource Management Survey. Includes a description of how we calculate net income for use on the "ONLY CCR" tab.
11. **Lists:** This worksheet contains lists used in drop-down menus throughout the workbook. You can add to this list as needed.

Data Sources for 2022 default values

This table is provided on the 'ReadMe' tab. It is a compilation of the data sources for the default values used throughout the 2024 tree nut R-SHEC.

Item	Release Date	Source
Crop Prices, Non-organic	February	USDA NASS. (February 2022). <i>Crop Values: 2021 Summary</i> . Retrieved on February 28, 2022 from https://usda.library.cornell.edu/concern/publications/k35694332
Crop Prices, Organic	Dec. 15, 2022	USDA NASS. (October 22, 2022). <i>Table 13. Certified Organic Field Crops and Hay Harvested and Value of Sales: 2019 Organic Survey</i> . Retrieved February 28, 2022, from https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Organic_Production/index.php
Fertilizer Prices	January	Iowa State University Extension and Outreach. (January 2022). <i>Ag Decision Maker: Estimated Costs of Crop Production in Iowa (File A1-20)</i> . Retrieved on February 22, 2022 from https://www.extension.iastate.edu/agdm/crops/html/a1-20.html
Hay Production Costs	January	Iowa State University Extension and Outreach. (January 2022). <i>Ag Decision Maker: Estimated Costs of Crop Production in Iowa (File A1-20)</i> . Retrieved on February 22, 2022 from https://www.extension.iastate.edu/agdm/crops/html/a1-20.html
Hay Yield, National Average	Indeterminant	USDA NASS. <i>QuickStats: Statistics by Subject: Hay - Yield, Measured in Tons/Acre, National Average 2010-2021</i> . Retrieved on March 2, 2022 from https://quickstats.nass.usda.gov/
Labor Rate, Farm Manager	March 31	U.S. Bureau of Labor Statistics. (March 31, 2022). <i>45-1011 First-Line Supervisors of Farming, Fishing, and Forestry Workers. Occupational Employment and Wage Statistics, May 2021</i> . Retrieved April 6, 2022, from https://www.bls.gov/oes/current/oes451011.htm
Machinery Cost Estimates	Biennially	University of Illinois at Urbana-Champaign Department of Ag and Consumer Economics. (September 2021). <i>Farm Business Management Machinery Cost Estimates: Field Operations</i> . Retrieved on February 22, 2022 from https://farmdoc.illinois.edu/management#handbook
Machinery Costs for Fertilizer Applications	March	Iowa State University Extension and Outreach. (March 2022). <i>Ag Decision Maker: 2022 Iowa Farm Custom Rate Survey (File A3-10)</i> . Retrieved on March 23, 2022 from https://www.extension.iastate.edu/agdm/crops/html/a3-10.html

Net Income Values	May 2 & Oct 3	USDA Economic Research Service. (May 2, 2022). <i>Commodity Costs and Returns: Recent Costs and Returns</i> . Retrieved on June 17, 2022 from https://www.ers.usda.gov/data-products/commodity-costs-and-returns/
Prices Paid Index	Monthly	USDA NASS. (Ongoing). <i>Prices Paid: Indexes for All Items and Production Items by Month - United States</i> . Retrieved September 22, 2022, from https://www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/index.php
Prices Received Index	Monthly	USDA NASS. (Ongoing). <i>Prices Received: Indexes for Ag, Crop, and Livestock Production by Month - United States</i> . Retrieved September 22, 2022, from https://www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/index.php

5. References

Economic Research Service. (2022, May 2). *Commodity Costs and Returns*. Retrieved from <https://www.ers.usda.gov/data-products/commodity-costs-and-returns/>

Gordon, H. (2013). *Economics Technical Note: Basic Economic Analysis Using T-Charts (TN.200.ECN-1)*. Washington, D.C.: U.S. Dept. of Agriculture Natural Resources Conservation Service.

Iowa State University. (2023, March). *Iowa Farm Custom Rate Survey*. Retrieved from Ag Decision Maker: <https://www.extension.iastate.edu/agdm/crops/html/a3-10.html>

Natural Resources Conservation Service. (n.d.). *Conservation Practice Standards*. Retrieved from USDA NRCS: <https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-standards>

University of California Davis. (n.d.). *Cost & Return Studies*. Retrieved from Agricultural & Resource Economics: <https://coststudies.ucdavis.edu/current/commodities>

University of Illinois at Urbana-Champaign. (2021, September). *Farm Business Management Machinery Cost Estimates: Field Operations*. Retrieved from Farmdoc: <https://farmdoc.illinois.edu/management#handbook>

University of Illinois at Urbana-Champaign. (2023, September 20). *Machinery Costs of Operations Estimates*. Retrieved from Farmdoc: <https://farmdoc.illinois.edu/management#handbook>

6. Appendix

A. List of data inputs for 2024 row crop R-SHEC

Tab	Data description	Variables	Data entry type*	Required** if applicable for analysis	Use
Study Area Overview	Farm info	Name		Optional (technically)	Farm name used in title of PBA table
		Location			User notes
		Study area acres			Used in acres calculator
		Organic (Y/N)	Dropdown	Required	Determines if tool uses organic or non-organic crop prices on 'Yields' tab
	Benchmark & current cash crop rotation	Crop(s)	Dropdown	Required	Used throughout and labels tables accordingly
		# years in rotation		Required	Used in acres calculator and to adjust establishment costs if hay in the rotation
		Acres per year		Required	Used throughout
		Planting Date			User notes
		Harvest Date			User notes
		Tillage method	Dropdown		Labels machinery tables
		Select "X" if a double crop	Dropdown	Required	Adjusts total acres and used throughout the tool
	Cover Crop Information	Cash Crop Before	Dropdown		User notes
		Cover crop species		Required	Labels tables accordingly
		Cash crop after	Dropdown		User notes
		Cover crop planting date			User notes
		Cover crop termination method	Dropdown		Labels cover crop tables
		Acres planted		Required	Used to calculate per acre weighted average and \$/yr
	Farmer-provided prices	N, P, K \$/lb			Default values provided (5yr rolling average)
		Manure \$/ton		Required	If applied in benchmark &/or current and analyzing CCR, this is required
		Compost \$/ton		Required	
Cash crop prices				Default values provided (5yr rolling average)	
Forage value				Default values provided (5yr rolling average)	

		Custom-hire costs			Will auto-populate as an option in machinery dropdown list
Machinery	Tillage Machinery by crop	Type	Dropdown	Required	If analyzing CCR, all benchmark &/or current machinery required for affected crops; if not analyzing CCR, can just capture what machinery changed between scenarios. Used to calculate change in machinery costs and net income by crop.
		# passes			
	Planting Machinery by crop	Type	Dropdown	Required	
		# passes			
	Chemical & Nutrient Machinery by crop	Type	Dropdown	Required	
		# passes			
		Gallons of manure applied via liquid drag line or injected		Optional	
		Hours loading and spreading manure &/or compost		Optional	
Harvest machinery by crop	Type	Dropdown	Required		
	# passes				
Cash Crop Inputs	Seed cost by crop	Cash crop seed cost (\$/ac)		Required	Required if analyzing a CCR; otherwise, option to capture change due to other
	Soil sampling costs by crop	Soil sampling method			User notes
		Cost per soil sample (\$/sample) by crop		Required	Used to calculate change in soil sampling costs presented as its own line item in the PBA table
		# soil samples per acre by crop		Required	
	Fertilizer inputs by crop	Amount N, P, &/or K (lbs/ac) by crop		Required	Required if analyzing a CCR; otherwise, option to capture change due to other
		Other fertilizer cost \$/acre		Required	
		Fertilizer form(s)		Optional	User notes
	Manure applied by crop	Type			User notes
		Tons/acre		Required	Required if analyzing a CCR; otherwise, option to capture change due to other
		\$/ton		Required	Study Area Overview tab

	Compost applied by crop	Type			User notes
		Tons/acre		Required	Required if analyzing a CCR; otherwise, option to capture change due to other
		\$/ton		Required	Study Area Overview tab
	Herbicide, Insecticide, &/or Fungicide applied by crop	Type			User notes
		Amount per acre			User notes
		\$/acre		Required	Required if analyzing a CCR; otherwise, option to capture change due to other
	What soil health practices do you attribute your change in nutrients to?		Dropdown	Required	Used in the PBA table line item descriptions to attribute what caused changes in cash crop inputs
Cover crops	Cover crop inputs	Cover crop seed cost (\$/acre)		Required	Used to calculate cost
		Additional nutrient inputs (\$/acre)		Required	Make sure to not double count with 'Cash Crop Inputs' tab; used to calculate cost
		Additional termination inputs (\$/acre)		Required	
		Additional costs (\$/acre)		Required	
	Cover crop planting machinery	Type	Dropdown	Required	Make sure to not double count with 'Machinery' tab; used to calculate cost
		# passes			
	Cover crop terminating machinery	Type	Dropdown	Required	
		# passes			
	Grazing cover crops	\$/ac benefit (see tool for nuances)		Required	
		\$/ac infrastructure (see tool for nuances)		Required	
		Additional labor (\$/ac/yr)		Required	
		Additional other costs (\$/ac/yr)		Required	
	Haying cover crops	Acres hayed		Required	Used to calculate NET per acre haying benefit (benefits minus costs)
		Hay yield (Tons/acre)		Required	
		Haying cost (\$/ac)		Required	
		Acres affected		Required	

Other Costs & Benefits	Value of decreased erosion	Tons/acre/year reduced soil erosion		&/or required	Used to put a value on decreased soil erosion
		\$/year change in erosion repair cost			
	Educational activities	Hrs/yr		Required	Used to put a value on the time it takes to learn new practices
		Farmer's reported labor hourly rate			If you want to put a higher or lower value on labor hourly rate; see 'Prices' tab for default value used
	Other costs/benefits	Description		Required	If you want to capture other effects that didn't have a place to be captured otherwise (e.g., one less week of irrigation, 1 day less of rock picking, etc.)
		\$/acre		Required	
		Acres		Required	
	Financial assistance payments	Source			Used in results tabs
		\$/ac/yr			
		Acres			
Yields	County average yields	Benchmark & current			For user reference
	Farmer-provided yields	Benchmark & current		Required	Required if analyzing a CCR
		% of change in avg yield attributed to soil health practices		Required	Used to calculate increase or decrease in yield due to soil health practice adoption

**If data entry type left blank, that means it is a write-in.*

***If not required, then it is optional unless otherwise noted.*

B. List of data inputs for Tree Nut R-SHEC

Tab	Data description	Variables	Data entry type*	Required** if applicable for analysis	Use
Orchard Info	Orchard info	Name		Optional (technically)	Orchard name used in title of PBA table
		Location			User notes
		Total Orchard Acres			User notes
		Study Area Acres		Required	Used throughout
		Study Area Planting Year			User notes; important to consider age of orchard with when soil health practices adopted
		Organic (Y/N)		Required	Determines if tool uses organic or non-organic crop prices throughout
	Study Area Soil Health Practices	Select soil health practices			User notes
	Educational Activities	Hours/Years		Required	Used to put a value on the time it takes to learn new practices
		Farmer's labor rate (\$/hr)			Default value provided; see 'Prices' tab
	Grower's fertilizer and crop prices	N, P, K \$/lb			Default values provided (5yr rolling average); see 'Prices' tab
		Micronutrients \$/lb		Required	Must provide if analyzing a change in micronutrients applied
		Tree nut prices\$/lb			Default values provided (5yr rolling average)
Nutrient Management	Benchmark & Current NM Machinery	Description			User notes
		Type	Dropdown	Required	Used to calculate change in machinery costs due to change in nutrient management
		# passes		Required	
NM, CC, Mulching, Compost, & Combined Practice Effects tabs (determine	Yield Impacts	Tree nut type	Dropdown	Required	Required if analyzing a change in yield
		Benchmark Average Yield (lbs/acre)		Required	
		% or lbs/ac yield change		Required	

which tab to enter this information on based on what practice you attribute the change to)	Primary Nutrients Used	Change in N, P, &/or K (lbs/ac)		Required	Required if analyzing a change in nutrients applied	
		Change in micronutrient (lbs/ac)		Required		
	Chemicals Used	Herbicide, Insecticide, &/or Fungicide Cost (\$/acre)			Required	Required if analyzing a change in chemicals applied; be careful to not double count with machinery costs accounted for on 'Nutrient Management' tab
		% change			Required	
	Value of decreased erosion	Acres			Required	Used to put a value on decreased soil erosion
		Tons reduced erosion (tons/acre/year)			&/or required	
		Change in repair costs (\$/year)				
	Financial Assistance	Source				Used in results tabs
		\$/ac/yr				
		Acres funded				
	Other costs/benefits	Description			Required	If you want to capture other effects that didn't have a place to be captured otherwise (e.g., one less week of irrigation, soil sampling, etc.)
		\$/acre			Required	
		Acres			Required	
	Cover crops	Cover species	Type		Optional (technically)	User notes
Acres planted		Acres		Required	Used to calculate weight average cost	
Cover crop seed cost		\$/acre		Required	Used to calculate cost	
Establishment interval		Years		Required	Used to calculate cover crop per acre cost by cover crop species; Make sure to not double count with other tabs	
Establishment cost		\$/acre		Required		
Termination cost		\$/acre		Required		
Maintenance cost		\$/acre		Required		
Other costs	\$/acre		Required			
Mulching	Benchmark & current mulching costs (including collecting prunings from the field, burning, transport to chipping facility,	\$/acre		Required	All mulching costs must be provided by the user	

	in-field chopping, and other)				
Compost application	Compost application costs (including making, purchasing, spreading and other)	\$/acre		Required	All compost application costs must be provided by the user; only capture change if applied compost in benchmark and current scenarios

**If data entry type left blank, that means it is a write-in.*

***If not required, then it is optional unless otherwise noted.*

C. List of data inputs for 2022 Row Crop R-SHEC

Tab	Data description	Variables	Data entry type*	Required** if applicable for analysis	Use
Farm Info	Farm info	Name		Required	Farm name used in title of PBA table
		Location			User notes
		Benchmark crop rotation	Dropdown	Required	Used throughout
		Current crop rotation	Dropdown	Required	Used throughout
	Study Area Soil Health Practices	Select soil health practices			User notes
	Educational Activities	Hours/Years		Required	Used to put a value on the time it takes to learn new practices
		Farmer's labor rate (\$/hr)			Default value provided; see 'Prices' tab
	Farmer's fertilizer and crop prices	N, P, K \$/lb			Default values provided (5yr rolling average); see 'Prices' tab
		Crop prices			Default values provided (5yr rolling average)
Tillage	Benchmark & Current Tillage Machinery by crop	Type	Dropdown	Required	Used to calculate change in machinery costs due to change in tillage practices
		# passes		Required	
Nutrient Management	Benchmark & Current NM Machinery	Type	Dropdown	Required	Used to calculate change in machinery costs due to change in nutrient management

		# passes		Required	Used to calculate change in machinery costs due to change in nutrient management
Tillage, NM, Cover Crops, & Combined Practice Effects tabs (determine which tab to enter this information on based on what practice you attribute the change to)	Yield Impacts	Benchmark Average Yield (lbs/acre)		Required	Required if analyzing a change in yield
		% or lbs/ac yield change		Required	
	Nutrients Used	Change in N, P, &/or K (lbs/ac)		Required	Required if analyzing a change in nutrients applied
		Change in manure/compost (tons/ac)		Required	
		Price of purchased manure/compost (\$/ton)		Required	
	Chemicals Used	Herbicide, Insecticide, &/or Fungicide Cost (\$/acre)		Required	Required if analyzing a change in chemicals applied; be careful to not double count with machinery costs accounted for on 'Nutrient Management' tab Used to put a value on decreased soil erosion
		% change		Required	
	Value of decreased erosion	Acres		Required	Used to put a value on decreased soil erosion Used in results tabs
		Tons reduced erosion (tons/acre/year)		&/or required	
		Change in repair costs (\$/year)			
	Financial Assistance	Source			Used in results tabs If you want to capture other effects that didn't have a place to be captured otherwise (e.g., one less week of irrigation, soil sampling, etc.)
		\$/ac/yr			
		Acres funded			
	Other costs/benefits	Description		Required	If you want to capture other effects that didn't have a place to be captured otherwise (e.g., one less week of irrigation, soil sampling, etc.) User notes
\$/acre			Required		
Acres			Required		

Cover crops	Cover species	Type		Optional (technically)	Used to calculate weight average cost
	Acres planted	Acres		Required	Used to calculate cost
	Cover crop seed cost	\$/acre		Required	Used to calculate cover crop per acre cost by cover crop species; Make sure to not double count with other tabs
	Establishment cost	\$/acre		Required	
	Termination cost	\$/acre		Required	
	Maintenance cost	\$/acre		Required	
	Other costs	\$/acre		Required	

D. 2024 Updates to the R-SHEC Tool

On May 30, 2024, we released an **updated version of the row crop R-SHEC Tool. Now, users can analyze a change in crop rotation in combination with other soil health practices.** To accomplish that, one of the biggest changes we needed to make is **a new format** to streamline data entry and more accurately calculate a farmer’s change in net income with the adoption of a conservation crop rotation. And, we updated the associated questionnaire and guidance materials accordingly.

Some major updates include:

- Now, if a conservation crop rotation is being analyzed, we require additional information including **all** before and after field operations, instead of just the changes due to soil health practices. Thorough guidance is provided in the new user manual to guide users on what data must be provided both with and without a conservation crop rotation.
- **REFORMATTING:** With the multi-tab format, we are no longer asking for changes in machinery, fertilizer inputs, chemical inputs, yield, and erosion by soil health practice tabs (asking the same questions multiple times between the tabs), but now we are asking for this by the field operations category (so only asking the questions just once). Users now enter data, not by soil health practice, but by these tabs: machinery, cash crop inputs, cover crops, other costs & benefits, and yield.
- Machinery per acre costs and labor rate updated to 2023 values.
- Crop prices and nutrient costs updated to use a five-year rolling average value, reflecting 2019-2023 values.
- The user now has the option to enter their custom-hire rates for field operations.
- Additional crops were added, including canola, ensilage, flaxseed, millet, mustard seed, rapeseed, rye, safflower, sugar beets, sunflower seed, & triticale (grain).

Notes on the Tree Nut R-SHEC Tool:

- Since conservation crop rotation is not an included soil health practice, there was no re-formatting of this version of the Tool.
- Machinery per acre costs and labor rate updated to 2023 values.
- Crop prices and nutrient costs updated to use a five-year rolling average value, reflecting 2019-2023 values.
- Updated to include walnut and pistachio crop prices in addition to almonds, hence the new name.

Notes on the previous, 2022 version of the Row Crop R-SHEC Tool:

- Machinery per acre costs, labor rate, crop prices, and nutrient costs in 2021 values.
- Crops that can be analyzed are limited to: barley, corn grain, corn silage, grain sorghum (milo), soybeans, oats, wheat, and/or hay.
- Users can only analyze a Conservation Crop Rotation (CCR) as a sole soil health practice. Also, corn silage cannot be analyzed within a CCR because there is no net income data for corn silage.
- The change in net income associated with a CCR is estimated using USDA Agricultural Resource Management Survey data on commodity costs and returns. These survey data represent average costs of production across the country and are not linked to specific management systems, such as conventional tillage or no-till. Since these estimated economic effects of a change in crop rotation do not correspond to specific management systems, we do not advise combining analysis of CCR with changes in tillage, nutrient management, or cover crops practices in this previous, 2022 version of the row crop R-SHEC Tool.
- Continuing to use this 2022 version of the row crop R-SHEC Tool will be fine for analyzing the other soil health practices (*conservation crop rotation, cover crops, composting, no-till or reduced tillage, &/or nutrient management*) as long as CCR was not adopted by the farmer.