

USDA FD-CIC USER MANUAL



U.S. DEPARTMENT OF AGRICULTURE

Introduction

The U.S. Department of Agriculture’s (USDA) Office of the Chief Economist (OCE) issued an interim rule titled, “Technical Guidelines for Climate-Smart Agriculture Crops Used as Biofuel Feedstocks”. The USDA Feedstock Carbon Intensity Calculator (FD-CIC) tool is referenced in the interim rule, and once finalized, will be used to quantify the Carbon Intensity (CI) for three domestic feedstock crops (field corn, soybeans, and sorghum) produced using one or more specified climate-smart agriculture (CSA) practices, in units of grams of carbon dioxide equivalent per bushel. USDA FD-CIC also quantifies the CI for field corn, soybeans, and sorghum produced without CSA practices.

USDA OCE collaborated with the Systems Assessment Center (SAC) at Argonne National Laboratory (ANL) on the development of the USDA FD-CIC. USDA FD-CIC estimates GHG emissions of feedstock production. Emissions sources include direct farm emissions, soil organic carbon (SOC) changes, and nitrous oxide (N₂O) emissions from specific CSA practices.

This user manual describes how to use the USDA FD-CIC tool to calculate crop-specific, field-level carbon intensities (CIs) as well as crop-specific, farm-level CIs. If a farm contains multiple fields growing the same crop, the final crop-specific farm-level CI is calculated as a weighted average of CIs across the fields containing that crop.

Step-by-Step Interface User Instructions

Users begin by selecting the CSA Interface Sheet (tab “USDA Interface”). Users do not need to use any other tab to run USDA FD-CIC. Users should enable macros prior to using the workbook. It is important to note that the content of the yellow cells are automatically generated and do not require user input.

Crop and Field Options Section

In the CSA Interface Sheet, users will click on the “*Crop to Model*” cell (C3), which will make the down-select grey arrow appear to the right of C3, and using the down-select grey arrow the user should select the feedstock from the options provided in the drop-down tab: *corn*, *sorghum*, or *soybeans*. See Figure 1 below.

Crop to Model:	Corn
	Corn
Number of Fields to Model:	Sorghum
	Soybeans

Figure 1: Select corn, sorghum, or soybeans for the "Crop to Model" cell (C3)

Users will then click on the “*Number of Fields to Model*” cell (C5) and enter the number of fields that are used to produce the selected crop in cell C5.

If adhering to the voluntary guidelines established in “Technical Guidelines for Climate-Smart Agriculture Crops Used as Biofuel Feedstocks”, the number of fields must equal the total number of fields across the farm used to produce the crop, regardless of whether CSA practices were used on each field.

See Figure 2 below.

Number of Fields to Model:	1

Figure 2: Enter in the number of fields to be modeled in cell C5

Upon selection of the “*Crop to Model*” and “*Number of Fields to Model*”, USDA FD-CIC will automatically generate columns corresponding to the number of fields to be modeled. Each column contains options for selecting the relevant CSA practices implemented on that field. See Figure 3 for examples of what the interface looks like when modeling for one field verses two fields. If modeling more than 2 fields, additional columns will be added to the sheet for each field to be modeled.

Crop to Model: Corn		Crop to Model: Corn	
Number of Fields to Model: 1		Number of Fields to Model: 2	
CSA Options Affecting GHG Emissions	Field #1	CSA Options Affecting GHG Emissions	Field #1
1.0) Location - State	AL	1.0) Location - State	AL
1.1) Location - County	Baldwin	1.1) Location - County	Baldwin
1.2) Location - FIPS	1003	1.2) Location - FIPS	1003
2) Cover crop	No cover crop No cover crop Cover crop	2) Cover crop	No cover crop No cover crop Cover crop
3) Tillage	None of the above Reduced till No till None of the above	3) Tillage	None of the above Reduced till No till None of the above
4) Fertilizer application timing	None of the above Spring only Split in-season with a 10% rate reduction None of the above	4) Fertilizer application timing	None of the above Spring only Split in-season with a 10% rate reduction None of the above
4.1) Enhanced Efficiency Fertilizer	None used Nitrification inhibitor None used	4.1) Enhanced Efficiency Fertilizer	None used Nitrification inhibitor None used
5) Total Production (Bushels)	15	5) Total Production (Bushels)	15
			Field #2
			AL
			Baldwin
			1003
			No cover crop No cover crop Cover crop
			None of the above Reduced till No till None of the above
			None of the above Spring only Split in-season with a 10% rate reduction None of the above
			None used Nitrification inhibitor None used
			15

Figure 3: User Inputs in the CSA Interface Tab with an Example of One vs Two Field Layouts

Field Location Section

Users will have the option of labeling their field names of FSA Field Number in Cell Row 9 for their own tracking purposes. For Field 1, this cell corresponds to cell C9. In each field column, users should identify the location of each field using (1.0) “*Location – State*” and (1.1) “*Location – County*” from the drop-down lists. For Field 1, these cells correspond to cells C10 and C11, respectively. When these cells are clicked the down-select arrows appear to the right of each cell. Accordingly, the (1.2) “*Location – FIPS (Federal Information Processing Standards)*” cell (C12 for Field 1) is automatically populated based on the user’s state/county selections. See Figure 4 below.

CSA Options Affecting GHG Emissions	Field #1
User Inputted Field Name:	
1.0) Location - State	AL
1.1) Location - County	Autauga
1.2) Location - FIPS	1001

Figure 4: From the drop-down options the user selects the state and county that the field is in to generate the FIPS number

CSA Option Selection

Once a state and county are selected, users select applicable CSA practices for each field. If fields are grown without specified CSA practices, users should keep the default selections for that field. All fields growing the crop specified in Cell C3, including those producing crops without CSA practices, should be included for proper calculation of the crop-specific, farm-level CI.

Note that certain CSA options are feedstock and practice specific. Table 1 provides a list of all of the crop-specific CSA options available to users in USDA FD-CIC. The following subsections provide notes when choosing CSA practice options in the interface. The appendix provides references to full definitions of CSA practices in “Technical Guidelines for Climate-Smart Agriculture Crops Used as Biofuel Feedstocks”. It is recommended that users consult the rule text to ensure that their use of each CSA practice adheres to the standards set forth.

Table 1. List of Crop-Specific CSA Options in USDA FD-CIC

Practices	Corn	Soybeans	Sorghum
No-till	✓	✓	✓
Reduced till	✓	✓	✓
Cover crops	✓	✓	✓
EEFs: Nitrification inhibitors	✓	✓	✓
Fertilizer Timing: Split in-season application	✓		✓
Fertilizer Timing: Spring Only	✓		

CSA Category: Cover Crops

Users will choose between the drop-down option choices “No cover crop” or “Cover crop” for the “2) Cover Crop” cell. To make this selection, click on C14 for Field 1. The down-select arrow will then appear to the right of C14 and the user should click one of the two options listed to correspond to the practice used on that field. Use the same procedure for additional fields. See Figure 5 below.

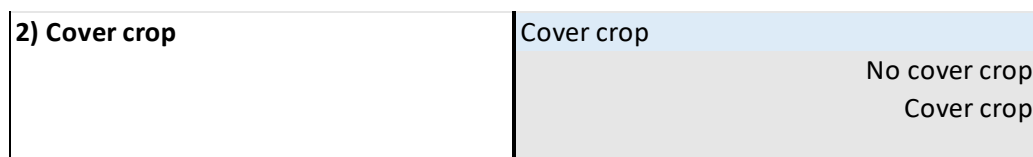


Figure 5: Choose between the drop-down options choices of No Cover Crop or Cover Crop in cell Row 14 for each field.

CSA Category: Tillage

Users will choose between the drop-down option choices “Reduced till”, “No till”, or “None of the above” for the “3) Tillage” cell. To make this selection, click on C18 for Field 1. The down-select arrow will then appear to the right of C18, and the user should click one of the three options listed to correspond to the practice used on that field. Use the same procedure for additional fields. See Figure 6 below.



3) Tillage	Reduced till
	Reduced till
	No till
	None of the above

Figure 6: Choose between the drop-down options choices of *Reduced till*, *No till*, or *None of the above* in cell C18 for field 1.

CSA Category: Fertilizer Application Timing

Users will choose between the drop-down option choices “*Spring only*”, “*Split In-Season*”, or “*None of the above*” for the “4) *Fertilizer application timing*” cell. To make this selection, click on C23 for Field 1. The down-select arrow will then appear to the right of C23, and the user should click one of the three options listed to correspond to the practice used on that field. Use the same procedure for additional fields. See Figure 7 below.

NOTE:

In accordance with the rule standards the following crop-specific CSA practice options are not enabled in USDA FD-CIC:

- The fertilizer application timing options “*Spring only*” and “*Split In-Season*” are not enabled when modeling *Soybeans*.
- The fertilizer application timing option “*Spring only*” is not enabled when modeling *Sorghum*.
- The fertilizer application timing option “*Spring only*” is not allowed with “*Cover crop*” selected when modeling *Corn*.

4) Fertilizer application timing	Split in-season
	Spring only
	Split in-season
	None of the above

Figure 7: Choose between the drop-down option choices “*Spring only*”, “*Split In-Season*”, or “*None of the above.*” Shown here, “*Spring only*” is disabled when “*Cover crop*” is selected when modeling *Corn*.

CSA Category: Enhanced Efficiency Fertilizer

Users will choose between the drop-down options “*Nitrification inhibitor*” or “*None used*” for the “5) *Enhanced Efficiency Fertilizer*” cell. To make this selection, select C28 for Field 1. The down-select arrow will then appear to the right of C28 and the user should click one of the two options listed to correspond to the practice used on that field. Use the same procedure for additional fields. See Figure 8 below.

NOTE: The drop-down option *Nitrification Inhibitor* is not allowed when using the *Split in-season* fertilizer application and modeling a *Corn* field, in accordance with the rule standards.

4.1) Enhanced Efficiency Fertilizer	<div style="border: 1px solid black; padding: 2px;"> <div style="background-color: #e0e0e0; padding: 2px;">None used</div> <div style="background-color: #d3d3d3; padding: 2px;">Nitrification inhibitor</div> <div style="background-color: #e0e0e0; padding: 2px;">None used</div> </div>
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Figure 8: Choose between the drop-down option choices *Nitrification inhibitor* or *None used*

Total Production (Bushels)

After selecting the appropriate CSA practices, users will then enter the number of bushels for each field that is being modeled in the “5) *Total Production (Bushels)*” cell (To make this selection, select C31 for Field 1). See Figure 9 below.

5) Total Production (Bushels)	0
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Figure 9: Enter the number total yield in bushels for each field being assessed.

Results

The results table provides the feedstock CIs, in the unit of grams CO₂ equivalent (CO₂e) per bushel. The GREET default CIs are also displayed for reference. The CI for fields not using any CSA practices should be equal to the GREET default CI. See Figure 10 for a visual example of the Results Output.

Results (g CO ₂ e/bushel)	Field #1	Field #2	Field #3	GREET Default
N Fertilizer upstream	1359	1359	1359	1359
Soil carbon emission	-1182	-264	0	N/A
Direct N ₂ O	2327	2772	2942	2942
Indirect N ₂ O	83	148	160	160
On-farm energy consumption	1194	836	1035	1035
Other chemicals	579	579	579	579
CO ₂ emission from Urea/lime	563	563	563	563
Location - FIPS	17019	17019	17019	N/A
CSA option				
Cover crop	Cover crop	No cover crop	No cover crop	N/A
Tillage	None of the above	Reduced till	None of the above	N/A
Fertilizer application timing	None of the above	Spring only	None of the above	N/A
Enhanced Efficiency Fertilizer	None used	None used	None used	N/A
Carbon intensity (g CO ₂ e/bushel)	4923	5993	6638	6638
CSA Effects relative to baseline:				
% change in g CO ₂ e/bushel	-25.8%	-9.7%	0.0%	0.0%
Absolute change in g CO ₂ e/bushel	-1715	-645	0	0
Soil carbon sequestration in Mg C/acre	0.065	0.014	0.000	0.000
Total Carbon Intensity for Farm (g CO₂e/bushel):	5699			

Figure 10: Results Table Output for a 3-field modeling layout

USDA FD-CIC also generates the percentage (%) and absolute changes in total CI (per bushel) and soil carbon sequestration rate (per acre) for each field compared to the baseline, if no CSA practices were applied. These cells correspond to C50, C51, and C52, respectively, for Field 1.

The crop-specific farm-level CI is reported in row 54. When one field is reported, the carbon intensity for the farm will equal the carbon intensity for that specific field. If a user performs the calculation for multiple fields, the value in row 54 will equal a production-weighted average CI for the farm.

Reporting USDA FD-CIC Inputs and Outputs

If adhering to the voluntary guidelines established in 7 CFR Part 2100 “Technical Guidelines for Climate-Smart Agriculture Crops Used as Biofuel Feedstocks”, farm producers must keep records (as defined in 7 CFR Part 2100.031) that includes USDA FD-CIC inputs and outputs. To provide documentation of the USDA FD-CIC calculation for each field or management unit and the farm-level crop-specific reduced-CI, users may take a screenshot, print out, or save a PDF showing USDA FD-CIC inputs and outputs on the **USDA Interface** tab. The documentation should include a CI and unique identifier for each field or management unit.

Appendix - Definitions of CSA Practices

If adhering the voluntary guidelines established in 7 CFR Part 2100 “Technical Guidelines for Climate-Smart Agriculture Crops Used as Biofuel Feedstocks, farm producers meet all of the applicable practice standards as follows:

- For reduced till or no-till, §2100.051 Tillage management.
- For cover crops, § 2100.052 Cover crop management.
- For fertilizer application timing or enhanced efficiency fertilizer, § 2100.053 Nutrient management.
 - The “Spring only” option for fertilizer application timing in USDA FD-CIC corresponds to the “No fall application standards” in 7 CFR Part 2100 § 2100.053 (c).