

Energy Savings through Cropping systems

A look at the NRCS Energy
Estimator

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On-Farm Energy

- Photosynthetic
- Direct
- Embodied

Big ticket on-farm energy users:

- Tillage
- Transportation
- Irrigation
- Inorganic fertilizers
- Petroleum based pesticides
- Plastics
- Grain drying

Management for energy efficiency:

- Optimize photosynthetic energy
- Minimize direct energy use
- Minimize losses of
 - Soil
 - Water
 - Farm chemicals

Fossil fuel energy can be conserved on-farm by...

- Reducing tillage operations
- Reducing trips to field
- Reducing fertilizer/pesticide/plastic inputs
- Conservative grain drying
- Irrigation use efficiency
- Recycling
- Substituting renewable energy

NOTE: Many of these practices also conserve **soil**, **water** and **air**.

Saving energy and soil

- **Reduce trips to the field**
- **Reduce trips across the field**
- **Reduce tillage depth**
- **Reduce tillage intensity**
- **Size tractors to equipment**

Saving energy and water Q^2

- Reduce runoff
- Reduce chemical inputs
- **Improve irrigation efficiency**
 - Improve irrigation efficiency
 - Reduce crop water requirement
 - Reduce pump pressure
 - Increase pump efficiency
 - Variable frequency drives

Saving energy and reducing crop fertilizer requirements

- **Crop rotations**
- **Cover crops**
- **Residue management**
- **Manure management**

Crop water needs depend on...

- **Climate**
- **Soil**
- **Crop growth stage**
- **Crop type**

Crop Water Use

Seasonal Crop Water Needs

Crop	Seasonal Water Use (mm per growing period)
Alfalfa	800-1600
Barley/oats/wheat	450-650
Cotton	700-1300
Maize	500-800
Potato	500-700
Rice	450-700
Sorghum	450-650
Soybean	450-700
Sunflower	600-1000

From FAO Irrigation Training Manual 1986

What are the energy trade-offs?

Example 1: No-till

- Less tillage
- Initially more fertilizers and pesticides

Example 2: Legume cover crops

- Less nitrogen fertilizer
- Additional planting
- Additional mowing?

Example 3: Manure application

- Less fertilizer
- More passes over the field
- More weight to carry to the field

Energy Estimator

(a work in progress)

Search

National NRC

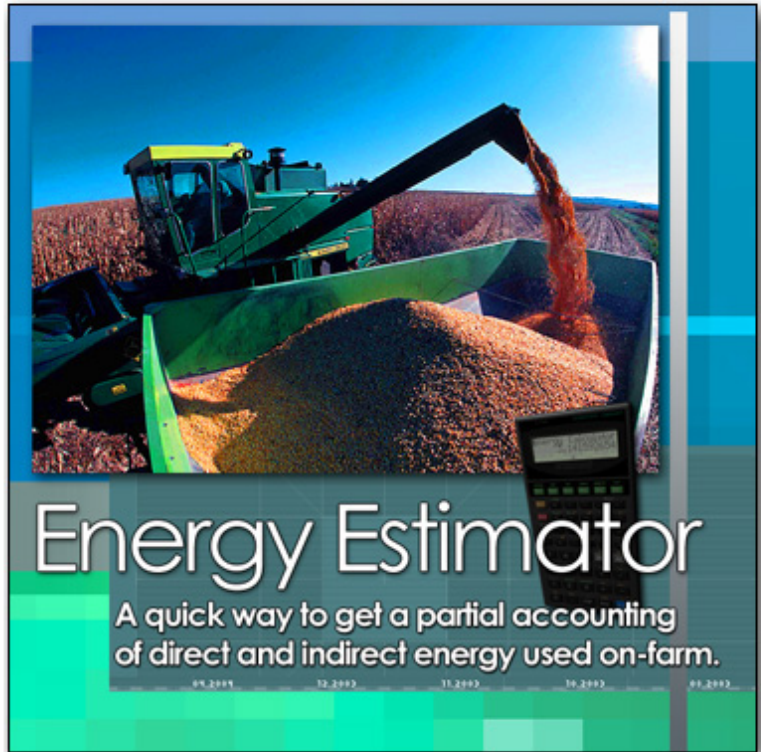
Enter Keywords GO

- Programs
- Farm Bill
- Find a Service Center
- States and Regions
- Centers and Institutes

Welcome

What is the Energy Estimator?

The **Energy Estimator** is a partial accounting of direct and indirect energy used on-farm. It is intended to allow farmers to compare the relative amount of fossil fuel energy consumed under different crop rotations and management activities. **This tool should be considered a prototype only.** While much of the information provided is derived from scientific and engineering literature, some is based on estimates. In addition, the tool has not yet been field tested. Therefore, accuracy is unknown.



To use this tool, begin by entering your zip code. Prepared data sets representing common crop management scenarios in your zip code area are automatically loaded. The user creates one or several multi-year cropping scenarios called **rotations**. After a user-specified rotation name has been entered, individual scenarios may be selected and modified to reflect your current operation and potential future operations using drop-down menus and direct entry. Reports summarize energy use by rotation, by crop and by type of management activity. *You cannot save your work, so it is important to complete all inputs and print all desired reports in one session.*



Energy Estimator - Crop Management Zone Search

Enter your zip code below.

Prepared data sets representing common crop management scenarios for individual crops in your zip code area will be automatically loaded into the estimator.

You will be able to modify a pre-defined crop scenario to reflect your operation using drop-down menus for field operations and farm inputs. Alternatively, you can build your crop management scenario "from scratch."

The Energy Estimator does not permanently save your data, so all calculations must be completed during a single session.

You can save and print reports of your farm energy calculations from the reports section when you are done.

Please begin by entering a zip code and clicking "Go": *

Rotation Identifier:

Rotation 1

Rotation Description:

Corn-soybeans conventional tillage

Years in Rotation:

2 *

Acres:

500 *

Irrigation: Yes No

Enter Crop Data

Clear Rotation

Create a new rotation:

- Enter an identifier for the rotation, for example, "current" or "corn-soybeans ridge till" (optional).
- Enter a rotation description (optional).
- Select years in rotation (required). For example, corn-soybeans-wheat is a 3-year rotation.
- Enter crop acres for this rotation (required).
- Click 'Yes' if pump irrigation is used and enter irrigation information (required if pump irrigated).
- Click "Enter Crop Data" when you have completed this screen.
- You can create up to four different rotations in the energy estimator to evaluate future options.
- You can add up to 16 crops for each rotation.
- You can change the crop management zone which was determined by your zip code by selecting the link on the left side of this page.
- For additional guidance click the Help button at the top of the page.

Select a crop:

Pre-defined crop

User defined crop

- Select a Crop Scenario --
- Select a Crop Scenario --
- Alfalfa,5yr, 4 cuts
- Alfalfa,7yr, 4 cuts
- Barley, grain; chisel, sweep
- Bermuda, hay
- Bermudarass, rotational grazing
- Corn, grain; fall chisel
- Corn, grain; nt
- Corn, grain; rows bedded, spring burn, disk
- Corn, grain; spring chisel
- Corn, silage; fall chisel
- Corn, silage; spring disk
- Cotton, stripper
- Cotton, stripper; w/wheat cover
- Fallow, chemical, w/ weed growth
- Oats, grain; fall plant
- Oats, grain; spring plant
- Rye, grain; chisel, sweep
- Rye, grain; disk
- Rye, grain; nt
- Sorghum, forage, cover crop
- Sorghum, grain; disk after wheat
- Sorghum, grain; fall chisel
- Sorghum, grain; nt
- Sorghum, grain; spring chisel
- Sorghum, grazed forage
- Sorghum, hayed forage
- Soybeans full: 15 in row

- Select "Pre-defined crop" or "User defined crop"
- If you select "Pre-defined crop", select one from the drop-down list of pre-defined crop management scenarios.
- If you select "User defined crop", you will enter all operations and inputs by hand.
- Your pre-defined selection will generate a list of associated field operations that can be edited below (after the page reloads).
- One at a time, you may add or create up to 16 crops for a "User defined crop" rotation. You must complete a crop for each year in your defined rotation.
- For additional guidance click the Help button at the top of the page.

- **Clear Crop:** Click to clear crop data.
- **Next:** Click to enter next crop in the rotation or create a report.

Insert	Edit	Delete	Field Operation
Insert	Edit	Delete	Chisel, st. pt.
Insert	Edit	Delete	Disk, tandem heavy primary op.
Insert	Edit	Delete	Disk, tandem secondary op.
Insert	Edit	Delete	Fert applic. anhyd knife 12 in
Insert	Edit	Delete	Planter, double disk opener
Insert	Edit	Delete	Combine

Insert	Edit	Delete	Input	Pounds
Insert	Edit	Delete	-- Select a Material --	0

Material - Microsoft Internet Explorer

Select a material:

- Select a material from the list.
- Enter the pounds applied per acre in the text box.
- Click the "Accept" button. The accepted material and pounds will be displayed in the Energy Estimator.
- You can calculate a custom blend by clicking on the material 'User Blend', then entering the pounds applied and NPK values.

Material:

-- Select a Material --

-- Select a Material --

- Ammonium Nitrate 33-0-0 (lb/ac)
- Ammonium Sulfate 21-0-0, 24% S (lb/ac)
- Anhydrous Ammonia (lb/ac)
- Atrazine, AI, emulsifiable concentrate (lb/ac)
- Calcium Oxide (CaO) lime (lb/ac)
- Diammonium phosphate (DAP) 18-46-0 (lb/ac)
- Fertilizer blend 12-12-12 (lb/ac)
- Fertilizer blend 33-10-5 (lb/ac)

Pounds/acre applied:

Pre-defined crop	Corn, grain; fall chisel
User defined crop	...or click 'Crop Text' and enter crop name here...

- Select "Pre-defined crop" or "User defined crop"
- If you select "Pre-defined crop", select one from the drop-down list of pre-defined crop management scenarios.
- If you select "User defined crop", you will enter all operations and inputs by hand.
- Your pre-defined selection will generate a list of associated field operations that can be edited below (after the page reloads).
- One at a time, you may add or create up to 16 crops for a "User defined crop" rotation. You must complete a crop for each year in your defined rotation.
- For additional guidance click the Help button at the top of the page.

ert	Edit	Delete	Field Operation
ert	Edit	Delete	Chisel, st. pt.
ert	Edit	Delete	Disk, tandem heavy primary op.
ert	Edit	Delete	Disk, tandem secondary op.
ert	Edit	Delete	Fert applic. anhyd knife 12 in
ert	Edit	Delete	Sprayer
ert	Edit	Delete	Planter, double disk opener
ert	Edit	Delete	Combine

Edit this list (or create a new list) of annual operations for this crop:

- Crop year begins after harvest of the previous crop and ends with current crop harvest.
- The order in which operations are entered will not affect results.
- Click on the Insert or Edit link to insert a new operation or edit the existing operation. A new window opens with a list of operations.
- To delete an operation from the list, click the Delete button.
- You can add any number of operations to a crop.
- You can create duplicate operations.

ert	Edit	Delete	Input	Pounds
ert	Edit	Delete	Anhydrous Ammonia (lb/ac)	130
ert	Edit	Delete	Pesticide, other (lb/ac)	2
ert	Edit	Delete	-- Select a Material --	0

Create a list of inputs for this crop:

- Click on the Insert or Edit link to insert a new material or edit the existing material. A new window opens with a list of materials.
- To delete a material from the list, click the Delete button.
- You can calculate a custom NPK blend by selecting 'User specified fertilizer blend.' For additional guidance click on the Help button at the top of the page.
- You can add any number of materials to a crop.

[Next](#) [Clear Crop](#)

- **Clear Crop:** Click to clear crop data.
- **Next:** Click to enter next crop in the rotation or create a report.

Pre-defined crop	Soybeans, full; 30 in. row ▼
User defined crop	...or click 'Crop Text' and enter crop name here...

- If you select "Pre-defined crop", select one from the drop-down list of pre-defined crop management scenarios.
- If you select "User defined crop", you will enter all operations and inputs by hand.
- Your pre-defined selection will generate a list of associated field operations that can be edited below (after the page reloads).
- One at a time, you may add or create up to 16 crops for a "User defined crop" rotation. You must complete a crop for each year in your defined rotation.
- For additional guidance click the Help button at the top of the page.

ert	Edit	Delete	Field Operation
ert	Edit	Delete	Disk, tandem heavy primary op.
ert	Edit	Delete	Field Cultivator
ert	Edit	Delete	Sprayer
ert	Edit	Delete	Planter, double disk opener
ert	Edit	Delete	Combine

Edit this list (or create a new list) of annual operations for this crop:

- Crop year begins after harvest of the previous crop and ends with current crop harvest.
- The order in which operations are entered will not affect results.
- Click on the Insert or Edit link to insert a new operation or edit the existing operation. A new window opens with a list of operations.
- To delete an operation from the list, click the Delete button.
- You can add any number of operations to a crop.
- You can create duplicate operations.

ert	Edit	Delete	Input	Pounds
ert	Edit	Delete	Glyphosate, AI, water soluble (lb/ac)	2
ert	Edit	Delete	-- Select a Material --	0

Create a list of inputs for this crop:

- Click on the Insert or Edit link to insert a new material or edit the existing material. A new window opens with a list of materials.
- To delete a material from the list, click the Delete button.
- You can calculate a custom NPK blend by selecting 'User specified fertilizer blend.' For additional guidance click on the Help button at the top of the page.
- You can add any number of materials to a crop.

Next

Clear Crop

- **Clear Crop:** Click to clear crop data.
- **Next:** Click to enter next crop in the rotation or create a report.



Reports

Energy Estimator for Farming Systems: Reports

[Farming operation summary report](#)

[Compare by rotation report](#)

[Compare crops in rotation report](#)

To modify existing rotations, [close](#) the report window.

Rotation: Rotation 1

Description	Years	Acres	Avg. Irrigation Energy (gal/acre/yr)	Avg. Direct Energy (gal/acre/yr)	Avg. Indirect Energy (gal/acre/yr)	Total Direct Energy (gal/rotation)	Total Indirect Energy (gal/rotation)
Corn-Soybeans conventional	2	500	.0	4.1	11.3	2,055	5,665
			Irrigation:	Lift: 0	PSI: 0	Power Source:	

Crop: Corn, grain; fall chisel	Irrigation Energy	Direct Energy (gal/acre/crop)	Indirect Energy (gal/acre/crop)	Total Direct Energy (gal/rotation)	Total Indirect Energy (gal/rotation)
	.0	4.9	19.7	2,465	9,860
Irrigation Inches: 0					

Operations:		
		Chisel, st. pt.
		Disk, tandem heavy primary op.
		Disk, tandem secondary op.
		Fert applic. anhyd knife 12 in
		Sprayer, pre-emergence
		Planter, double disk opnr
		Harvest, killing crop 50pct standing stubble
Materials:		Pounds:
	Anhydrous Ammonia (lb/ac)	130.0
	Pesticide, other (lb/ac)	2.0

Crop: Soybeans, full; 30 in. row	Irrigation Energy	Direct Energy (gal/acre/crop)	Indirect Energy (gal/acre/crop)	Total Direct Energy (gal/rotation)	Total Indirect Energy (gal/rotation)
	.0	3.3	2.9	1,645	1,470
Irrigation Inches: 0					

Operations:		
		Disk, tandem heavy primary op.
		Cultivator, field 6-12 in sweeps
		Sprayer, pre-emergence
		Planter, double disk opnr

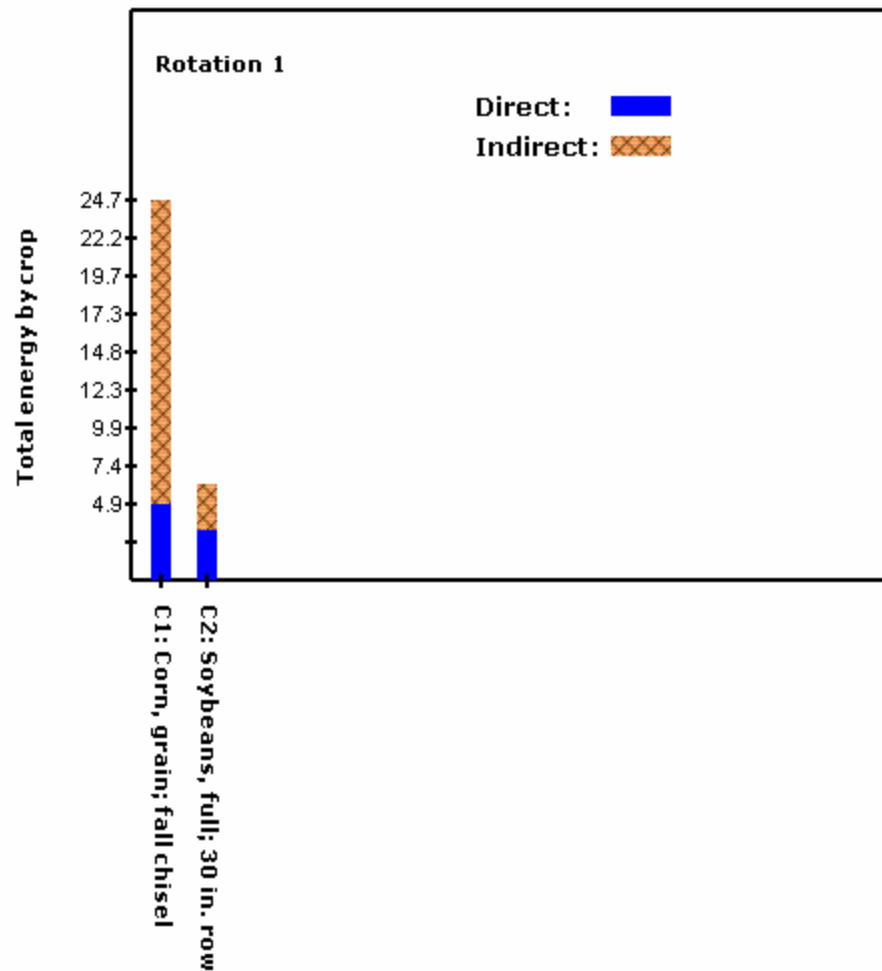
Compare crops in rotations energy use reports

(diesel equiv. gal/acre/crop)

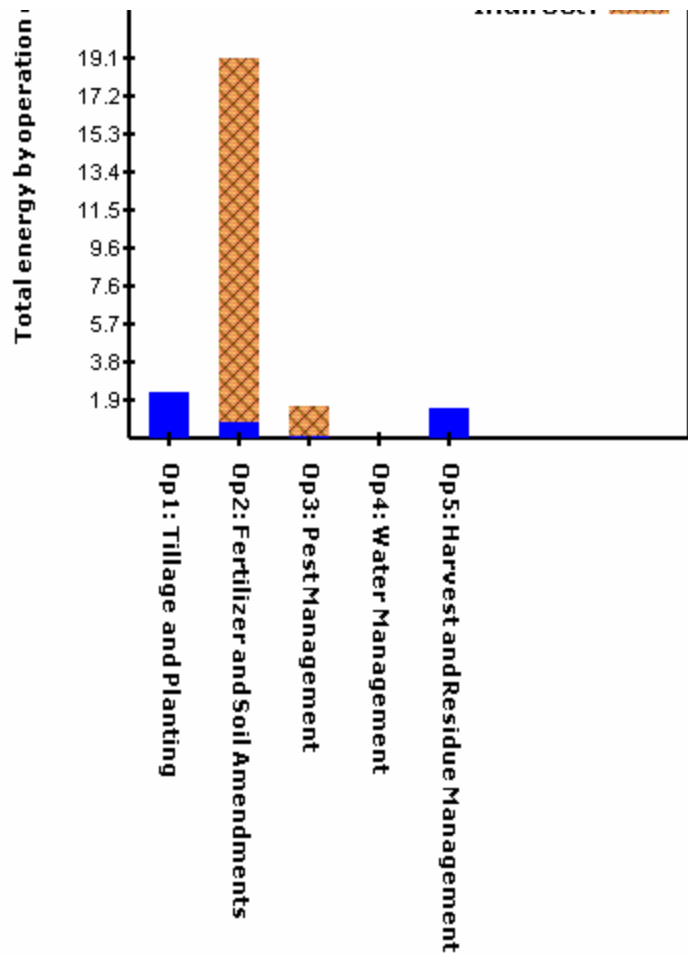
is displayed below:

each rotation: Total Energy By Crop
each crop in rotation: Total Energy By Operation Category

Total energy by crop for rotation: Rotation 1

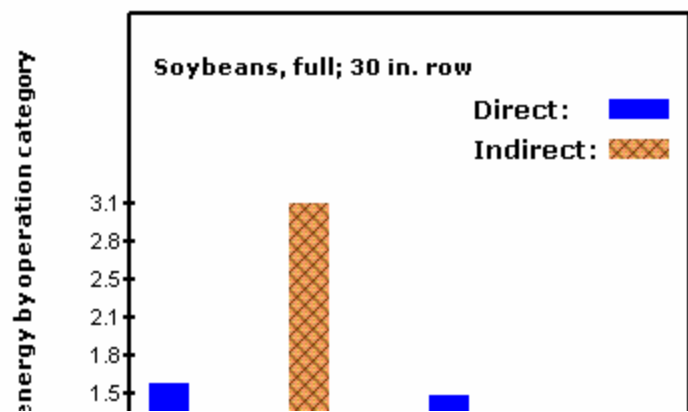


Total energy by Crop			
	Direct	Indirect	Total
C1:	4.9	19.7	24.7
C2:	3.3	2.9	6.2



Op3:	0.1	1.5	1.7
Op4:	0.0	0.0	0.0
Op5:	1.5	0.0	1.5

Total energy by operation category for Rotation 1: Soybeans, full; 30 in. row



Total energy by Operation			
	Direct	Indirect	Total
Op1:	1.6	0.0	1.6
Op2:	0.0	0.0	0.0
Op3:	0.1	2.9	3.1
Op4:	0.0	0.0	0.0
Op5:	1.5	0.0	1.5

Rotation

Energy Estimator for Farming Systems: Enter Rotation data

Modify Previous Rotation

Rotation Identifier:

Rotation 2

Rotation Description:

Corn soybeans no-till

Years in Rotation:

2 *

Acres:

500 *

Irrigation: Yes No

Enter Crop Data

Clear Rotation

Create a new rotation:

- Enter an identifier for the rotation, for example, "current" or "corn-soybeans ridge till" (optional).
- Enter a rotation description (optional).
- Select years in rotation (required). For example, corn-soybeans-wheat is a 3-year rotation.
- Enter crop acres for this rotation (required).
- Click 'Yes' if pump irrigation is used and enter irrigation information (required if pump irrigated).
- Click "Enter Crop Data" when you have completed this screen.
- You can create up to four different rotations in the energy estimator to evaluate future options.
- You can add up to 16 crops for each rotation.
- You can change the crop management zone which was determined by your zip code by selecting the link on the left side of this page.
- For additional guidance click the Help button at the top of the page.

Pre-defined crop

User defined crop

- Select the defined crop or user defined crop
- If you select "Pre-defined crop", select one from the drop pre-defined crop management scenarios.
- If you select "User defined crop", you will enter all operations and inputs by hand.
- Your pre-defined selection will generate a list of associated operations that can be edited below (after the page reloads).
- One at a time, you may add or create up to 16 crops for defined crop" rotation. You must complete a crop for each defined rotation.
- For additional guidance click the Help button at the top of the page.

Insert	Edit	Delete	Field Operation
Insert	Edit	Delete	Planter, double disk opener
Insert	Edit	Delete	Sprayer
Insert	Edit	Delete	Fert applic. anhyd knife 12 in
Insert	Edit	Delete	Combine

Edit this list (or create a new list) of annual operations for this crop:

- Crop year begins after harvest of the previous crop and current crop harvest.
- The order in which operations are entered will not affect the rotation.
- Click on the Insert or Edit link to insert a new operation or edit an existing operation. A new window opens with a list of crop operations.
- To delete an operation from the list, click the Delete button.
- You can add any number of operations to a crop.
- You can create duplicate operations.

Insert	Edit	Delete	Input	Pounds
Insert	Edit	Delete	Anhydrous Ammonia (lb/ac)	130
Insert	Edit	Delete	Pesticide, other (lb/ac)	2
Insert	Edit	Delete	Diammonium phosphate (DAP) 18-46-0 (lb/ac)	25
Insert	Edit	Delete	-- Select a Material --	0

Create a list of inputs for this crop:

- Click on the Insert or Edit link to insert a new material or edit an existing material. A new window opens with a list of materials.
- To delete a material from the list, click the Delete button.
- You can calculate a custom NPK blend by selecting 'Use fertilizer blend.' For additional guidance click on the Help button at the top of the page.
- You can add any number of materials to a crop.

- **Clear Crop:** Click to clear crop data.
- **Next:** Click to enter next crop in the rotation or create a new crop.

Method 2 - Create the next crop using a predefined scenario or manually.

Pre-defined crop Soybeans, full; nt, 30 in. row

User defined crop ...or click 'Crop Text' and enter crop name here...

Select a crop:

- Select "Pre-defined crop" or "User defined crop"
- If you select "Pre-defined crop", select one from the pre-defined crop management scenarios.
- If you select "User defined crop", you will enter all inputs by hand.
- Your pre-defined selection will generate a list of annual operations that can be edited below (after the page loads).
- One at a time, you may add or create up to 16 crop defined crop" rotation. You must complete a crop for defined rotation.
- For additional guidance click the Help button at the top of the page.

Edit this list (or create a new list) of annual operation

Insert	Edit	Delete	Field Operation
Insert	Edit	Delete	Planter, double disk opener
Insert	Edit	Delete	Sprayer
Insert	Edit	Delete	Combine

- Crop year begins after harvest of the previous crop or current crop harvest.
- The order in which operations are entered will not affect the crop rotation.
- Click on the Insert or Edit link to insert a new operation into an existing operation. A new window opens with a list of operations to choose from.
- To delete an operation from the list, click the Delete button.
- You can add any number of operations to a crop.
- You can create duplicate operations.

Create a list of inputs for this crop:

Insert	Edit	Delete	Input	Pounds
Insert	Edit	Delete	Pesticide, other (lb/ac)	2
Insert	Edit	Delete	-- Select a Material --	0

- Click on the Insert or Edit link to insert a new material into an existing material. A new window opens with a list of materials to choose from.
- To delete a material from the list, click the Delete button.
- You can calculate a custom NPK blend by selecting 'fertilizer blend.' For additional guidance click on the top of the page.
- You can add any number of materials to a crop.

[Next](#) [Clear Crop](#)

- **Clear Crop:** Click to clear crop data.
- **Next:** Click to enter next crop in the rotation or create a new rotation.

Rotation: Rotation 2

Description	Years	Acres	Avg. Irrigation Energy (gal/acre/yr)	Avg. Direct Energy (gal/acre/yr)	Avg. Indirect Energy (gal/acre/yr)	Total Direct Energy (gal/rotation)	Total Indirect Energy (gal/rotation)
Corn-Soybeans no-till	2	500	.0	2.6	12.2	1,275	6,080

Irrigation: Lift: 0 PSI: 0 Power Source:

Crop: Corn, grain; nt	Irrigation Energy	Direct Energy (gal/acre/crop)	Indirect Energy (gal/acre/crop)	Total Direct Energy (gal/rotation)	Total Indirect Energy (gal/rotation)
	.0	3.0	21.4	1,500	10,690

Irrigation Inches: 0

Operations:

- Planter, double disk opnr w/fluted coulter
- Sprayer, pre-emergence
- Fert applic. anhyd knife 12 in
- Harvest, killing crop 50pct standing stubble

Materials:

Pounds:

Anhydrous Ammonia (lb/ac)	139.0
Diammonium phosphate (DAP) 18-46-0 (lb/ac)	20.0
Pesticide, other (lb/ac)	2.0

Crop: Soybeans, full; nt, 30 in. row	Irrigation Energy	Direct Energy (gal/acre/crop)	Indirect Energy (gal/acre/crop)	Total Direct Energy (gal/rotation)	Total Indirect Energy (gal/rotation)
	.0	2.1	2.9	1,050	1,470

Irrigation Inches: 0

Operations:

- Planter. double disk opnr w/fluted coulter

Copy:

Information will be
 You can update that
 You can create a copy of
 this Rotation" button. A
 selected one. After you
 new crop with the

op"
 from the drop-down list
 for all operations
 of associated field
 the page reloads).
 crops for a "User
 crop for each year in
 at the top of the page.

or create a report.

Compare rotations energy use report

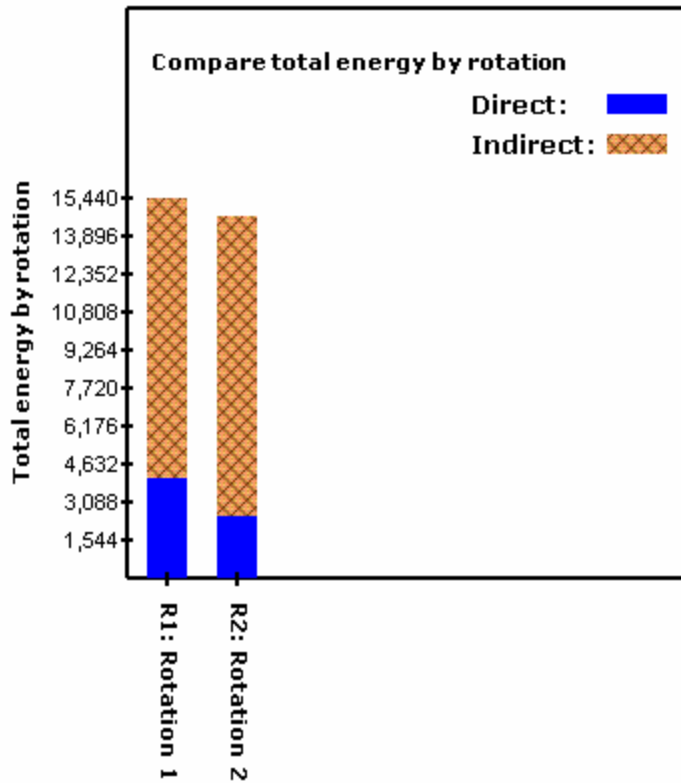
(diesel equiv. gallons/rotation)

is displayed below:

all rotations: Total Energy By Rotation

each rotation: Total Energy By Operation Category

Total energy by rotation:



Total energy by Rotation

	Direct	Indirect	Total
R1:	4,110	11,330	15,440
R2:	2,550	12,160	14,710

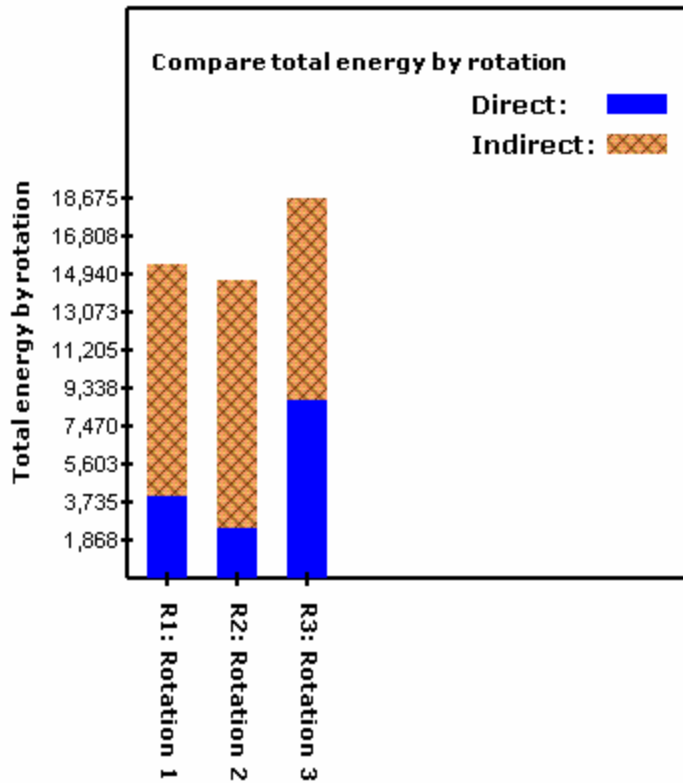
(diesel equiv. gallons/rotation)

is displayed below:

all rotations: Total Energy By Rotation

each rotation: Total Energy By Operation Category

Total energy by rotation:

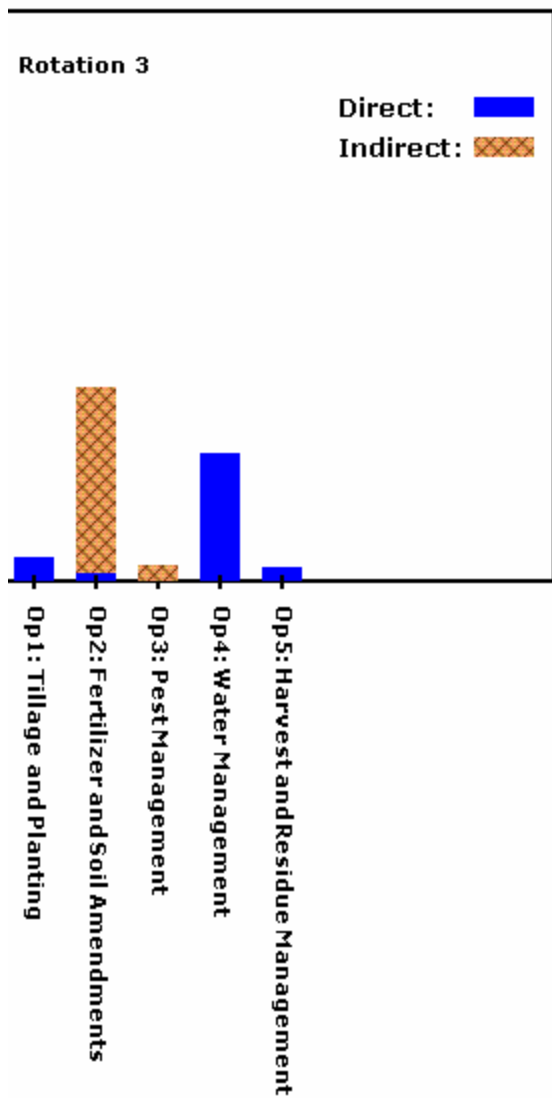


Total energy by Rotation

	Direct	Indirect	Total
R1:	4,110	11,330	15,440
R2:	2,550	12,160	14,710
R3:	8,815	9,860	18,675

nts
:ment

Energy by operation category for Rotation 3



Total energy by Operation			
	Direct	Indirect	Total
Op1:	1,185	0	1,185
Op2:	450	9,100	9,550
Op3:	65	760	825
Op4:	6,350	0	6,350
Op5:	765	0	765

Close

Print

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