

Guidance for Constructing Operation Sequences in RUSLE 2 to Simulate Vertical Tillage

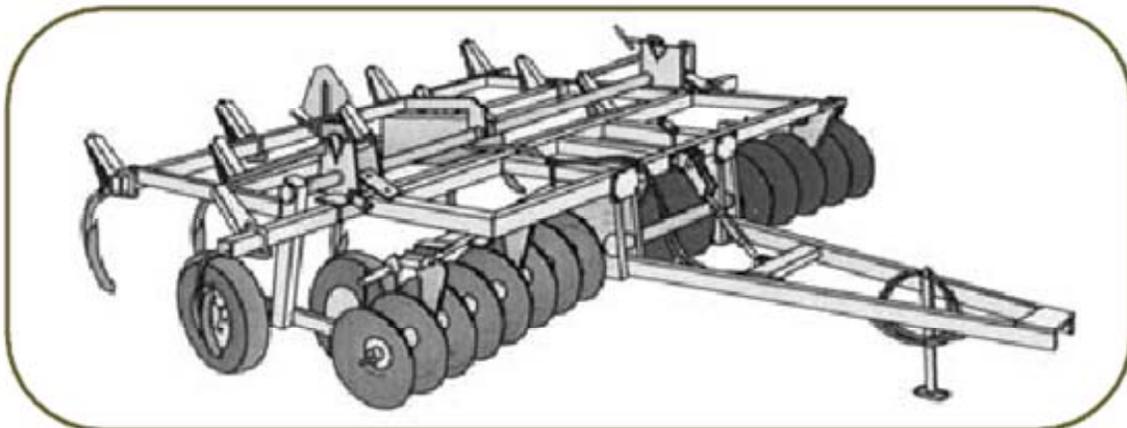
Tillage implements continue to evolve in design and purpose. Competition in the farm implement industry and changes in cropping patterns drive manufacturers to develop new designs for tillage tools. Trends toward larger farms and higher fuel prices have prompted farmers to reduce the number of tillage passes needed per acre to plant a crop. Consequently, single action tools such as plows, discs, and harrows have largely been replaced with implements that are multiple action tools commonly referred to as combination tillage tools. Combination tillage tools perform actions on the soil that once required separate passes with two or more separate implements. A type of combination tillage tool known as vertical tillage implements is now commonly used in Illinois. Under high residue conditions, vertical tillage tools tend to disturb the soil less than other types of tillage implements due to shallower operation depths and less inversion of the crop residues by the components of the implement. Under low residue conditions, surface soil disturbance can significantly increase sheet and rill erosion rates. Even though vertical tillage is typically less aggressive than other types of tillage it is **not** considered to be no-till. Soil disturbance from tillage operations can have short term benefits such as sizing crop residue, warming soils, hastening nutrient cycling, fracturing surface crusts, and providing a more optimum seedbed conditions for crop emergence. Long term detrimental effects however such as the loss of organic matter, increased compaction, and sheet and rill erosion can occur. Questions have arisen from RUSLE 2 users as to how best to simulate the effects of vertical tillage implements. The guidance to follow will assist field offices in using RUSLE 2 for conservation planning where vertical tillage implements are used.

As an introduction, the link provided below provides an excellent description of vertical tillage implements and provides an overview of the variations that are now on the market.

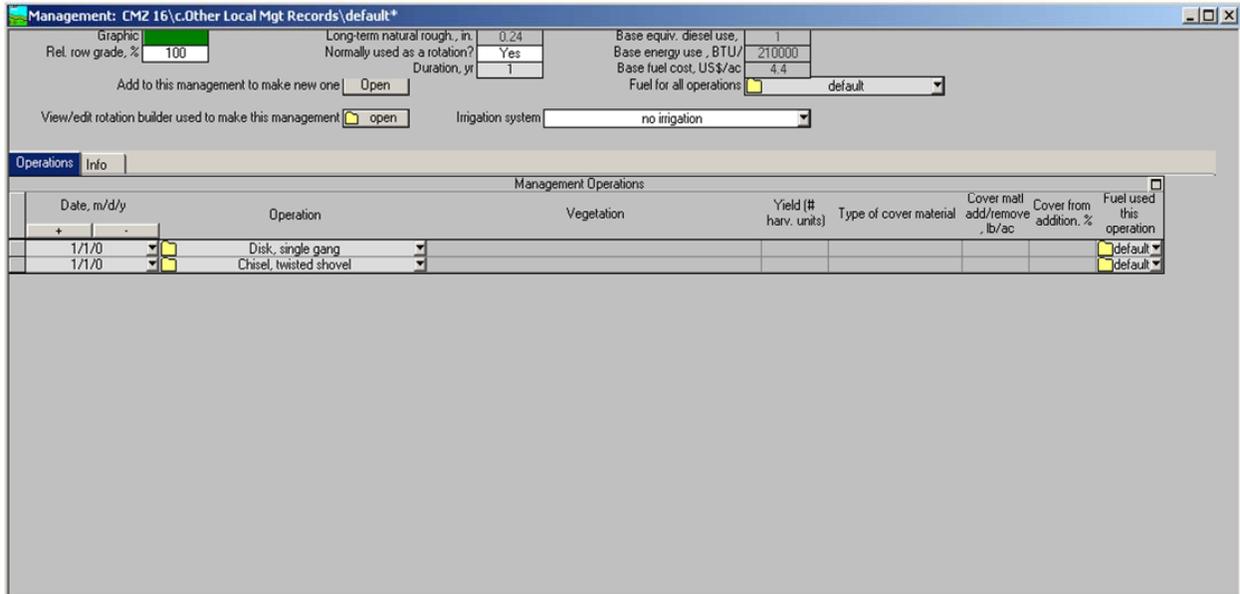
<http://www.youtube.com/watch?v=RuH6li1H4Lk>

Vertical tillage implements are a new type of combination tillage tool. To simulate a combination tillage implement in RUSLE 2, the user must identify the basic components of the implement being used. The user will enter each component as single operation performed on the same day in RUSLE 2. For example, the implement in the figure 1 is combination tillage tool, although not a vertical tillage implement, comprised of a single gang of disks followed by chisel plow shanks with twisted points or shovels.

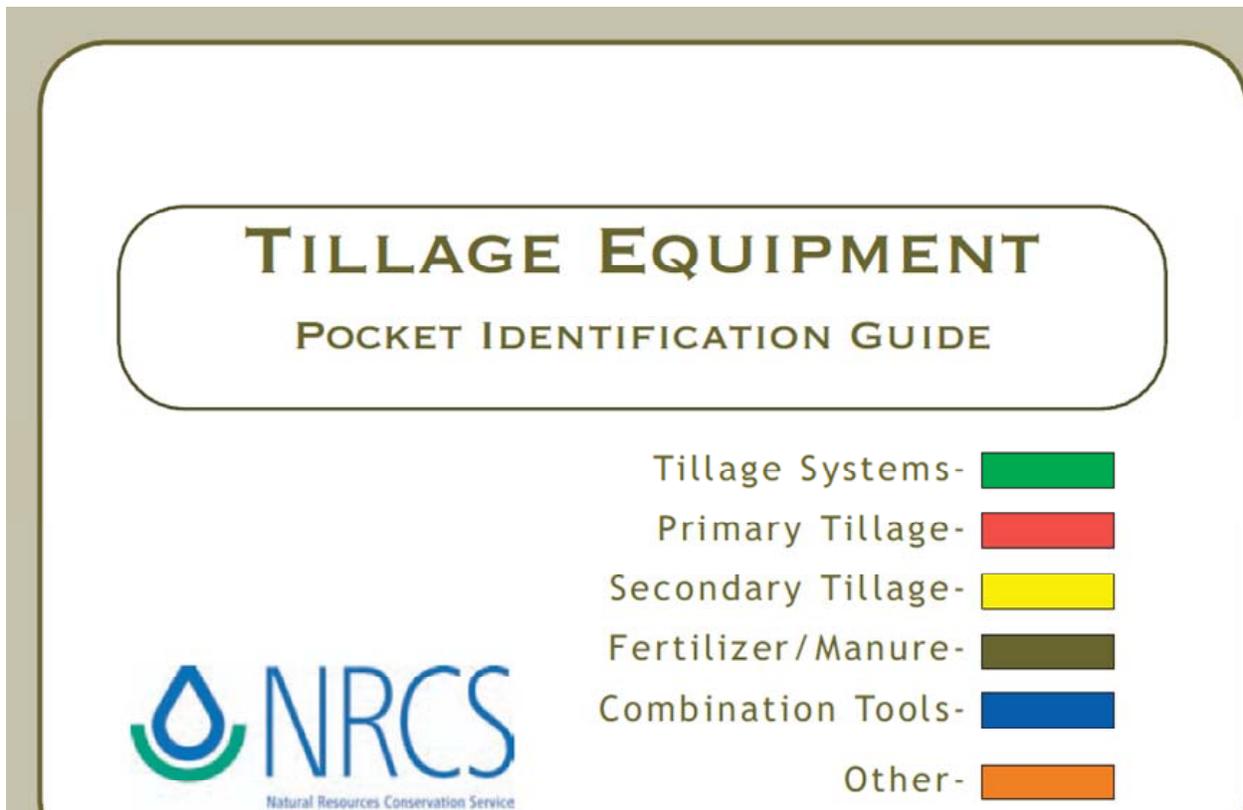
Figure 1.



The RUSLE 2 print screen below demonstrates how to simulate the implement above when conducted on January 1.



Identifying the components of a combination tillage implement is essential to knowing which operations to enter into RUSLE 2. Each field office has been provided a copy of the "Tillage Equipment-Pocket Identification Guide.



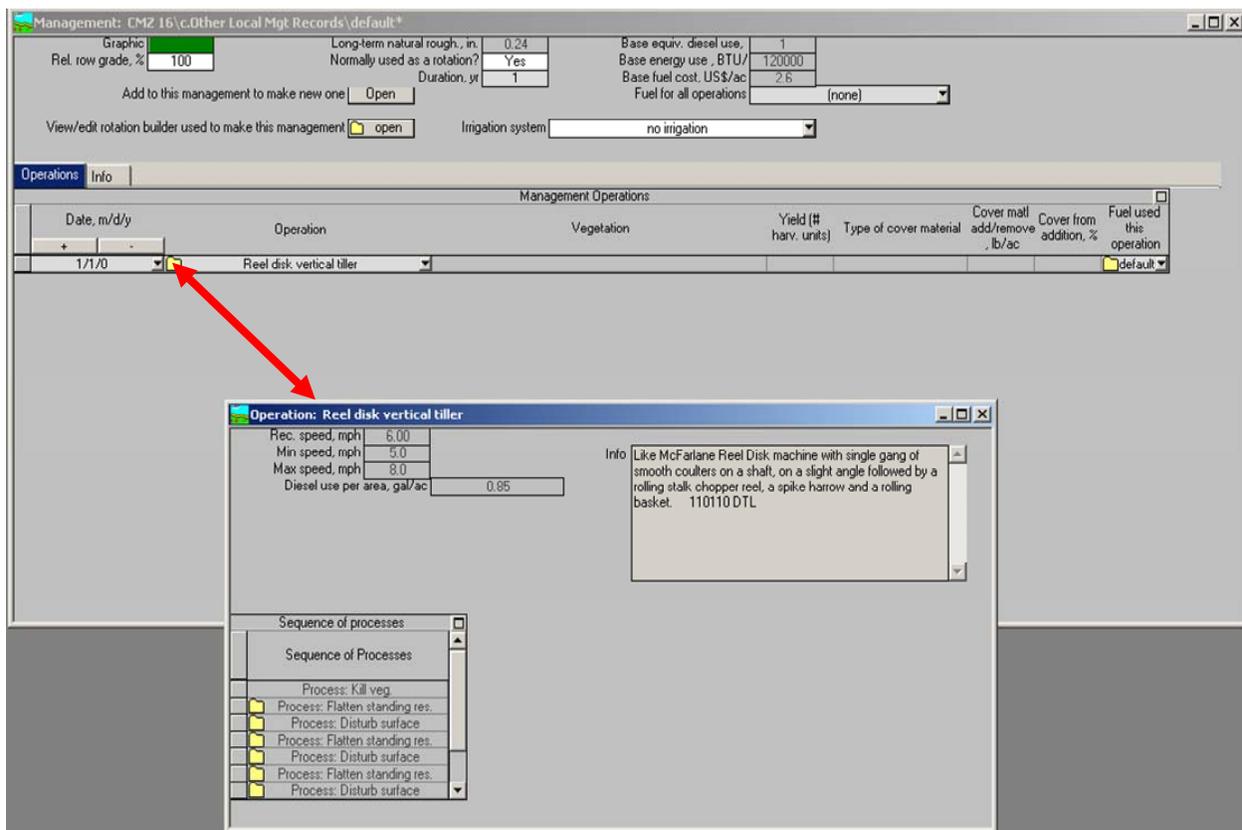
A revised version of the guide dated October 2010 is available in electronic format only and will be provided with this document as a “pdf” file. Note the section of the Pocket Tillage ID guide that is devoted to combination tillage implements along with directions on how to select individual operations in RUSLE 2 to represent them.

In a few instances, single RUSLE 2 operations have been constructed to simulate a particular variation of a vertical tillage implement and thus allowing the RUSLE 2 user to select a single operation to represent the multiple effects of single combination tool. At this time, there is not a single operation in the RUSLE 2 database created for every vertical tillage tool that is currently on the market. In these cases, the effects of a particular vertical tillage tool will have to be represented in RUSLE 2 as several single operations performed on the same day. The following examples will consist of a short film on various vertical tillage implements with corresponding RUSLE 2 print screens to help RUSLE 2 users to accurately identify the specific operations in RUSLE 2 to select.

The link below is a demonstration of a vertical tillage implement manufactured by the McFarlane Manufacturing Company Incorporated.

<http://www.youtube.com/watch?v=Cr8fjlvkKg&feature=related>

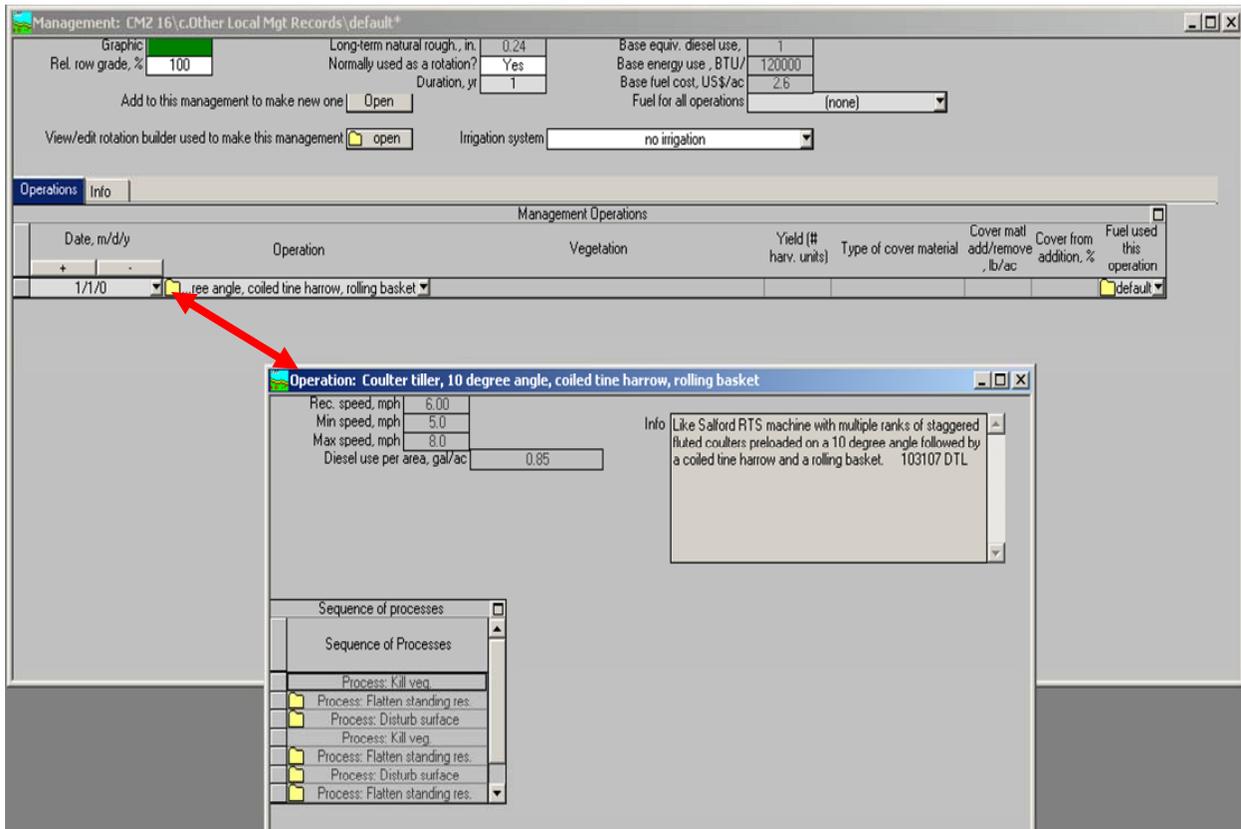
The RUSLE 2 screen below demonstrates how the implement would be represented in RUSLE 2 if operated on January 1.



The link below is a demonstration of a vertical tillage implement manufactured by the Salford Machinery Limited company.

<http://www.youtube.com/watch?v=yY09JkXPAGk>

The RUSLE 2 screen below demonstrates how the implement would be represented in RUSLE 2 if operated on January 1.



The link below is a demonstration of a few different versions of a vertical tillage implement manufactured by the Summers Manufacturing Limited company.

<http://www.youtube.com/watch?v=wVpnrJicyRI&feature=related>

The RUSLE 2 screen below demonstrates how one version of the implement would be represented in RUSLE 2 if operated on January 1. Note that the coulters can be different. In the example below, the first set of coulters are smooth and the rear gang of coulters are fluted.

The screenshot shows the RUSLE 2 software interface. The title bar reads "Management: CMZ 16\c.Other Local Mgt Records\default*". The interface is divided into several sections:

- Management Parameters:**
 - Graphic: [Green box]
 - Rel. row grade, %: 100
 - Long-term natural rough., in.: 0.24
 - Normally used as a rotation?: Yes
 - Duration, yr: 1
 - Base equiv. diesel use, gal: 1
 - Base energy use, BTU/: 200000
 - Base fuel cost, US\$/ac: 4.3
 - Fuel for all operations: default
 - View/edit rotation builder used to make this management: open
 - Irrigation system: no irrigation
- Operations Table:**

Date, m/d/y	Operation	Vegetation	Yield (# harv. units)	Type of cover material	Cover mat add/remove, lb/ac	Cover from addition, %	Fuel used this operation
1/1/0	Coulter caddy, with smooth coulters						default
1/1/0	Coulter caddy, w/ fluted coulters						default
1/1/0	Stalk chopper, rolling						default

The example above illustrates how a vertical tillage tool would be represented in RUSLE 2 where there are no single operations in the database to represent the implement. The user will need to identify the different components of the tool and then add them in sequence on the same day.

Note: The implements depicted in the examples were chosen for illustrative purposes only and are not intended to be an endorsement by the USDA-Natural Resources Conservation Service.

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