NETL Life Cycle Inventory Data
Process Documentation File

Process Name: Tiller, 5015 lbs, Tractor-Propelled, Construction

Reference Flow: 1 piece (pcs) of Tiller, 5015 lbs, Tractor-Propelled

Brief Description: Based on manufacturer specifications for a John Deere Model 425 disk harrow, tractor-propelled, 5,015-lb tiller. This unit process quantifies the amount of steel plate used to construct a single tiller.

Section I: Meta Data

Geographical Coverage: US **Region:** N/A

Year Data Best Represents: 2009

Process Type: Manufacturing Process (MP)

Process Scope: Gate-to-Gate Process (GG)

Allocation Applied: No

Completeness: Individual Relevant Flows Recorded

Flows Aggregated in Data Set:

☒ Process ☐ Energy Use ☐ Energy P&D ☐ Material P&D

Relevant Output Flows Included in Data Set:

Releases to Air:	☐ Greenhouse Gases	☐ Criteria Air Pollutants	☐ Other
Releases to Water:	☐ Inorganic Emissions	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

Tracked Input Flows:

Steel Plate, BF (85% Recovery Rate) [Metals]	*Steel plate from blast furnace (BF) used to construct tiller, assumes 85% recycled/recovery rate*

Tracked Output Flows:

Tiller, 5015 lbs, Tractor-Propelled [Construction]	*Construction of a single, 5,015-lb, tractor-propelled John Deere tiller*

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage1_C_Tiller_5015_lbs_TractorPropelled_2009.01.xls*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

The scope of this process encompasses the weight of materials necessary to construct a single 5,015-lb, tractor-propelled tiller, to be used for ground preparation during biomass cultivation. The process is based on the reference flow of 1 piece (pcs) of tiller, 5,015 lbs, tractor-propelled, as described below and shown in **Figure 1.** The tiller is assumed to be constructed entirely of steel; other materials are assumed to be negligible. By default, all steel within this study was assumed to be steel plate, based on available GaBi profiles, unless other steel types were specified per available data, or a higher grade of steel would be required, per NETL engineering judgment. Therefore, all steel considered in this unit process was assumed to be steel plate.

This process is used during Life Cycle (LC) Stage #1 to assist in ground preparation for the cultivation of biomass feedstocks. It is combined with other cultivation equipment construction unit processes in individual assembly cultivation unit processes for switchgrass, DF_Stage1_C_Assembly_SG_Cultivate_2010.01.xls, short rotation woody crops (SRWC), DF_Stage1_C_Assembly_SRWC_Cultivate_2010.01.xls, and corn stover, DF_Stage1_C_Assembly_CS_Cultivate_2010.01.xls. These assembly unit processes quantify the fraction of each piece of equipment needed under LC Stage #1 to produce 1 kg of biomass ready for transport (LC Stage #2) to the energy conversion facility (LC Stage #3).

Boundary and Description

Construction of the tiller is based on manufacturer specifications for a John Deere 5,015-lb, tractor-propelled tiller. The cultivation of biomass requires a tiller, which is pulled by a tractor for ground preparation.

Figure 1 provides an overview of the boundary of this unit process. Emissions related to the physical assembly of the tiller (e.g., emitted while assembling the components of a tiller, including transport of those components) are not considered in this study. Upstream emissions from the production of raw materials used for the construction of the tiller (e.g., steel plate) are calculated outside the boundary of this unit process, based on proprietary profiles available within the GaBi model. As shown in Figure 1 and discussed above, the tiller constructed in this unit process is incorporated into the cultivation assembly processes for LC Stage #1 for switchgrass, SRWC, and corn stover.

The total weight of a tiller is readily available, but reliable data for the material breakdown of tiller subcomponents were not. Therefore, the tiller was assumed

to be composed entirely of steel plate (Steel plate, BF (85% Recovery Rate) [Metals]).

Table 1 shows relevant properties and assumptions used to calculate the amount of steel plate contained in a single tiller. The manufacturer specifications for tillers show a range of weights from 3,307 to 5,015 lbs (1,500 to 2,275 kg); these weights depend partly on the width and number of disks in the tiller. The maximum weight of 5,015 lbs (2,275 kg) was chosen for this unit process based on estimated optimal tiller width requirements (John Deere 2009). Based on the assumption that the tiller is constructed entirely out of steel plate, the total weight is assigned to this material. **Table 2** provides a summary of modeled input and output flows. Additional detail regarding input and output flows, including calculation methods, is contained in the associated DS.

Figure 1: Unit Process Scope and Boundary

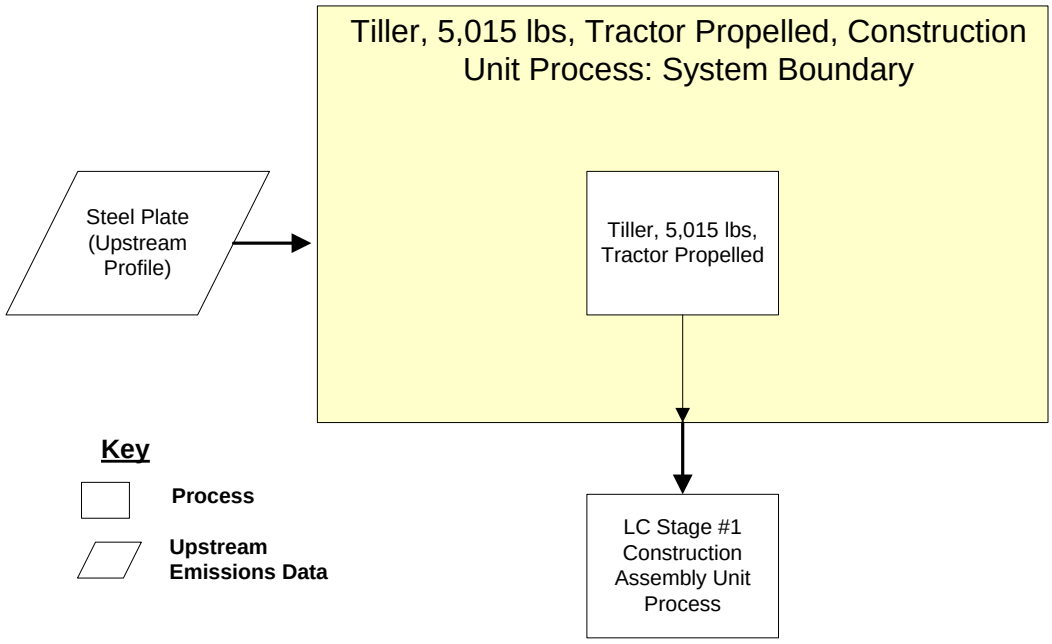

Table 1: Properties of the 5,015-lb, Tractor-Propelled Tiller

Total Weight of Single Tiller	Weight	Reference
One Tiller Weight, kg (lb)	2,275 (5,015)	John Deere 2009
Total Steel Plate in One Tiller, kg (lb)	2,275 (5,015)	NETL Engineering Judgment

Table 2: Unit Process Input and Output Flows

Flow Name*	Value	Units (Per Reference Flow)
Inputs		
Steel Plate, BF (85% Recovery Rate) [Metals]	**2,275**	**kg**
Outputs		
Tiller, 5015 lbs, Tractor-Propelled [Construction]	1	piece

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows. Upstream environmental flows were added during the modeling process using GaBi modeling software, as shown in Figure 1.

Embedded Unit Processes

None.

References

John Deere 2009 — John Deere. 2009. *Specifications: 425 Disk Harrow*. Deere & Company. http://manuals.deere.com/omview/OMP57112_19/AG_PX03972_1439_19_02FEB00_1.htm (Accessed December 15, 2009).

Section III: Document Control Information

Date Created: May 8, 2009

Point of Contact: Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV

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