

Training Workshop on Data Acquisition and Dataset Development for Life Cycle Inventory

Exercise 1 - Primary raw data acquisition and modeling

Data for producers:¹

The dataset covers all relevant steps involved with a Mango production from cradle-to-gate, i.e. all processes from raw materials extraction till Mango harvesting are taken into account.

PART 1.1 – Primary data collection

You are a successful producer that started your 20ha Mango plantation about 7 years ago, for that you needed to start from scratch and buy a piece of land that still had a forest on it, thus, first of all it was necessary to clean the “fields”.

Preparing the field for the plantation demanded machines to cut the trees and prepare the fields, electricity to power some machinery, diesel and land.

The machines can clean and prepare 263 ha of field during its lifetime which means that for your Mango plantation only 0.076 Machine units were necessary.

In total 13360 kW of electricity to power machines working 4 hours per hectare was needed.

$$13360/4 = 3340 \text{ kWh per 20 ha}$$

$$3340/20 = 167 \text{ kWh /ha}$$

Necessary materials and resources		
..		
..		
Diesel	1.61	MJ
..		

In the End of this process you had 20ha of clean and prepared field, 1000m³ of Biomass coming from the cut trees that need to be disposed and emissions of pollutants to the air in a low populated area.

Products / by-products / waste		
..		
..		

Emissions to air per hectare		
CO2 (biogenic)	21.14	kg
N2O	2.6	kg
CO2 (fossil)	78.58	kg
PM (particulate matter)	15	kg

¹ This fact sheet describes a simplified Mango production farm based on data from EcoInvent and Agribalyse databases.

PART 1.2 - Primary data collection

After preparing the field you needed to start your production, for this step you needed to consider again all the necessary resources and materials.

The plantation needs irrigation through the whole year, each plant consumes 100 liters of water per week and there is a total of 140 plants per hectare.

You expect you can produce Mangos on this field for at least 25 years.

The irrigation system uses a 2.5kW pump per hectare that works every day for 12h.

The land needs to be fertilized every year, therefore 111.9 kg of fertilizer is applied to each hectare of cultivated land per year.

DATA:

Mango production area: 20 ha

Annual yield: 15 t/ha/year

Necessary materials and resources		
Pesticides	8.82E-05	kg
Transport of fertilizers and pesticides to plant	200	km

Products / by-products / waste		

Emissions per kg of Mango		
Phosphate emissions to groundwater	2.09E-06	kg
Pesticides emissions to soil	8.82E-05	kg

PART 2 – Allocation

In the end of the harvest you have 2 products:

- Mangos for selling at the market
- Mangos that are too ripe and can only be consumed after being processed (jams, dry mango snacks, Mango pickles, etc.)

The main product is the Market mango and the Ripe mango is the by product which is 15% of the production and is responsible for 5% of the farm income.

Because 2 products are generated the environmental burdens need to be correctly split between them. There are many ways of doing it but we will check the results for mass allocation and economic allocation.

Mass allocation:

1 ton of Mango = 850 kg of Market mango + 150 kg of Ripe mango, but emissions are for 1 kg of Mango

Products / by-products / waste		
Market mango	0.85	kg
Ripe mango	0.15	kg

Emissions per kg of Mango		
Phosphate emissions to groundwater	2.09E-06	kg
Pesticides emissions to soil	8.82E-05	kg

Mass distribution		

Emissions per product		
Phosphate emissions to groundwater		kg
Pesticides emissions to soil		kg
Phosphate emissions to groundwater		kg
Pesticides emissions to soil		kg

Economic allocation:

Market mango is worth Rs. 500/kg while Ripe mango is worth Rs. 25/kg

Products / by-products / waste		
Market mango	500	Rs
Ripe mango	25	Rs

Emissions per kg of Mango		
Phosphate emissions to groundwater	2.09E-06	kg
Pesticides emissions to soil	8.82E-05	kg

Mass distribution		

Emissions per product		
Phosphate emissions to groundwater		kg
Pesticides emissions to soil		kg
Phosphate emissions to groundwater		kg
Pesticides emissions to soil		kg