LCSA of an Edible bowl

Altina-Christina Toraj

Juliana Lampkowski

Tracy Hügel

Goal and Scope Definition

- Sustainability
- Circular economy

Zero waste packing!

- *“We work in the present for a sustainable future.”*

Goal and Scope Definition

- OKA Bioembalagens =Bio-packaging

  Owner: Mrs. Érika Cardoso

- Botucatu – SP – Brazil (South America)

- Functional Unit: 1 Edible Bowl

System Boundaries

Cradle to Gate

25 Km

TechnoAmido
amidos e derivados

173 Km

OR biotecnologia

São Pedro do Turvo - SP, Brazil

Botucatu - SP - Brazil

Methodological approach:
Mr. João Fadel and Mrs. Érika Cardoso, EcoInvent databases and other LCI databases.

Process Trees

Planting → Harvest → Discard of the stem

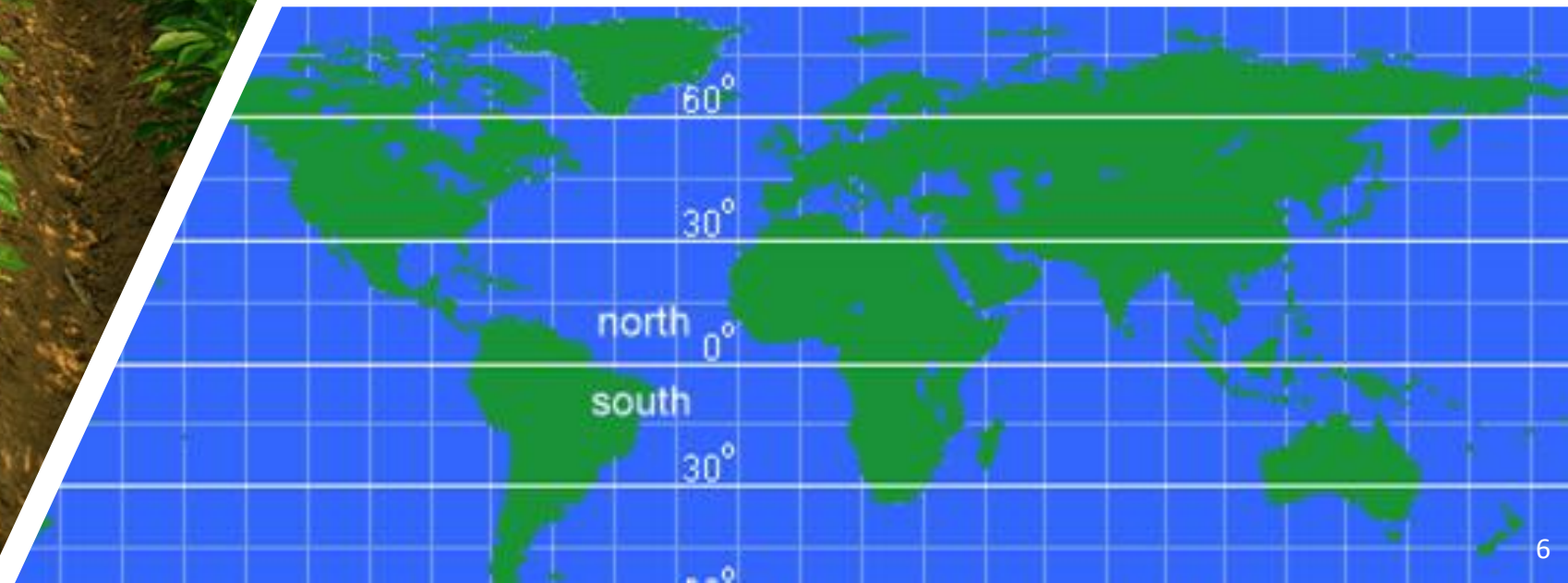
25 Km

Pre-Cleaning → Washing → Milling → Extracting → Spinning → Drying → Packaging

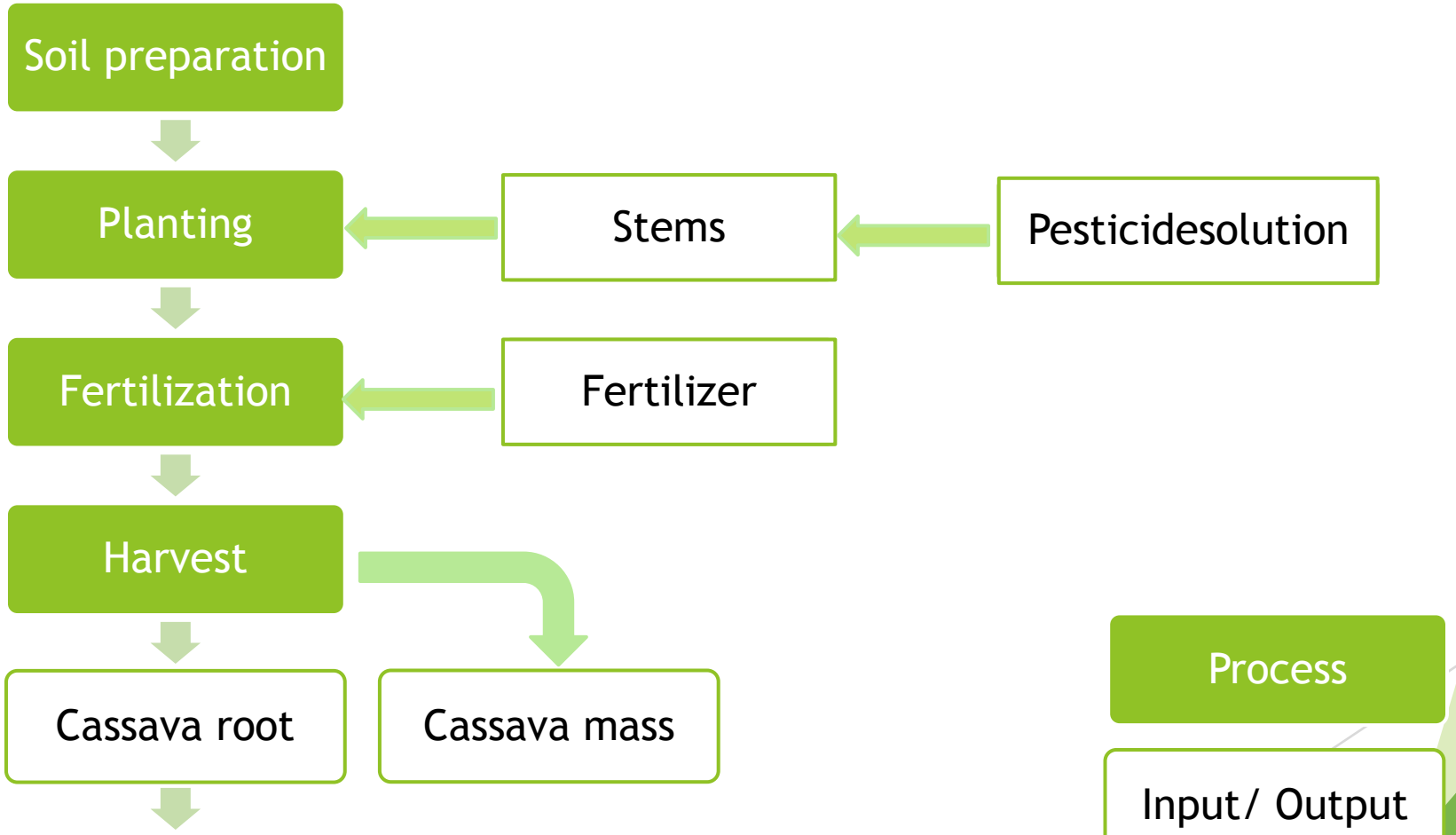
173 Km

Mixing Cooking Molding Cooling → Edible Bowl → Removal Sandpaper → Packaging Stocking Dispatch

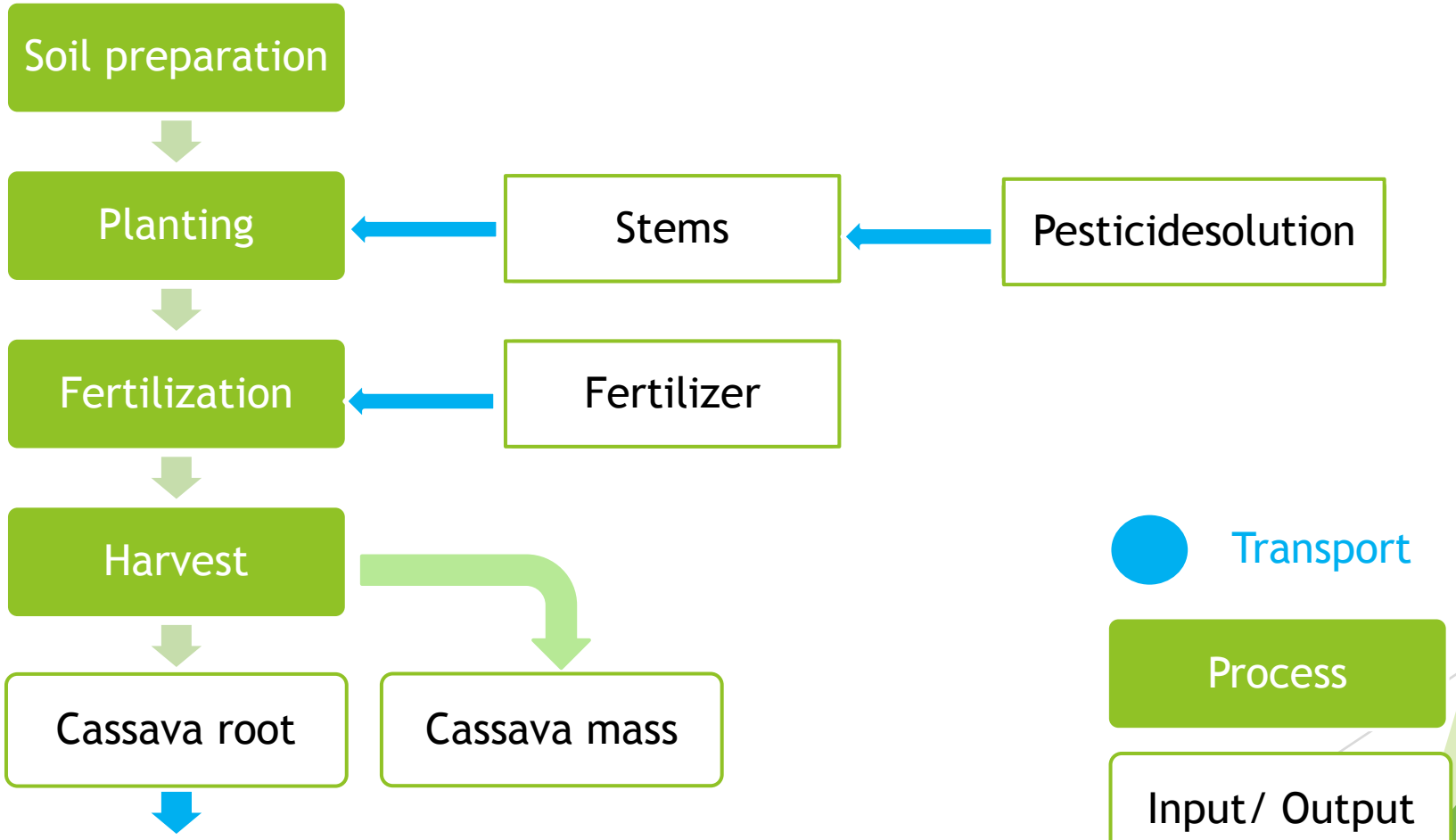
Cassava Cultivation



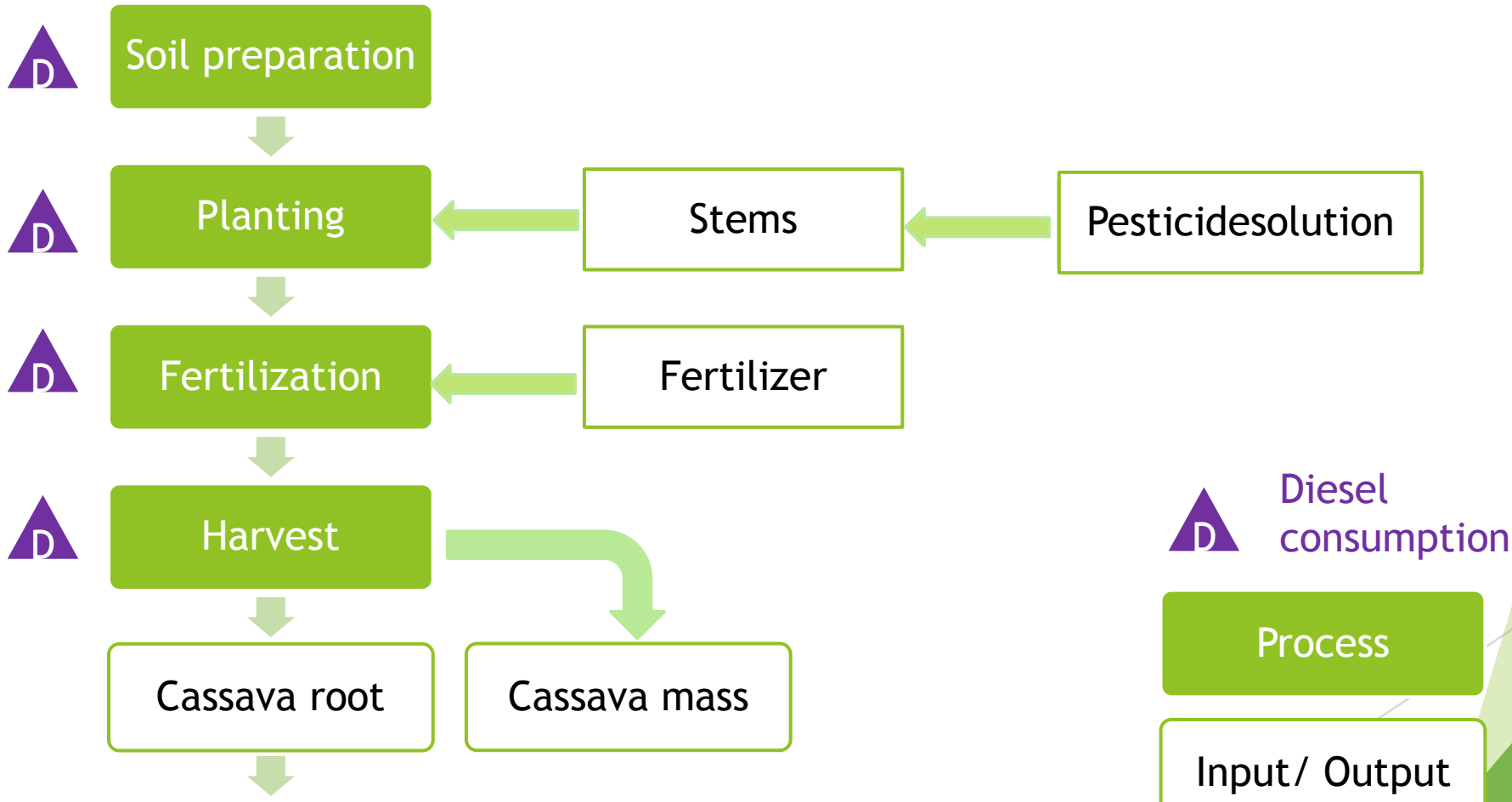
Cassava cultivation



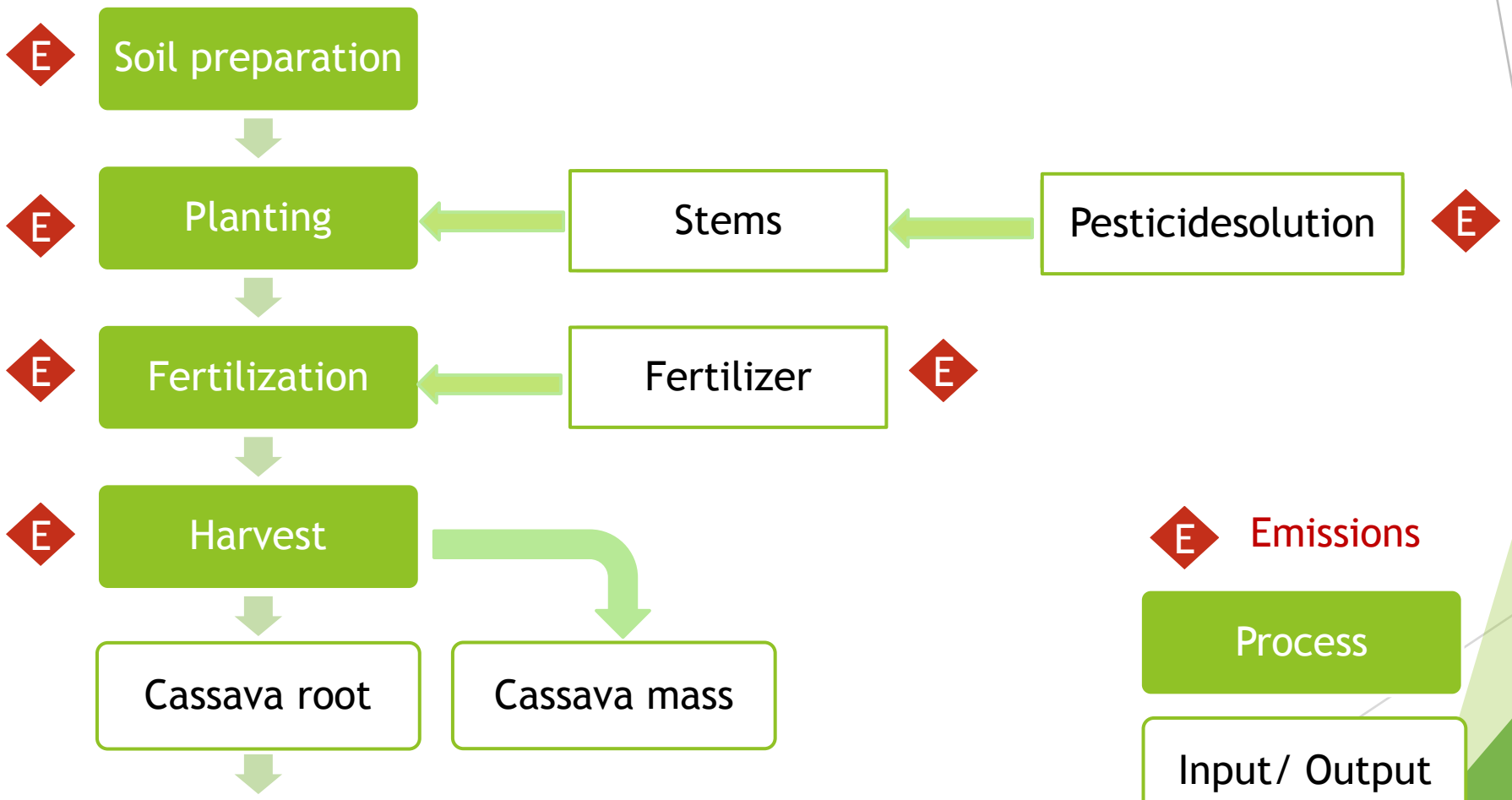
Cassava cultivation



Cassava cultivation



Cassava cultivation



Cassava production - inputs

Soil preparation	Planting	Pesticides	Fertiliser	Harvest	Transport	Work load
1 ha	Stems from last year 1 ha	Solution: thiamethoxam (1 kg) + water (1000 l water)	Manure: 12.5 t/ ha Nitrogen: 100 kg/ha Potassium: 100 kg/ha Phosphate: 100 kg/ha	By complete harvester 1 ha	1 t → 25 km 12,984 t → 324,6 km	936,1464 h

Cassava production - outputs

Cassava root

- 12,984 t/ha
- 60% of the whole plant

Cassava mass

- 40% of the whole plant
- 8,656 t/ha

Emissions to air

- Ammonia: 2,662 kg
- Dinitrogen monoxide: 5,72070 kg

Emissions to water

- Nitrate: 3,3225 kg
- Nitrogen monoxide: 1,28570 kg
- Phosphate: 0,88338 kg
- Phosphorrus: 0,53 kg

Manioc starch production

Manioc starch production

Process

Input/ Output

Manioc starch production

- Transport

Process

Input/ Output

Manioc starch production

Electricity

Process

Input/ Output

Manioc starch production - inputs

Cassava

74,4 g

Electricity

0,048 kWh

Transport

1 ton → 178 km

74,4 g → 12,841 km

Work load

0,00005556 h

Manioc starch production – outputs

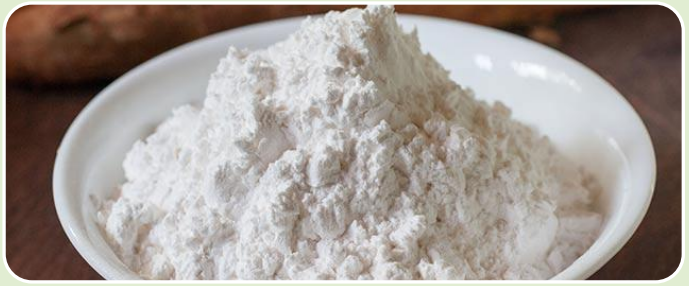
Manioc starch

- 18,6 g

Edible bowl production

Functional Unit

Cassava (74,4g)



Manioc starch (18,6g)

1 Edible bowl (19g)

Edible Bowl Production

Raw Material

Cassava

Manioc Starch

Bio Gel

Equipment

Heating System
Cooling System
Shaking machine

Process

Mixing
Cooking
Molding
Cooling

Functional Unit

Edible Bowl

Food-Feed
Compostable

Finishing

Removal
Sandpaper

Logistics

Packaging
Stocking
Dispatch

Edible bowl production input

Eelectricity Medium Voltage	Manioc Starch	Work load
• 0,43400 kWh	• 18.6 g	• 0,65360 h
0,04340 €	0,41837 €	0,38162 €

Edible bowl production output

Flow	Amount	Costs /Revenues
Edible Bowl Production	19 g	0,84339 €
Illiteracy rate, total, medium risk	0,65360 h	
Children in employment, low risk	0,65360 h	
Minimum Wage, per month, very high risk	0,65360 h	
Rate of fatal accidents at work place, high risk	0,65360 h	

OKA Closed Cycle Product

Feeding Life and Soil

biotecnologia

Environmental LCA For Cassava

Climate change

Cassava
29,36% Nitrogen
08,61% Harvesting
05,17% Phosphate

Acidification

Cassava
27,16% Nitrogen
14,64% Phosphate
14.21% Harvesting

Eutrophication

Cassava
18,22% Nitrogen
09,51% Phosphate
07,23% Harvesting

Environmental LCA For Edible Bowl

Bio edible Bowl	Plastic disposable bowl
95,19% Transportation in Manioc starch	57,30% electricity mw
92,35% Transportation	16,89% Electricity mw
00.53% Electricity mw	09,55% Electricity mw

Bio edible Bowl	Plastic disposable bowl
95,12 Transportation	53,70% Electricity mw
00,89 Cassava production	11,43% Electricity mw
3,59% Electricity mw	09,48% Electricity mw

Bio edible Bowl	Plastic disposable bowl
95,93% Transportation in Manio starch	35,01% Electricity
03,02% Electricity mw	29,62% Electricity
	09,98% Solid Bleached board

Disposable PLASTIC Bowl

Impacts on Sustainable Development - S.E.E

- Synthetic polymer from **fossil based**;
- Responsible for **CO2 emissions** = **1.8 metric tons** (2015);
- **400 years** to decompose on Nature (Environment);

•BRAZIL

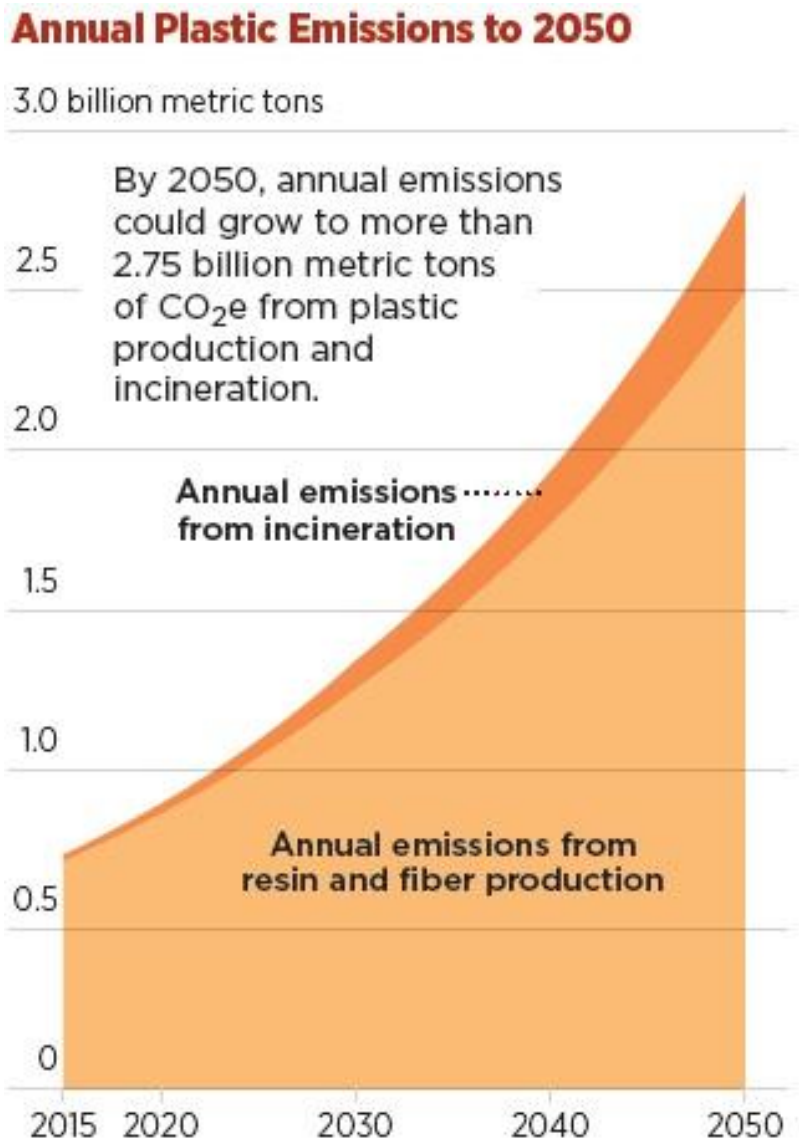
- 4TH country in the global rank = plastic waste "generate" = **11,3 million tons**. (World Bank);

7,7 millions tons **LANDFILLS**

2,4 millions tons **Illegally discarded**

Sources: WWF; World Bank (2019).

Greenhouse gas emissions from the plastic lifecycle



Emission of GHG in

2019

850 million metric tons

Source: Ciel, 2019

BioEdible Bowl from manioc starch

- Bio-based product (**biogel**);
- **ZERO** of **CO2** emission;
- **20 days** to decompose in the soil;
- Several options of use;
- 100% **(Made in Brazil**) – raw material and production process.

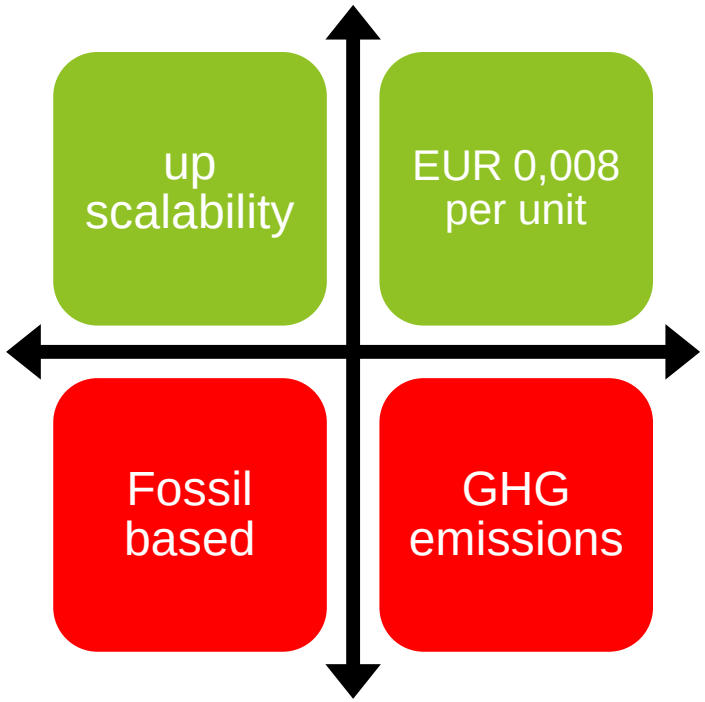
Impacts on Sustainable Development - S.E.E

COSTS and its implications

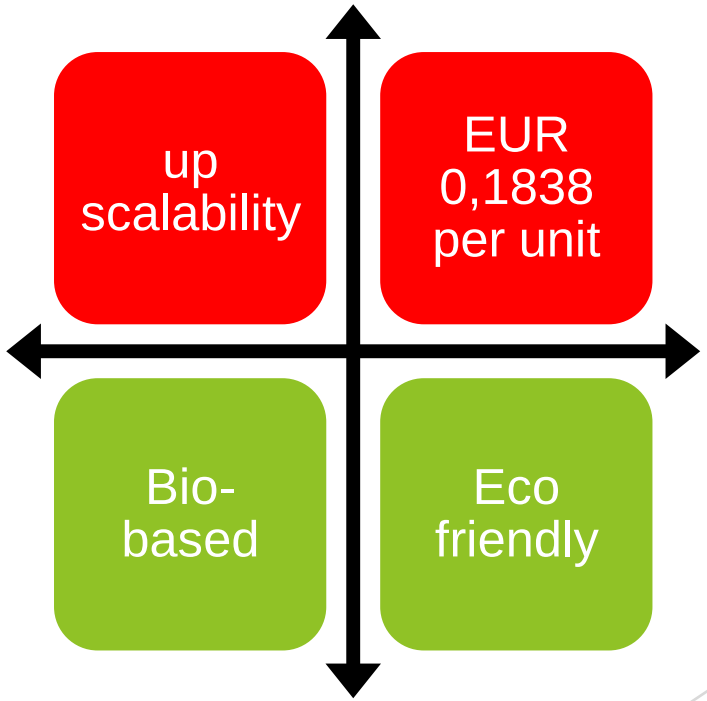
bad

good

Disposable PLASTIC bowl



BIO EDIBLE bowl



Hot spots identification – BioEdible Bowl

Special Acknowledgments

Mrs. Érika Cardoso

Mr. João Fadel

Professor Marney Cereda- Specialist in manioc starch

Mr. Ricardo from Frankfurt