Supplementary S1: Feed for organic and conventional farm

1. Feed for organic farm production

Supplementary Table S1.1 LCI of organic guinea grass 1 kg (Control).

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	1.33×10^{-1}
- Diesel	kg	2.87×10^{-3}
- Electricity	kWh	9.00×10^{-2}
- Manure (organic waste)	kg	6.67×10^{-1}
2. Output		
- Organic guinea grass silage	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.2 LCI of organic guinea grass 1 kg (Without control).

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	37.20
- Diesel	kg	8.00×10^{-1}
- Electricity	kWh	–
- Manure (organic waste)	kg	6.67×10^{-1}
2. Output		
- Organic guinea grass silage	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.13 LCI of organic napier grass 1 kg (Control).

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	1.61×10^{-2}
- Diesel	kg	2.77×10^{-4}
- Electricity	kWh	3.86×10^{-3}
- Manure (organic waste)	kg	6.00×10^{-2}
2. Output		
- Organic napier grass	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.4 LCI of organic maize 1 kg (Control).

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	6.00×10^{-4}
- Diesel	kg	1.72×10^{-3}
- Electricity	kWh	2.40×10^{-2}
- Manure (organic waste)	kg	1.00×10^{-2}
2. Output		
- Organic maize	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.5 LCI of organic sorghum 1 kg (Control).

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	6.00×10^{-4}
- Diesel	kg	2.87×10^{-3}
- Electricity	kWh	4.00×10^{-2}
- Manure (organic waste)	kg	3.00×10^{-2}
2. Output		
- Organic sorghum	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.6 LCI of organic napier grass fermentation 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Organic napier grass	kg	1.00
- Water	kg	2.00×10^{-1}
- Molasses	kg	1.25×10^{-2}
- Air	kg	4.01×10^{0}
2. Outputs		
- Organic napier grass fermentation	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.7 LCI of organic maize fermentation 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Organic maize	kg	1.00
- Water	kg	2.00×10^{-1}
- Molasses	kg	1.25×10^{-2}
- Air	kg	4.01×10^{0}
2. Outputs		
- Organic maize fermentation	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.8 LCI of sugarcane 1 kg (Control).

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	1.40×10^{-2}
- Fertilizer N	kg	2.19×10^{-3}
- Fertilizer P	kg	1.06×10^{-3}
- Fertilizer K	kg	7.77×10^{-4}
- Pesticides	kg	3.11×10^{-4}
- Diesel	kg	1.73×10^{-3}
- Gasoline	kg	1.13×10^{-4}
- Electricity	kWh	2.58×10^{-4}
- Water	kg	3.61×10^{-3}
2. Outputs		
- Sugarcane	kg	1.00

Source: Pongpat et al. (2017) [41].

Supplementary Table S1.9 LCI of molasses 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Sugarcane	kg	11.25
- Water	kg	5.65
- $Ca(OH)_2$	kg	7.38×10^{-2}
- Stream	kg	4.78×10^{0}
- Electricity	kWh	1.70×10^{-1}
2. Outputs		
- Molasses	kg	1.00

Source: Suwanmanee et al. (2017) [42].

Supplementary Table S1.10 LCI of organic total mixed ration (TMR) 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Organic rice bran	kg	2.00×10^{-1}
- Organic broken rice	kg	2.00×10^{-1}
- Organic napier grass fermentation	kg	2.50×10^{-1}
- Organic maize fermentation	kg	2.50×10^{-1}
- Organic guinea grass (Control)	kg	5.00×10^{-2}
- Organic guinea grass (Without control)	kg	5.00×10^{-2}
- Electricity	kWh	2.77×10^{-2}
2. Outputs		
- Total mixed ration (TMR) 1 kg.	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

2. Feed for conventional farm production

Supplementary Table S1.11 LCI of conventional napier grass 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	6.25×10^{-2}
- Diesel	kg	5.91×10^{-4}
- Fertilizer N-P-K (15-15-15)	kg	1.25×10^{-2}
- Fertilizer N-P-K (46-0-0)	kg	2.50×10^{-3}
2. Output		
- Conventional napier grass	kg	1.00

Source: Paengkoum and Paengkoum (2017) [39].

Supplementary Table S1.12 LCI of conventional guinea grass 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	8.57×10^{-4}
- Diesel	kg	1.35×10^{-3}
- Fertilizer N-P-K (15-15-15)	kg	2.86×10^{-2}
- Fertilizer N-P-K (46-0-0)	kg	5.71×10^{-3}
2. Outputs		
- Conventional guinea grass	kg	1.00

Source: Paengkoum and Paengkoum (2017) [39].

Supplementary Table S1.13 LCI of conventional maize 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	4.53×10^{-3}
- Diesel	kg	7.24×10^{-3}
- Fertilizer N-P-K (15-15-15)	kg	6.12×10^{-2}
- Fertilizer N-P-K (46-0-0)	kg	2.40×10^{-2}
- Herbicide	kg	2.02×10^{-3}
2. Outputs		
- Conventional maize	kg	1.00

Source: Phettharawadee (2019) [38].

Supplementary Table S1.14 LCI of conventional sorghum 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Seed	kg	3.00×10^{-4}
- Diesel	kg	5.74×10^{-4}
- Fertilizer N-P-K (15-15-15)	kg	7.59×10^{-3}
- $Ca(OH)_2$	kg	1.21×10^{-2}
- Pesticide	kg	3.28×10^{-4}
2. Outputs		
- Conventional maize	kg	1.00

Source: Rongrit et al. (2011) [40].

Supplementary Table S1.15 LCI of conventional napier grass fermentation 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Conventional napier grass	kg	1.00
- Water	kg	2.00×10^{-1}
- Molasses	kg	1.25×10^{-2}
- Air	kg	4.01×10^{0}
2. Outputs		
- Conventional napier grass fermentation	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.16 LCI of conventional maize fermentation 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Conventional maize	kg	1.00
- Water	kg	2.00×10^{-1}
- Molasses	kg	1.25×10^{-2}
- Air	kg	4.01×10^{0}
2. Outputs		
- Conventional maize fermentation	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

Supplementary Table S1.17 LCI of conventional total mixed ration (TMR) 1 kg.

Parameters	Unit	Amounts
1. Inputs		
- Rice bran	kg	2.00×10^{-1}
- Broken rice	kg	2.00×10^{-1}
- Conventional napier grass fermentation	kg	2.50×10^{-1}
- Conventional maize fermentation	kg	2.50×10^{-1}
- Conventional guinea grass	kg	1.00×10^{-1}
- Electricity	kWh	2.77×10^{-2}
2. Outputs		
- Total mixed ration (TMR) 1 kg.	kg	1.00

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].

3. All resources requirements and emissions

Supplementary Table S1.18 All resources requirements and emissions for entire life cycle of organic and conventional cows.

Parameters	Unit	Organic farm	Conventional farm
Inputs			
1. Feeds (total)	kg/head	79,278.75	67,431.72
- TMR	kg/head	77,850.00	65,953.20
- Pasture	kg/head	1,300.00	1,478.52
- Mineral	kg/head	128.75	–
2. Water (total)	L/head	336,942.00	281,687.00
- Feed water	L/head	109,200.00	48,207.00
- Shower water	L/head	1,587.90	9,851.60
- Cleaning water	L/head	226,154.60	223,628.4
3. Energy			
- Electricity	kWh/head	1,302.99	307.29
- Diesel	L/head	70.18	345.86
4.Chemicals			
- Chlorine	L/head	8,650.50	–
- Detergent	L/head	28.44	24.67
5. Herb	kg/head	30.90	–
Outputs			
7. Sack	kg/head	1.69	129.86
8. Bottle	kg/head	5.93	16.56

Source: Data obtained from Trakulthaveesuk et al. (2019) [35] and Saothao et al. (2020) [36].