FARMER ANGUS

Farmer Angus Beef LCA Metadata

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Jon-Jon Abelheim

+27 73 588 9422

j.abelheim@gmail.com

Overview

This document is to accompany the Cradle-to-Gate Life Cycle Assessment of the Carbon Footprint of Farmer Angus Beef production on Spier Biodiversity Farm, Stellenbosch, South Africa. The study identifies and evaluates 5 stages of production:

1. Raw Materials (inputs and outputs at field level)
2. Transport of animals (from Spier BD Farm to the Abattoir)
3. Processing of animals at the abattoir
4. Transport of animals (from Abattoir back to Spier BD Farm)
5. Processing of animals at the on-farm butchery.

This document includes quantity calculations, sources of particular quantities and conversion ratios, notes relevant to each of the five stages of production, omitted data and Stellenbosch University Harvard Style references.

Quantity Calculations

1. Raw Materials: Field level

Diesel (on farm)

1543.93 litres (monthly average)

12 month per year

1543.93 x 12

= 18527.13818 litres diesel/year

Petrol (on farm)

313.3589332 (monthly average)

12 months/year

313.3589332 x 12

= 3760.307198 litres petrol/year

Electricity: Irrigation

= 35834.33333 kWh (yearly average)

Feed (pigs)

200 pigs/year

2.7 kg feed/pig/day

365 days/year

200 x 2.7 x 365

= 197 100 kg feed/year

Feed (chickens)

5000 chickens

0.14 kg feed/chicken/day

365 days/year

5000 x 0.14 x 365

= 255 500 kg feed/year

2. Transport (Farm to Abattoir)

110 km distance

4km/litres consumption

27.5 litres/trip

52 trips/year

27.5 x 52

= 1430 litres/year

3. Processing: Abattoir

Electricity Usage

400 kWh/tHSCW (tonne Hot Standard Carcass Weight)

0.4kWh/kg beef

4. Transport (Abattoir to Farm)

110 km distance

4km/litre consumption

27.5 litres/trip

52 trips/year

27.5 x 52

= 1430 litres/year

5. Processing: Butchery

599.32 kWh Average High Demand kWh/day

365 days/year

599.32 x 365

= 218751.80 kWh/year

Quantity and Conversion Sources

Diesel Conversion:	(Ecoscore, 2020)
Petrol Conversion:	(Ecoscore, 2020)
Electricity Conversion:	(MAC, 2013)
Methane Conversion	(EPA, 2020)
Pig Feed Conversion	(Zhou, Dong, Xin, Zhu, Huang & Wang, 2018)
Chicken Feed Conversion	(Kim, Dale & Jenkins, 2009)
Cow Methane Emissions	(John Wallace, Sasson, Garnsworthy, Tapio, Gregson, Bani, Huhtanen, Bayat, Strozzi, Biscarini, Snelling, Saunders, Potterton, Craigon, Minuti, Trevisi, Callegari, Cappelli, Cabezas-Garcia, Vilkki, Pinares-Patino, Fliegerová, Mrázek, Sechovcová, Kopečný, Bonin, Boyer, Taberlet, Kokou, Halperin, Williams, Shingfield & Mizrahi, 2019)
Pigs Methane Emissions	(Dunkley, 2008)
Chickens Methane Emissions	(Dunkley, 2008)
Soil Carbon Sequestration:	(Burke & Cohen, 2020)
Electricity Abattoir:	(Petrovic, Djordjevic, Milicevic, Nastasijevic & Parunovic, 2015)

Notes

1. Raw Materials: Field level

Diesel (on farm)

N/A

Petrol (on farm)

Petrol quantities had to be calculated using total Rands per month/price of diesel for that time period.

Electricity: Irrigation

N/A

Feed (pigs)

Getting accurate data for feed GHG is challenging due to the complex nature of feed production - i.e. raw materials, production inputs like electricity, transport distance and methods etc.

Feed (chickens)

Getting accurate data for feed GHG is challenging due to the complex nature of feed production - i.e. raw materials, production inputs like electricity, transport distance and methods etc.

2. Transport (Farm to Abattoir)

Diesel

N/A

3. Processing: Abattoir

Electricity

4. Transport (Abattoir to Farm)

Diesel

N/A

5. Processing: Butchery

Electricity consumption figures were based off "high demand" averages for a conservative estimation.

Omissions

Packaging

Fuel – Angus Eggs Transport

Electricity – Office and Workshop

Effect of Methanotrophs

GHG (cows) – Manure, N_2O, CO_2

GHG (chickens) – Manure, N_2O, CO_2

GHG (pigs) – Manure, N_2O, CO_2

"When livestock or poultry manure are stored or treated in systems that promote anaerobic conditions (e.g., as a liquid/slurry in lagoons, ponds, tanks, or pits), the decomposition of the volatile solids component in the manure tends to produce CH4. When manure is handled as a solid (e.g., in stacks or dry-lots) or deposited on pasture, range, or paddock lands, it tends to decompose aerobically and produce little or no CH4." (EPA, 2018)

References

Burke, A.M. & Cohen, B. 2020. *Verification of the carbon dioxide sequestrated and resultant*.

Dunkley, C.S. 2008. Global Warming : How Does It Relate to Poultry ? *UGA extension*. (B 1382):1–7.

Ecoscore. 2020. *How to calculate the CO2 emission from the fuel consumption?* [Online], Available: https://ecoscore.be/en/info/ecoscore/co2 [2020, October 28].

EPA. 2018. U.S. Greenhouse Gas Emissions and Sinks, 1990-2016. *Epa 430-R-18-003*. 106(11):1323–1330.

EPA. 2020. *Greenhouse Gases Equivalencies Calculator - Calculations and References*. [Online], Available: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references.

John Wallace, R., Sasson, G., Garnsworthy, P.C., Tapio, I., Gregson, E., Bani, P., Huhtanen, P., Bayat, A.R., et al. 2019. A heritable subset of the core rumen microbiome dictates dairy cow productivity and emissions. *Science Advances*. 5(7).

Kim, S., Dale, B.E. & Jenkins, R. 2009. Life cycle assessment of corn grain and corn stover in the United States. *International Journal of Life Cycle Assessment*. 14(2):160–174.

MAC. 2013. South Africa ' s Grid Emission Factor. (March):1–9.

Petrovic, Z., Djordjevic, V., Milicevic, D., Nastasijevic, I. & Parunovic, N. 2015. Meat Production and Consumption: Environmental Consequences. *Procedia Food Science*. 5:235–238.

Zhou, Y.Q., Dong, H.M., Xin, H.W., Zhu, Z.Z., Huang, W.Q. & Wang, Y. 2018. Carbon footprint assessment of a large-scale pig production system in northern China: A case study. *Transactions of the ASABE*. 61(3):1121–1131.