MILK CARBON FOOTPRINT ON DAIRY FARMS IN THE NORTHERN PERUVIAN AMAZON

Deysi Ruiz[1], José Velarde-Guillén[1], Eduardo Fuentes[1]

and Carlos Gómez[1,*]

[1] Universidad Nacional Agraria La Molina, Lima, Peru.

*corresponding author: cagomez@lamolina.edu.pe

Introdution

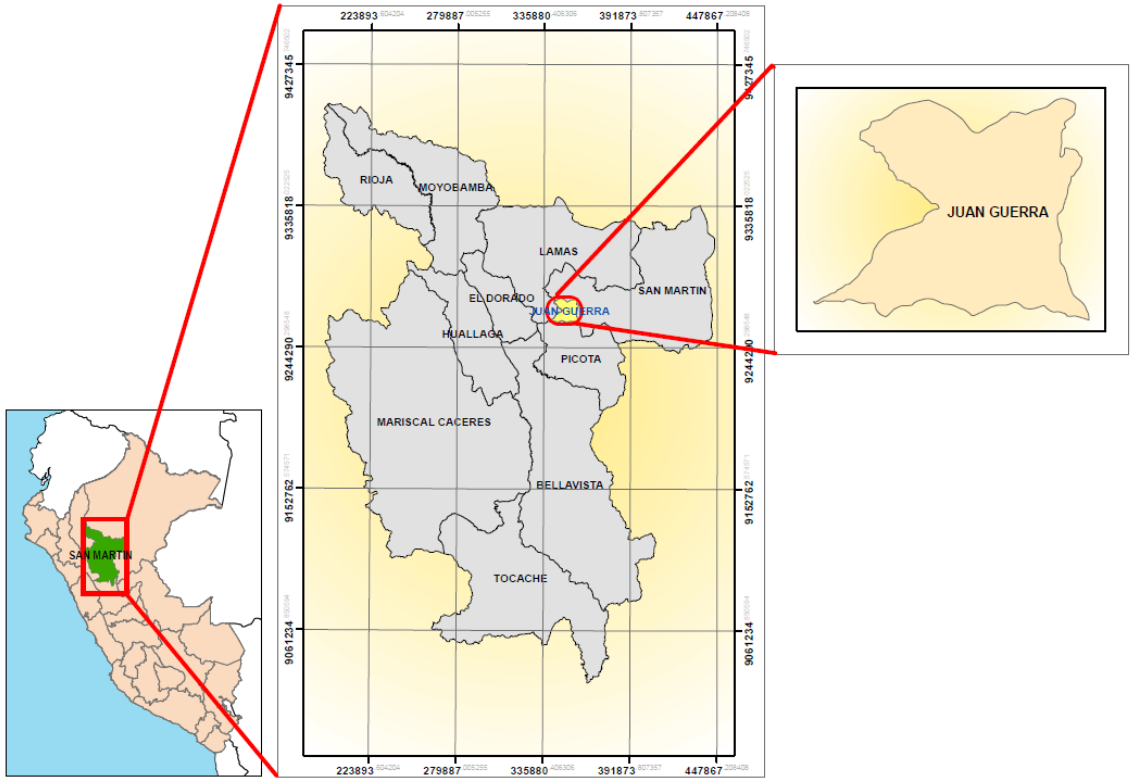
- Around 77% of the population in the Peruvian Amazon is dedicated to agricultural activity, of which 21% is in San Martín (Echevarría *et al.*, 2019).
- The San Martín region is characterized by the presence of farms dedicated to the production of milk (32,697 t / year) and beef (5,443 t / year) (MIDAGRI, 2020).
- Dairy farming in the Peruvian Amazon region is mainly in the hands of smallholders. Prevalent herds < 10 animals in San Martín (Pizarro et al., 2019).
- Most of them have a low number of cows and low production levels (6 L/cow/day) (DRASAM, 2016).
- It is unknown their current contribution to the greenhouse gas emissions (GHG) per unit of milk produced.

Objective

The objective of this study was to estimate the carbon footprint (CF) of milk production (in kg of CO_2equivalents (CO_2e) per kg fat and protein corrected milk (FPCM)) on dairy farms of San Martín region, in the Peruvian Amazon.

Materials and Methods

Localization



Predominant breed: Gyr x Holstein

Extensive grazing system (*Brachiaria brizantha*)

Source	Equations	Result	GWP
Enteric methane	10.3, 10.4, 10.6, 10.8, 10.13, 10.14, 10.15, 10.16, 10.21 (IPCC, 2019)	Kg CH4/year	28 (IPCC, 2014)
Manure methane	10.23, 10.24 (IPCC, 2019)	Kg CH4/year	28 (IPCC, 2014)
Nitrous oxide from manure management	10.25, 10.28, 10.29, 10.31, 10.32, 10.33 (IPCC, 2019)	Kg N2O/year	265 (IPCC, 2014)
Nitrous oxide from soil management	11.1, 11.9, 11.10, (IPCC, 2019)	Kg N2O/year	265 (IPCC, 2014)
Carbon dioxide from energy, fuel and transport	3.2.1 (IPCC, 2006), Ecoinvent (2010)	Kg CO2/year	1 (IPCC, 2014)

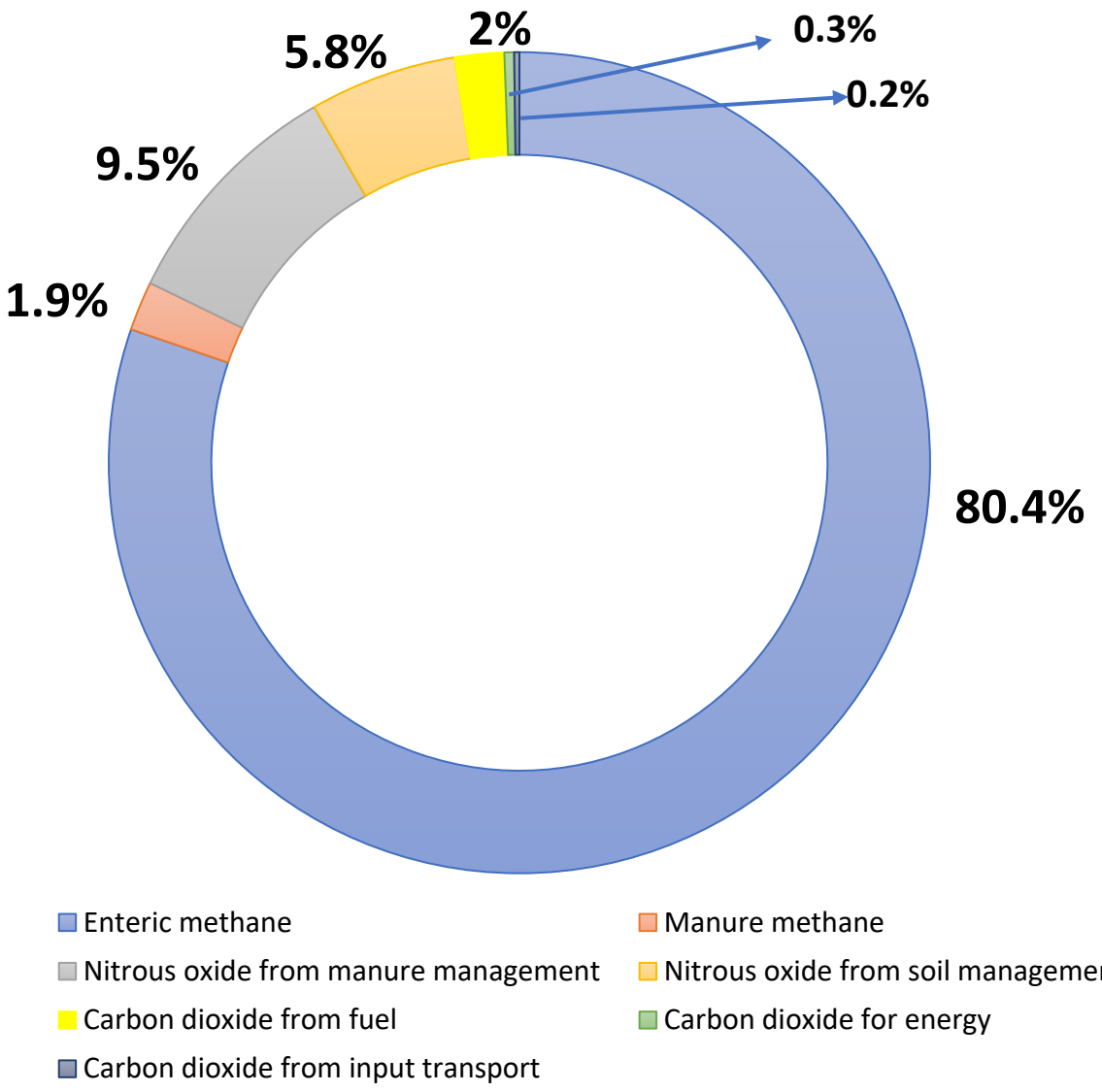
Results

Total annual emission (kg of CO2e) from each farm evaluated according to emission sources.

Farm	enteric CH4 /Kg FPCM	manure CH4 /Kg FPCM	N2O from manure management /Kg FPCM	N2O from soil management/Kg FPCM	CO2 from fuel/Kg FPCM	CO2 from energy/Kg FPCM	CO2 from input transport /Kg FPCM	kg CO2e/Kg FPCM
F1	1.31	0.03	0.16	0.10	0.03	0.00	0.004	1.63
F2	1.55	0.03	0.17	0.10	0.07	0.02	0.005	1.95
F3	2.49	0.06	0.28	0.18	0.08	0.00	0.005	3.09
F4	1.90	0.05	0.25	0.15	0.00	0.02	0.003	2.38
F5	1.32	0.03	0.13	0.08	0.05	0.02	0.002	1.64
F6	1.40	0.03	0.17	0.10	0.01	0.00	0.005	1.72
F7	1.43	0.03	0.21	0.13	0.03	0.00	0.004	1.83
F8	2.55	0.05	0.25	0.16	0.08	0.00	0.007	3.10
Average (kg)	**1.74**	**0.04**	**0.20**	**0.12**	**0.04**	**0.01**	**0.004**	**2.17**
Standard deviation	**0.51**	**0.01**	**0.05**	**0.03**	**0.03**	**0.01**	**0.001**	**0.62**

F1: Farm 1; F2: Farm 2; F3: Farm 3; F4: Farm 4; F5: Farm 5; F6: Farm 6; F7: Farm 7; F8: Farm 8. FPCM: Fat and protein corrected milk.

Figure 1. Average of emissions sources



Discussion

Author	Year	Country	Carbon footprint	Type of production
This work	2021	Peru	2.17 ± 0.62 kg CO2e/ kg de LCGP	Dairy
Bartl *et al.*	2011	Peru	1.74 y 5.42 kg de CO_2e/kg LCE	Dairy
Gaitán *et al.*	2017	Nicaragua	3.1 y 2.4 kg CO2e/ kg de LCGP	Dairy
Gómez Palencia	2018	Colombia	1.3 a 1.7 kg CO2e/ kg de LCGP	Dairy
Gonzáles Quintero	2020	Colombia	2.1 a 4.2 kg CO2e/ kg de LCGP	Double purpose
Laca *et al.*	2020	Nueva Zelanda	0.60 a 1.52 kg CO2e/ kg de LCGP	Dairy
Lizarralde *et al.*	2014	Uruguay	0.99 ± 0.10 kg CO_2e/kg LCGP	Dairy
Mazzetto *et al.*	2020	Costa Rica	1.9 a 5.3 kg CO2e/kg LCGP	Dairy
Ribeiro-Filho *et al.*	2020	Brasil	0.9 a 1 kg CO2e/kg LCGP	Dairy
Rivera *et al.*	2014	Colombia	1.61 y 1.76 kg de CO_2e/kg de LCGP	Dairy
Rivera *et al.*	2016	Colombia	2.05 y 2.35 kg de CO2e/kg de LCGP	Double purpose
Zhu *et al.*	2016	Latinoamérica	1.45 kg de CO2e/kg de LCGP	Dairy

Conclusion

- In this study, the carbon footprint was 2.17 ± 0.62 kg CO_2e/kg FPCM.
- Dairy farms in the Peruvian Amazon region may reduce their current levels of CF if they improve their current feeding practices.
- However, further studies considering the estimation of carbon sequestration of trees, soil and crops, and the carbon footprint of the off-farm feeds are also necessary to determine the real carbon balance of these systems.

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¡THANK YOU!