Journal of Cleaner Production 121 (2016) 198–199

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Letter to the Editor

Response to 'Assessing the carbon footprint of beef cattle in Brazil: a case study with 22 farms in the State of Mato Grosso'

Keywords:
Brazilian beef production
Carbon footprint
Carcass production
GHG emissions
Live weight gain

A B S T R A C T

The recent article in this journal of Cerri et al. (2016) gives estimates of greenhouse gas (GHG) emissions for cattle production on extensively managed farms in the State of Mato Grosso, Brazil. The results are expressed as GHG emission per kg of animal in the herd, and not per kg of product. These estimates should not be referred to as "carbon footprints" as they do not reflect the estimate of the GHG emissions utilized in the production of 1 kg of animal or carcass, but the total emission per kg of the total mass of animals in the herd, whether calves, heifers, steers or mature bulls and cows. This leads to a large underestimation of the true GHG emissions for the production of Brazilian beef.

The recent article of Cerri et al. (2016) purports to show that the carbon footprints (total GHG emissions per kg product) for extensive beef production estimated for 22 ranches in the State of Mato Grosso, are between 4.8 and 8.2 kg CO_2eq per kg of live weight gain, equivalent to 9.02 and 15.9 kg CO_2eq per kg of carcass weight, respectively. As the authors acknowledge these values are far lower than recent estimates made in southern Brazil by Ruviaro et al. (2015) and Dick et al. (2015), and also for different beef-on-pasture production systems in the Cerrado region estimated by Cardoso et al. (2016). These values are also considerably lower than three studies cited by the authors from the USA, France and Australia. In the review of Crosson et al. (2011) most values given in 34 studies from 15 publications are above 20 kg CO_2eq per kg of carcass weight, and almost all are systems more intensively managed than the free ranging pasture systems in Mato Grosso.

Cerri et al. (2016) calculated the total emissions for each farm/herd using entirely appropriate techniques (improved Tier 1 for methane emissions, direct Tier 1 for nitrous oxide emissions and detailed LCA accounting for fossil CO_2 emissions). However, when they calculated the "carbon footprint" the authors divided the total GHG emissions in CO_2eq by the total herd weight and not the weight gain, which is obviously far smaller. We show in Table 1 the calculations which lead to the total herd weight for each farm and data on total GHG emissions per herd from Tables 5 and 6 of Cerri et al. (2016). The final column of data are those given by the authors as kg CO_2eq kg live weight^{-1} and the values in the penultimate column are our calculations from dividing total GHG emission per herd by the total weight of the herd. We did not have access to the original data but the similarity between our results and that of Cerri et al. (2016) show that the same procedure was adopted. The units given by the authors (kg CO_2eq kg live weight^{-1}) are quite correct, but these values are not a "carbon footprint" as they are not expressed as kg of product exported from the farm, which would be per live weight gain or per kg carcass. In the Abstract and the Conclusion the authors state that "the carbon footprints ranged from 4.8 to 8.2 kg (or 5.0 to 7.2 kg) of CO_2eq per kg of live weight gain", while the results are in fact per kg total animal weight. They refer many times in the text that their results are for carbon footprint and even calculate the emission per weight of carcass even though this represents the total carcass weight of all animals in the field, not those exported for sale.

Our concern is that government policy makers and others may use these erroneous results as emissions data for beef or carcass production in Brazil, totally underestimating much more realistic estimations published recently by Dick et al. (2015), Ruviaro et al., 2015 and Cardoso et al. (2016).

DOI of original article: http://dx.doi.org/10.1016/j.jclepro.2015.10.072.

http://dx.doi.org/10.1016/j.jclepro.2016.02.032
0959-6526/

Table 1
Total number and weight of cattle in herds and estimates of total GHG emissions per kg animal, in herds on 22 properties in Mato Grosso. GHG emissions per kg animal estimated by the authors from mean data and original estimates published by Cerri et al. (2016).

Farm number	Non-dairy cow		Bull		Young animals		Herd weight	Total GHG	GHG emission/animal	
	Number	[a]Total weight (kg)	Number	[a]Total weight (kg)	Number	[a]Total weight (kg)	Total live weight (Mg)	Emissions (Mg CO_2eq $herd^{-1}$)	Calculated	Original
									kg CO2eq. $kg\ animal^{-1}$	
Group 1										
1	938	309,540	566	215,080	438	100,740	625.36	4017.39	6.42	6.00
2	244	80,520	0	0	729	167,670	248.19	1846.85	7.44	8.20
3	894	295,020	527	200,260	33	7590	502.87	3481.79	6.92	6.07
4	292	96,360	150	57,000	716	164,680	318.04	2025.64	6.37	6.72
5	553	182,490	9	3420	311	71,530	257.44	1730.26	6.72	6.84
6	80	26,400	39	14,820	64	14,720	55.94	363.14	6.49	7.04
7	0	0	470	178,600	0	0	178.6	966.15	5.41	4.78
8	531	175,230	47	17,860	496	114,080	307.17	1988.67	6.47	6.80
9	592	195,360	84	31,920	260	59,800	287.08	1873.92	6.53	6.40
10	500	165,000	3	1140	58	13,340	179.48	1290.57	7.19	5.83
11	7	2310	600	228,000	320	73,600	303.91	1707.93	5.62	5.56
Group 2										
12	1093	360,690	372	141,360	1139	261,970	764.02	4778.26	6.25	6.46
13	3000	990,000	1301	494,380	1586	364,780	1849.16	11,732,92	6.34	6.03
14	3050	1,006,500	2827	1,074,260	1524	350,520	2431.28	14,905	6.13	5.76
15	1728	570,240	63	23,940	1488	342,240	936.42	6284.14	6.71	6.84
16	8095	2,671,350	2675	1,016,500	4539	1,043,970	4731.82	31,887,69	6.74	5.51
17	2000	660,000	60	22,800	1500	345,000	1027.8	6598.43	6.42	6.87
18	3446	1,137,180	1279	486,020	1275	293,250	1916.45	12,264,69	6.40	5.93
19	2448	807,840	278	105,640	1588	365,240	1278.72	9193.59	7.19	7.15
20	0	0	6087	2,313,060	0	0	2313.06	12,467,35	5.39	4.97
21	1357	447,810	1643	624,340	2058	473,340	1545.49	9619.48	6.22	6.33
22	1400	462,000	3000	1,140,000	4500	1,035,000	2637	15,317,93	5.81	6.24

[a] Calculated from mean of range of animal weights given in column headings of Table 2 of Cerri et al. (2016).

References

Cerri, C.C., Silva Moreira, C., Alves, P.A., Raucci, G.S., Castigioni, B. de A., Mello, F.F.C., Cerri, D.G.P., Cerri, C.E.P., 2016. Assessing the carbon footprint of beef cattle in Brazil: a case study with 22 farms in the State of Mato Grosso. J. Clean. Prod. 112, 2593–2600.

Cardoso, A.S., Berndt, A., Leytem, A., Alves, B.J.R., de Carvalho, I. das N.O., de Barros Soares, L.H., Urquiaga, S., Boddey, R.M., 2016. Impact of the intensification of beef production in Brazil on greenhouse gas emissions and land use. Agric. Syst. 143, 86–96.

Crosson, P., Shalloo, L., O'Brien, D., Lanigan, G.J., Foley, P.A., Boland, T.M., 2011. A review of whole farm systems models of greenhouse gas emissions from beef and dairy cattle production systems. Anim. Feed Sci. Tech. 166–167, 29–45.

Dick, M., Silva, M.A., Dewes, H., 2015. Life cycle assessment of beef cattle production in two typical grassland systems of southern Brazil. J. Clean. Prod. 96, 426–434.

Ruviaro, C.F., de Léis, C.M., Lampert, V.N., Barcellos, J.O.J., Dewes, H., 2015. Carbon footprint in different beef production systems on a southern Brazilian farm: a case study. J. Clean. Prod. 96, 435–443.

Robert M. Boddey*, Abmael S. Cardoso[1], Bruno J.R. Alves
Embrapa-Agrobiologia, Rodovia BR 465, km 07, Seropédica, RJ, 23891-000, Brazil

* Corresponding author.
E-mail address: robert.boddey@embrapa.br (R.M. Boddey).

27 January 2016
Available online 13 February 2016

[1] Present address: Departamento de Zootecnia, Faculdade de Ciências Agrárias e Veterinárias, UNESP, 14884-900, Jaboticabal, SP, Brazil.