**Supplementary material: Estimating the impact of clinical mastitis in dairy cows on greenhouse gas emissions using a dynamic stochastic simulation model: a case study**

P.F. Mostert, E.A.M. Bokkers, I.J.M. de Boer, and C.E. van Middelaar.

Animal journal.

Supplementary Table S1. Dietary composition and energy content (NE) of feed ingredients of dairy cows.

|  |  |  |  |
| --- | --- | --- | --- |
|  Feed ingredient | NEa(MJ/ kg DM) | Summer dietb (%/kg DM) | Winter dietb(%/kg DM) |
| Concentrates standardc | 7.43 | 21 | 20 |
| Concentrates proteinc | 7.45 | 0 | 7 |
| Wet by productsd | 7.50 | 4 | 5 |
| Grass | 6.95 | 39 | 0 |
| Grass silage | 6.08 | 25 | 55 |
| Maize silage | 6.26 | 11 | 14 |

a Vellinga *et al.,* 2013

b CBS, 2014

c Nevedi, 2012, 2013, 2014, 2015

d Wet by products consisted of (%/kg DM): 29% brewer’s grain dried, 32% potato peel steamed, 16% potato pulp dried, 23% maize gluten meal

Supplementary Table S2. Composition of concentrates for dairy cows, and dry matter content per ingredient, and greenhouse gas (GHG) emissions of feed production, land use and land use change (LULuc), and enteric methane per ingredient and per composition.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Feed ingredient | Standarda (%/kg) | Proteina (%/kg) | Feed productionb(g CO2e /kg) | LULucb (g CO2e /kg) | Enteric methaneb (g CH4 /kg) | Dry Matterb (g/kg) |
| Peas | 0.00 | 1.20 | 578 | 744 | 21.97 | 867 |
| Barley | 0.35 | 0.15 | 219 | 166 | 22.17 | 869 |
| Soya (bean) meal Mervobest | 0.00 | 0.15 | 475 | 414 | 19.21 | 872 |
| Soybean hulls CFc 320-360 | 14.52 | 19.47 | 306 | 222 | 22.94 | 883 |
| Sugarcane molasses SUGc<475 | 3.01 | 3.17 | 265 | 27 | 28.58 | 734 |
| Rape seed, expeller | 0.17 | 0.99 | 270 | 184 | 17.36 | 894 |
| Rye | 5.15 | 1.10 | 274 | 237 | 23.27 | 872 |
| Wheat | 2.05 | 2.17 | 216 | 147 | 22.9 | 868 |
| Palm kernel expeller CF<180 | 11.80 | 15.95 | 417 | 30 | 17.07 | 961 |
| Sugarbeet pulp SUG>200 | 3.80 | 4.70 | 366 | 0 | 25.76 | 915 |
| Maize | 15.87 | 6.57 | 390 | 167 | 20.09 | 872 |
| Soybean meal CF45-70 CPc<450 | 0.14 | 2.95 | 463 | 401 | 20.27 | 876 |
| Wheat middlings | 11.32 | 2.07 | 158 | 77 | 20.34 | 865 |
| Palm kernel oil | 0.21 | 0.42 | 2606 | 301 | 0 | 995 |
| Maize glutenfeed CP200-230 | 8.60 | 1.65 | 1632 | 186 | 19.78 | 893 |
| Sunflower seed meal CF>240 | 0.67 | 1.00 | 375 | 410 | 16.97 | 887 |
| Salt | 0.46 | 0.56 | 180 | 0 | 0 | 998 |
| Chalk (finely milled) | 0.99 | 1.28 | 18.5 | 0 | 0 | 990 |
| Triticale | 5.45 | 6.03 | 305 | 254 | 23.2 | 877 |
| Rape seed, extruded CP>380 | 0.18 | 0.47 | 253 | 163 | 18.79 | 906 |
| Rape seed, extruded CP 0-380 | 1.78 | 5.38 | 251 | 161 | 18.69 | 873 |
| Rape seed meal Mervobest | 0.00 | 0.15 | 258 | 168 | 17.51 | 872 |
| Soybean meal CF45-70 CP>450 | 0.09 | 0.48 | 478 | 418 | 20.27 | 875 |
| Premix Dairy 31 | 1.00 | 1.00 | 4999 | 0 | 0 | 1000 |
| Vinasses Sugarbeet CP<250 | 2.99 | 3.00 | 393 | 0 | 21.69 | 663 |
| Magnesiumoxide | 0.04 | 0.01 | 1060 | 0 | 0 | 1000 |
| Distillers grains and solubles | 9.36 | 17.93 | 295 | 0 | 19.51 | 901 |
| GHG emissions |   |   |   |   |   |  |
| Ingredients (g CO2e /kg DM) | 669 | 571 |  |  |  |  |
| Transport to farm (g CO2e /kg DM) | 11 | 11 |  |  |  |  |
| Feedmill (g CO2e /kg DM) | 82 | 81 |  |  |  |  |
| Total feed production (g CO2e /kg DM) | 762 | 664 |  |  |  |  |
| LULuc (g CO2e /kg DM) | 142 | 142 |  |  |  |  |
| Enteric methane (g CH4/kg DM) | 23.1 | 22.7 |   |   |   |  |

a Nevedi, 2012, 2013, 2014, 2015

b Vellinga *et al.*, 2013

c CF= Crude fiber, CP= crude protein, SUG= sugar in (g/kg)

Supplementary Table S3. Greenhouse gas emissions of feed production and land use and land use change (LULuc), enteric methane emissions, and nitrogen content of feed ingredients of dairy cows.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Feed ingredient | Feed productiona(g CO2e /kg DM) | LULuca(g CO2e /kg DM) | Enteric methanea(g CH4/kg DM) | Na(g /kg DM) |
| Concentrates standardb | 762 | 142 | 23.1 | 26.1 |
| Concentrates proteinb | 664 | 142 | 22.7 | 31.4 |
| Wet by productsc | 388 | 20 | 19.2 | 46.5 |
| Grass | 439 | 69 | 21.2 | 37.3 |
| Grass silage | 426 | 78 | 20.1 | 28.3 |
| Maize silage | 148 | 92 | 17.7 | 12.6 |

a Vellinga *et al.*, 2013

b Nevedi, 2012, 2013, 2014, 2015

c Wet by products consisted of (%/kg DM): 29% brewer’s grain dried, 32% potato peel steamed, 16% potato pulp dried, 23% maize gluten meal

Supplementary Table S4. Emissions factors (EF) forCH4 andN2O emissions, NO3-N leaching and NH3-N + NOX-N volatizing of manure from dairy cows in stable and manure from dairy cows from grazing.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stable/storage |   |   |   |   |   |
| N2O-N direct | kg/kg TANa | 0.0015 | (De Vries *et al.*, 2011) |
| NH3-N | kg/kg TAN | 0.1000 | (De Vries *et al.*, 2011) |
| NOx-N | kg/kg TAN | 0.0015 | (De Vries *et al.*, 2011) |
| CH4  | kg/ton manure | 0.746 | (De Mol and Hilhorst, 2003) |
| Grazing |   |   |   |   |   |
| N2O-N direct | kg/kg N  | 0.033 | (Vonk *et al.*, 2016) |
| NOx-N | kg/kg N | 0.012 | (Vonk *et al.*, 2016) |
| NH3-Nb | kg/kg TAN |  | 0.053 | (Vonk *et al.*, 2016) |
| NO3-N leach | kg/kg N |  | 0.12 | (Velthof and Mosquera, 2011) |
| CH4  | kg/m3 manure |  | 0.11 | (De Mol and Hilhorst, 2003) |
| All |   |  |  |   |   |
| N2O-N indirect | kg/kg NH3-N + NOX-N | 0.01 | IPCC, 2006 |
|   | kg/kg NO3-N | 0.0075 | IPCC, 2006 |

a TAN= Total Ammoniacal Nitrogen

b EF NH3 grazing = 1.98 x 10-5 x (Ncontentdiet)3.664

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