

Polluting compounds in Po Valley dairy system: amount, variation and some determinants in Veneto region farms

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This study, part of the wider project Mitigactions (Rural development program 2014-2020, Regione Veneto) aimed to quantify the environmental footprint (Life Cycle Assessment) of milk production in Veneto region specialized dairy farms and to identify its main determinants in order to address specific mitigation strategies. Data originated from 28 dairy farms (103±95 lactating cows, 9092±1235 kg fat protein corrected milk - FPCM/cow in 305-d lactation). System boundaries included herd and manure management, on-farm feedstuffs production, purchased feedstuffs and materials. Global warming (GWP), acidification (AP) and eutrophication (EP) potentials were assessed as impact categories. Functional unit was 1 kg FPCM, with biophysical milk vs meat allocation (IDF method). Mean impact values per 1 kg FPCM were 1.10±0.15 kg CO₂-eq, 17.1±2.5 g SO₂-eq and 6.0±1.0 g PO₄-eq. The greatest contributors to GWP, AP and EP were enteric fermentation (43% of total emission), manure storage (50%) and feeds production (65%) phases, respectively.

General linear models (GLM) were used to investigate separately the effects of farm management (MAN_F), ration composition (DIET_F) and animal response factors (ANI_F) on the variation of impact categories. Among MAN_F, both GWP and AP linearly decreased (P<0.10) at increasing stocking rate (SR). All impact categories were quadratically related with feed self-sufficiency (FSS), and the lowest emissions were associated with medium FSS (around 50% of dietary DM) compared to low or high FSS (average dietary DM 20 and 70%, respectively). Among DIET_F, GWP linearly decreased at increasing the amount of dietary cereal silages. Acidification potential and EP linearly decreased at the decreasing of dietary CP content (P<0.05), which was in turn quadratically related to GWP. Among ANI_F, both GWP and EP were significantly influenced by FPCM (P<0.05). Namely, they decreased moving from low to medium productivity herds (7800 vs 9100 kg average FPCM, respectively), whereas high productivity herds (average FPCM 10800 kg) had mean GWP and EP comparable to medium productivity ones. GWP linearly increased at increasing culling rate and when average age at first calving of the herd exceeded 24 mo. AP and EP were lower in herds characterized by age at first calving ≤ 24 mo. In conclusion, some farm, diet and animal management factors were significant related to impact categories, and can be used as targets or aims when considering mitigation strategies of dairy farms.