

Reducing environmental impact in the Dutch dairy sector with ANCA-tool

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ANCA or 'KringloopWijzer' (in Dutch) is a software instrument that offers Dutch dairy farmers insight in the environmental performances of their farm. The ANCA instrument measures the cycles of nitrogen, phosphorus, greenhouse gases and carbon. Using this instrument will help to reduce mineral losses and to reduce costs on a dairy farm.

The dairy sector, the feed industry, the milk processors and the accountancy organisations made an agreement to reduce the environmental impact in the Netherlands by using ANCA. They agreed that from 2016 onwards using ANCA would be mandatory for all Dutch dairy farmers. ZuivelNL organised the data collection and storage of the data in a central database. This database with information of all Dutch dairy farms enables to establish a benchmark for relevant indicators. In 2020 data analyses about greenhouse gases were performed with more than 34.000 farm records. The average green house gas emission allocated to milk yield in the Netherland from 2016 – 2018 was 1226 g CO₂-equivalents per kg FPCM. The results can be used for improving the mineral management on a dairy farm, to save costs. On the other hand, the results can be used as indicators in sustainability programs. Depending on the scores of the indicators, farmers can be rewarded with financial bonuses.

Abstract

In the main dairy exporters, Oceania, EU-28 and North America, dairy farming is under pressure to reduce greenhouse gas emissions, ammonia emissions, and nitrogen and phosphate losses. This is also the case for the Netherlands. Therefore WUR developed an instrument that calculates the greenhouse gas emission, ammonia emission, nitrogen and phosphate losses for each dairy farm individually (de Vries et al., 2020). Eventually to avoid pollution. This instrument (ANCA, Annual Nutrient Cycling Assessment or 'KringloopWijzer' in Dutch) uses detailed farm specific input that is measured on farm and collected from governmental and industrial data sources. Examples are animal numbers, feed stocks, manure exports and nitrogen and phosphorus contents of feed and manure. This paper shortly describes the greenhouse gas emissions in ANCA, the ANCA introduction in the Dutch dairy sector and its greenhouse gas emissions. Closing with the (potential) benefit for the individual dairy farmer.

Introduction

ANCA or KringloopWijzer

The ANCA instrument measures the cycles of nitrogen (together with ammonia and nitrous oxide), phosphorus, greenhouse gases and carbon. It subsequently quantifies the excretion of nitrogen and phosphorus of the herd for individual farms, the uptake of nitrogen and phosphorus with crops and the total crop yield as well (Aarts et al., 2015). The greenhouse gas emissions are calculated according to the PEFCR guidance (PEFCR, 2018a, b, c). This is chain approach where the following aspects are taken into account:

- The production of purchased feed.
- The production of all inputs to the farm, such as fuels, fertilizers and machines.
- Machine use by contract workers.
- The land use change associated with the cultivation of crops outside the farm

Methane is an important part of the greenhouse gas emissions. The ration fed to the herd and characteristics of the feed components are important for methane production from enteric fermentation and manure. ANCA is able to determine the rations and uses the mentioned characteristics for calculation of the methane emission. The greenhouse gas nitrous oxide is calculated according to IPCC (2006) and depends on the total nitrogen application (de Vries et al., 2020). The other greenhouse gas that is calculated concerns carbon dioxide. This is not only about fuel and electricity but purchased feed and materials as well (de Vries et al., 2020). To be able to sum different gases, the greenhouse effect of methane and nitrous oxide is expressed in CO₂ equivalents. 1 kg methane from biological processes corresponds to 34 kg CO₂, 1 kg CH₄ from fossil fuel corresponds to 36.75 kg CO₂ and 1 kg N₂O corresponds to 298 kg CO₂ (PEFCR, 2018a).

Scaling up to national level

The ANCA-tool provides useful management information about feeding and crops. The farmer and his adviser get signals if feeding and crop yields can be improved. This helps to reduce mineral losses and to reduce costs for feed, fertilizer and manure. In 2013 the dairy sector recognized this potential positive effect of the ANCA tool. So in that year the dairy sector, the feed industry, the milk processors and the accountancy organisations made an agreement to reduce the environmental impact from Dutch dairy farms by using ANCA. They agreed that from 2016 onwards it is mandatory for Dutch dairy farmers to use the ANCA tool and to store the input and output data in the central database that is owned by ZuivelNL (DairyNL). ZuivelNL is an organisation of the Dutch dairy supply chain. ZuivelNL has developed a database system to connect available input data to the ANCA tool to determine the environmental performance for each farm individually. Using available data connections with dairy processors, feed companies, governmental institutes (animal numbers, manure and land) and analysing laboratories reduce the effort from farmers and advisors to fill out the ANCA tool. However, using these data sources will also help to ensure the correct data input values. This database with input and output results enables to establish a benchmark for relevant indicators and thus room for improvement. In the past the data are used for analysing trends in nitrogen use efficiency (Oenema and Oenema, 2021). Recently the performances for all individual dairy farms in the Netherlands were analysed (Mollenhorst en de Haan, 2021). The database not only gives insight in the performances about nitrogen surpluses, ammonia emissions but gives insight in the average greenhouse gas emissions as well, see table 1. However (almost) all dairy farms had to use the ANCA instrument, far less records were used for analysing (Table 1) than the number of dairy farms in the Netherlands. Because, when screening

Table 1 Greenhouse gas emission (g CO₂-equivalent/kg FPCM¹) from dairy farms recorded in the central database in the years 2016, 2017 and 2018 (calculated with ANCA version 2019). Subsequently are the average GHG-emissions for 2016, 2017, 2018 and the three year average shown, together with the division into 5 different sources, the average performance of the 25% farms with the lowest GHG (Q1) and 25% farms with the highest GHG (Q3).

	2016	2017	2018	Overall	%	Q1 overall	Q3 overall
# records	10802	10799	12560	34161			
Total GHG (average, allocated to FPCM)	1208	1213	1254	1226	100%	1105	1312
- Enteric Methane	495	484	500	493	40%	452	527
- Stored Manure	139	140	148	143	12%	130	157
- Feed Production	134	135	141	137	11%	79	151
- Imports	375	391	402	390	32%	340	432
- Energy sources					5%		

¹fat and protein corrected milk yield

the data, about 12 – 33% of all the records appeared to be incorrect. Still the number of records used for analysing is considerably high. Table 1 shows that the average production of greenhouse gasses allocated to dairy of a Dutch dairy farm is 1226 g CO₂-equivalents per kg FPCM. 40% is enteric methane, 12% comes from the manure storage, 11% is nitrous oxide coming from the fields and 32% of the emissions is due to imports (eg concentrates, artificial fertilizer). Emission from energy sources are a rather small part and not analysed.

The results can be used for improving the mineral management on a dairy farm. On the other hand, the results can be used as indicators in sustainability programs. Organized by dairy processors or other organisations that want to improve sustainability on farm level. Greenhouse gas emission is usually an indicator used in sustainability programs. Depending on the scores of the indicators farmers can be rewarded with financial bonuses. Several dairy processors already implemented indicators from the ANCA tool in their sustainability programs, where dairy farmers can earn extra income. Quite well known is the ‘on the way to planet proof’ certificate (managed by SMK¹), where collaborating dairy farmers can earn up to 2 cents extra per kg milk.

Taking advantage of using ANCA

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¹ Stichting milieukeur: <https://www.smk.nl/761/about-smk/smk—partner-for-sustainability.html>

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