Life-Dairyclim, European project aiming to mitigate methane emissions and carbon footprint of dairy cows

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Abstract

How can dairy farming contribute to reduce the climate change without compromising food security and farm economy? This is the question the project Life-Dairyclim wants to answer. The project gathers partners from research groups, association of advisory services to farmers and feed industry in collaboration with private farmers in three countries (Belgium, Luxembourg and Denmark). It focuses on production of feed, including utilisation of grassland and feeding of dairy cows in order to implement strategies that can contribute to a sustainable development of the dairy sector.
Feeding experiments to decrease methane from dairy cows will be assessed at the University of Liège (Belgium) with cows milked by an automatic milking system. Methane production will be analysed individually by a device (Guardian®) inserted in the feeding bin as well as by mid infrared spectrum analysis of milk. The effect of concentrate composition on methane production during grazing in combination with optimization of grazing practices will be studied in collaboration with the industrial partner, Dumoulin (Belgium). The carbon footprint of produced milk will be determined using lifecycle assessment methods based on input from the experiments in combination with effect of feed production on especially carbon sequestration from different type of crop and utilization by Aarhus University (Denmark) and Convis, association of advisory services to farmers (Luxembourg). An important part of the project is dissemination based on pilot farms in all three countries documenting the impact of mitigation strategies adopted during the project

Introduction

Following the report of FAO (2014), agriculture is responsible for 12% of the production of greenhouse gases (GHG). Out of these, methane from enteric fermentation in cattle represents 74% of total emissions. Following several studies (FAO, 2010; Müller-Lindelauf et al., 2010) intensification of farming is considered as a way to diminish methane emissions/kg milk. On the other hand, grasslands sequester carbon (Soussana et al., 2010) and consequently can contribute to reduce the Carbon Footprint (CF) of dairy products. Furthermore, dependence to off-farm produced feedstuffs has an impact on the milk CF and could increase economic difficulties of the dairy sector because of the volatility of prices. It is thus necessary to quantify the impact of different strategies on GHG emissions by using a method that include all the emissions before and at the dairy farm including effects of feed production on carbon sequestration from different type of crop and utilization. In this context, the Life–Dairyclim project funded by the European Commission aims to develop feeding strategies to mitigate GHG emissions of dairy cows during winter indoor feeding with silage as well as during summer with pasture and to evaluate their impact on the CF of produced milk. Three countries (Belgium, Luxembourg and Denmark) involving partners from feed industry (Dumoulin), association of advisory services to farmers (CONVIS, Luxembourg), science (Aarhus University, Denmark and University of Liège, Belgium) and private farmers collaborate in this project.

Material and methods

The project is focused on 3 objectives:

First, feeding strategies likely to limit methane emissions will be tested during the winter (barn feeding) and summer (grazing and supplementary feeding) in the experimental farm of Sart Tilman (Belgium). During the winter period the cows will receive a totally mixed ration (TMR), mainly composed of maize and grass silages, representative of those observed in the dairy farms of the participating countries. The herd of 50 dairy cows milked by an automatic milking system (AMS) will be divided into two groups. Both group will receive the same TMR, with daily registration of intake at herd level, but a concentrate of standard composition (AT1) will be allocated to one group while the other one will receive concentrate whose composition is likely to decrease methane emissions (AT2). AT1 and AT2 quantities will be determined on basis of days in milk and of mean milk yield of previous days on individual basis. During milking by the robot, several data will be recorded: milk yield, milk composition (estimation of fat and protein %), rumination time, weight, activity time. Furthermore, methane and CO_2 emissions of each cow will be registered by a device (Guardian®) installed in the feed bin of the robot. Individual milk samplings will be collected 3 times during each trial and methane emission will by estimated by near infra-red (NIR) spectrum analysis. The evaluation of CF of milk from each treatment will be performed by the lifecycle assessment methodology described by Mogensen et al. (2014).

At summer time, the utilisation of grass will be optimized by using precision grazing methods. Total dry matter provided by the grass will be checked every week by measuring grass height on each paddock with the rising plate meter (Jenquip®). The grass height will then be multiplied by the grass cover (kgDM/ cm grass) obtained by mowing a 10 meter long band, weighing the cut and drying it in oven for 72 h to estimate the DM content. Grass nutritional values will also be monitored by sampling the paddocks. All these data will be implemented in a file named “Observatory of grass” to estimate the total DM/Ha of grass available on the farm. A strip will be used to divide pastures into smaller areas to offer the cows the most correct quantities to cover their needs and avoid spoilage. . This methodology will enhance the productivity and is expected to lower CH_4 emissions/kg milk. This effect will be quantified in the Life-Dairyclim project using the methodology described by CONVIS (Lioy et al., 2012). Effect of concentrates given at milking on methane emissions will be studied by collecting the same parameters as described previously. Data will be assessed to find the best compromise regarding resilience and sustainability. The CF will be calculated as described before, including the effect on pasture productivity.

The second goal will be to evaluate grasslands use and grazing practice based on a survey conducted among dairy farmers of the 3 participating countries and development in grassland productivity and area at national level based on information from national statistics. Monitoring the development in grasslands and the proportion of grazing dairy cattle in the involved countries will allow to estimate emissions accounting from land use and from land use change in the three participating countries.

Finally dissemination of results will be a key-point of this project. The best feeding practices will be evaluated in 10 private pilot farms of the collaborating countries. In 4 of them methane emissions will be determined by the Guardian® while NIR-spectrum analysis will evaluate methane emissions in the other pilot farms. Productivity at herd, crop and farm level will be monitored each year with specific focus on resource efficiency, economic turnover and suitability indicators like fossil energy use and emission of GHG. Figures based on the method developed by Kristensen et al. (2011) will be faced with those obtained by Convis with the methodology described within the frame of the Interreg-Project Optenerges (Lioy et al., 2012).

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