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Background

The 2013 HELCOM Ministerial Meeting agreed to establish by 2016 national guidelines or standards for nutrient content in manure and develop by 2018 guidelines/recommendation on the use of such standards.

The commitment of the 2013 Ministerial Meeting is also reflected in the Terms of Reference and Work Plan of the HELCOM Group on Sustainable Agricultural Practices (Agri group).

Finland has taken the lead for the work on nutrient content in manure. Finland will lead the work via supporting the creation of manure standards. More specifically, Natural Resources Institute (Luke) and Finnish Environment Institute (SYKE) are currently building a calculation system for Finnish normative manure (manure standards) in a project (2014-2015) funded by the Finnish Ministry of the Environment. The work towards HELCOM standards can be initiated within this project.

The first meeting of the Agri group (AGRI 1-2014) in November 2014 took note of the ongoing work in Finland (c.f. document 8-1).

The aim of this document is to give an overview of the existing system for assessing the nutrient content in manure and the national regulations in some Baltic Sea countries and to describe the benefits and challenges of a more advanced system from a local and regional perspective.

Action required

The Meeting is invited to take note of the ongoing activities in Finland.

Denmark and Germany and other countries are asked to prepare a presentation of national systems and to present in a concise form the state of play in each country following the structure of the Finnish example presented here.

The Contracting Parties are asked to identify relevant organisations/persons to join the work lead by Finland towards standards/guidelines on manure nutrient content.

To facilitate the preparations for the meeting the Contracting Parties are invited to confirm the name of the presenter in advance of the meeting, by 21 May at the latest, to enable further communication. Presentations of max 10 minutes (5 ppt slides) are expected.

Developing a system for national standards for nutrient content in manure – example: Finland

1. State of play based on existing systems and practices in Finland

At the time of writing, definition of manure nutrient content in Finland is regulated by the Government Decree on the restriction of discharge of certain emissions from agriculture (1250/2014), subject to the Nitrates directive (91/676/EC). The Decree requires each animal farm to sample and analyse their manure minimum every five years. However, the farm may also choose not to base manure fertilisation on the analysis result. The newly updated Decree also allows utilisation of table values, which are given as an appendix to the Decree and are based on a large quantity on manure analyses from commercial laboratories. This option between farm-specific analysis and table values is also included into the voluntary agri-environmental support scheme of the Rural Development Programme 2014-2020.

Prior to joining the EU in 1995, Finnish manure nutrient content was reported in guidebooks apparently based on analysed manure samples, but more official table values were given after 1995 using data from one commercial laboratory. The current table values were updated in 2014 by SYKE and Luke as requested by the working group preparing the Government Decree (1250/2014). The working group had representatives e.g. from Ministry of Agriculture and Forestry, Ministry of the Environment, Farmers' Union and research institutions.

The Government Decree is applied to all Finland as a nitrate vulnerable zone, and thus it also applies to all farms. Many of the clauses in the Decree are tied to additional measures in the RDP, thus requiring their fulfillment to receive support and subjecting the farms for controlling. This also makes manure nutrient content tightly regulated.

2. Advantages and challenges of the existing systems at the national level in Finland

The most important advantage of using farm-specific manure analysis or table values is their simplicity. They are understandable to all stakeholders. The table values are based on a large dataset of analysed manures from all over the country. The large size of the dataset behind it adds to the reliability. Moreover, such a dataset would not be available without the legislative requirement for manure analyses minimum every five years. Farm-specific manure analysis increases the precision per farm as long as the farm practices stay relatively stable during the five years of one analysis being valid.

However, the table values are generalisations subjected to several errors. They are currently limited to only a few animal categories/groups and manure types (slurry/solid manure/urine of cattle, slurry/solid manure/urine of pig, solid manure of sheep, goat, horse, broiler, laying hen, turkey, mink and fox). More precise division into different animal categories and manure types is difficult as the samples are poorly identifiable. For example, naming the sample "poultry manure" does not determine which poultry is meant. Additionally, the quality of manure from different animals and different manure systems (slurry, dung and urine, farmyard manure, deep litter) may vary considerably. For example, "cattle slurry" neglects the differences in e.g. breeds, feeding and manure management between farms producing beef or dairy cattle. Practices within farms may also vary significantly in relation to e.g. water usage and bedding choice and amount. Table values should be updated regularly to reflect the change in housing practices in general.

Farm-specific manure analysis may give a more precise result. Still, the chance of errors is significant due to several reasons, such as poor sampling of the heterogeneous material, errors in sample preparation and/or errors/variation in analysis methods. The latter has been noticed e.g. when comparing the datasets of two separate commercial laboratories in Finland.

The short-comings of the current system may lead to overfertilisation on some farms and underfertilisation on others, depending on the choice between analysis and table values and their representativeness of the actual farm-specific manure. The effects on farm economy and the environment also vary accordingly.

In addition to the afore-mentioned problems, manure data for policy making and steering manure management into economically and environmentally more sustainable direction has been inconsistent, outdated or lacking. This is an issue common to most EU member states as also noticed in the European Commission. All EU member states are required to calculate animal nutrient excretion to faeces and urine and collect certain manure related data for the enactment of several EU policies, including emission inventories, agri-environmental indicators and Nitrates directive. A study issued by the Commission revealed that a lot of manure related data is based on (outdated) expert estimates instead of up-to-date measurements, calculations or surveys, only few countries have consistent national datasets, and the data sent to the Commission may vary significantly[1,2]. Variation was also noted in the Finnish data.

3. Advantages of developing a more advanced system in Finland

The challenges related to table values, manure analysis and lack of data may be overcome with a science-based normative manure system. It calculates manure nutrient content (and other parameters) starting from feeding and excretion of the animals and proceeding along the manure management chain until fertiliser use of manure. Such systems are already in use e.g. in Denmark. It provides consistent, up-to-date information on average manure quality and quantity) for all stakeholders e.g. in policy making, research, technology development and manure fertilisation plans on farms.

The system offers manure data from the entire manure management chain, including the quantity and quality of feaces and urine (ex animal), manure from different housing solutions (manure types ex housing) and manure to be spread on the fields (ex storage). This is an advantage in comparison to manure samples which are usually analysed only prior to spreading and thus give no information on the changes in manure quality along the management chain. The system provides research with consistent data on manure quality and quantity, thus improving the quality and comparability of research. The data is also vital for national emission inventories. Also for planning and developing manure processing, the difference between fresh and stored manure may be significant.

Farm-specificity can be included into the calculation system by allowing e.g. choice of feeding (instead of average feeding recommendations), bedding material and amount, water use and storage type. Also, the system can be created so that it calculates animal-specific manures (e.g. dairy cow, heifer, calf, bull, suckler cow separately) and farm-specific manures (mixture according to the number of different animals). Such a tool will be necessary for implementation of the forthcoming new BAT reference document for the Intensive Rearing of Poultry and Pigs (IRPP BREF) which contains farm-specific requirements for estimations of nutrient excretion and emissions.

If the normative manure system can be created as described above, it provides an equal basis for development and implementation of manure utilisation for all stakeholders. The system is documented and thus transparent, and regularly updated. The uniform basis for manure utilisation enhances the effectiveness of measures on different levels from policy making to practical farming.

[1] Van Beek, C., Heesmans, H., Pietrzak, S. & Oenema, O. 2011. Characterisation of data collection – processing – reporting for agri-environmental policies in Member States of the European Union. EUROSTAT. Agriculture and fisheries. Methodology and working papers. ISBN 978-92-79-22084-5. European Union.
[2] Oenema, O. 2013. Ramiran 2013. http://www.ramiran.net/doc13/Proceeding_2013/documents/S11.07..pdf

4. Challenges of an advanced system

The normative manure system under development in Finland is a complex model consisting of calculations for excretion, housing, storage and emissions. All sections are integral for the outcome. Excretion of faeces and urine set the baseline and constitute most of the quantity and nutrients present in subsequent manures. Housing defines the manure type with significant impact on the quantity and quality. Emissions are inevitable along the manure management chain and impact especially the nitrogen content in manure. Depending on the housing choices they vary considerably.

Excretion calculation is in the core of the normative manure system. It is very complex and the choices made in the formulas used affect the outcome tremendously. During the course of creating the Finnish system, a difference between calculated and measured manure quality has been noted. This will be explored further with consideration to e.g. the following issues. Excretion values are always based on feeding, and the choice of feeding data used has a significant effect on the result. In Finland, national feeding recommendations are used during the creation of the normative manure system. However, it is apparent that not all farms use them to the point or at all. Thus, farm-specific excretion does not necessarily follow those given by feeding recommendations and little is known about the extent to which farms follow the recommendations. Feeding can also be organized in different ways. For example phase-feeding of pigs has affects excretion depending on the phase of pig growth. In case farm-specific feeding data is available, excretion calculations can be done per farm. This requires development of a "farm calculator" and cannot be the first step when creating normative manure system. Alternatively, some coefficients to consider farm-specific differences in feeding should be developed.

The number of animal categories and subsequent manure types for each is large and the calculations must be consistent and available for all. Housing and emission calculations require upto-date data from manure management. In Finland, large farm surveys were made in 2013-2014 to update previous data from 1980s and subsequent expert estimates. The data includes detailed information on manure management techniques and practices per animal and manure type. Such data is not available in many countries. It is also notable that there is variety even within one manure type. For example dairy cattle may produce solid manure, but depending on the housing (loose/stall, cold/semi-cold/warm) manure quality differs.

When creating such system, it should be clearly stated which institutions (persons) are responsible for maintaining and updating the system. It cannot be openly accessible due to the complex nature. The updating also means updating the data required for the calculations, such as manure management data. Clear routines are required for both data management and updating. Finland has not yet created such routines and the system is still under development and its eventual use is not defined.

The normative manure system may seem difficult to understand due to its complexity. Also, the result may not be quite the same as the old manure analysis of a specific farm. To make the system acceptable to all stakeholders, it should be created in co-operation and dialogue with them.

No joint protocol exists to these calculations, making all normative manure systems unique and incomparable. A common baseline from which to define the national systems would assist significantly in making more comparable and uniform systems.

5. The role of regional international cooperation in the developing and implementation of the advanced nutrient standard system

To create joint standards / guidelines for manure nutrient content across Baltic Sea Region, regional and international co-operation is integral. The key institutions must be committed to work together to form such standards and to set a common baseline for national systems taking into account region-specific differences in animal production. Together it is possible to create a system which enables more comparable estimation

of manure nutrient content in each country / region and of its potential environmental load. Grounds for fertilisation with manure could become more equal between the countries / regions. Together with improved spreading time and methods this could lead to significant decrease in nutrient load to the Baltic Sea. Economical impacts should also be assessed. In case the normative manure system presents higher nutrient contents in manure than in current national systems, the need for more field area for fertilisation may bring costs for animal farms. On the other hand, it may also reduce the need for mineral fertilisers and potentially improve the precision of feeding to decrease nutrient excretion, thus also reducing farm costs. It may also boost manure processing into more advanced nutrient products and therefore improve nutrient reuse in the BSR.

6. Conclusions

The HELCOM Agri group has agreed on establishing national guidelines or standards for nutrient content in manure by 2016, including instruments applied to facilitate the processes at regional level. Further, by 2018 guidelines/recommendations on the use of such standards should be available. The schedule is tight for such a complex issue. The key institutions to jointly create the standards should be immediately identified and a collaborative project with clear schedule formed. It is obvious that proper resources are also needed.