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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.

Poland has carried out significant work on a manure content. Since 2002, the Polish National Research Institute of Animal Production (NRIAP) has carried permanent, detailed studies on the impact of animal production on the natural environment via the creation of manure standards (among others). In 2002 and 2012, the NRIAP elaborated a study of the amounts of manures produced as well as on the concentration of biogenic compounds in these manures. Currently, it is decided to validate the previously created normative manure standards in a project (2015-2017) aiming at manure composition verification. The work towards HELCOM standards can be initiated with this project.

Action required

The Meeting is invited to take note of the ongoing activities in Poland as required in under Agenda Item 3.1-1.

The natural manure composition in Poland – estimating and verification

1. Needs to acquire information

As required by the Community law, the Member States are obliged to protect and improve conditions of all waters e.g. by reducing the content of nitrogen and phosphorus compounds. (Water Framework Directive, Nitrates Directive, IED). Their provisions transposed onto Polish conditions also affected agriculture, including animal production. In the case of Poland, also particular role is that of the Baltic Sea Action Plan set up by HELCOM. The aforementioned regulations necessitated setting standard production figures for natural fertilizers, as well as for the concentrations of biogenic compounds (N and P) for the Polish local conditions in animal production. Throughout the last decade, the animal breeding in Poland underwent significant changes both in terms of production potential depending on the breeds and lines, and in terms of feeding regimes and housing systems. Undoubtedly, the accession to EU structures and the necessity to compete in the global food market, has influenced the state of affairs.

One of the priority actions taking part at the waters quality improving is standardizing/normalizing the amounts of produced manures, and the amounts of biogenic substances they contain. On the one hand it will allow to balance the turnover of these compounds at the level of a farm, territorial unit, and the whole national area whereas, on the other hand, it constitutes the first step to further control and reduction. The normalization/standardization would be welcomed at the level of each farm.

2. Methods of data gathering

In many EU states, there are standards imposing the permissible amounts of manures produced in a farm, and the concentrations of nutrients contained in the manures. As indicated by data from Eurostat/OECD, these amounts differ between individual countries, and often fail to cover the whole scope of species or housing systems. This phenomenon reflects the specificity of animal production in various countries associated with the scale or concentration of production, differences in technologies used, or even with climatic conditions.

Standardizing activities were also pursued in Poland, based on scientific research, aimed at estimating the relationships between the animal species bred, their feeding and maintenance regimes, as well as the scale and concentration of production. Since 2004, the standards have been binding on all farms situated within NVZs, as well as in the areas meeting the IED criteria. These standards are also applied by the State Inspectorate for Environmental Protection to all farms inspected in Poland. At present, after 10 years of operating, the standards are now undergoing amendments.

The specificity of Polish animal production consists, *inter alia*, in remarkable level of use of bedding systems (including deep litter), native/local breeds, extensive feeding regimes based on pasturing and fodders produced within the farm, and maintaining several species of livestock in the same farm. It is a result of low concentration and profitability of production. The cost of feeding constitutes as much as 65-75% of the production cost, and the depreciation of buildings lasts even as many as 25 years. Nearly 50% of Polish farms keeping livestock animals, maintains annually of up to 5 LU, and 40% of these farms – up to 2 LU. Additionally, there is a high number of factors affecting the quantities and quality of manures typical for the particular level of concentration, and for a given region. In view of these features, as well as some other, one may imply the need for verification of the before mentioned standards based on scientific research data, for medium and high intensive production, using the data from direct monitoring of manure production in the whole of Poland. This verification exercise presumes a multi-layered use of the results obtained, also for control purposes as well as to further processing in the form of databases answering to new challenges and needs of the sector.

As a result of the activities undertaken, a three-component system for determining the composition of manures in Poland was found. The two principal components, namely the standards and their verification are the most important for the quality of the environment whereas the control component enforces the compliance.

3. Standards, scientific analysis – methodology

Since 2002, the National Research Institute of Animal Production (NRIAP) has carried out permanent, detailed studies on the impact of animal production on the natural environment. These studies include all species of livestock animals recognized in Poland, maintained both under bedding and non-bedding system of housing, and the feeding regimes are based on national standards. The results obtained were then subjected to statistical analysis by one-way analysis of variance, with the use of Lotus, Statgraph, and Statistica software packages. In 2002 and 2012, the NRIAP elaborated a study of the amounts of manures produced, and on the needs to secure the capacity of buildings required to store them, as well as on the concentrations of biogenic compounds in these manures.

In scientific studies on the standards for the amounts of production and concentrations of manures, have drawn their starting point from the national average productivities of milk, meat, and eggs, derived from the data of the Central Statistical Office (GUS), based on nationwide agricultural census, as well as from the databases of the national system of verifying the livestock utilities (cattle, pigs, sheep). The levels of productivity were then matched with feeding regimes following the national standards, and the concentrations of protein and energy in the fodders. The data from the national data base of fodder monitoring were taken into account, together with data on concentrations of biogenic compounds. The aforementioned parameters were then adapted to the information on numbers of stock animals and the maintenance system used, obtained from associations of livestock breeders. The data on manures was verified practically by the field studies on many thousands of animals, involving also the chemical analyses of thousands of samples of manures. Such verification enabled correcting the levels of manure production, and taking into account the losses in the concentrations of biogenic compounds via gaseous emissions and leaching.

4. Standards, scientific analysis – results

Following the analyses in the NRIAP, data was obtained on the annual amount of production of solid and liquid manures for each technological group of animals, as well as for the most widespread housing systems.

5. Manure composition verification study – objective of the exercise

Currently, it is over 10 million LU of all livestock species maintained in Poland. The breeding of these animals is conducted in as many as one million farms. The practices applied to manure use in these farms are very divergent. Thus, it was decided that the study of farms involving the practices applied in production, storing, and application of manures will be necessary. Obviously, it is impossible to complete a survey of such the large number of farms and the manure samples collected. Therefore, the study will involve only their representative portion on a country level. It was decided that the exercise will use the stratified random sampling method, universally applied in population statistics. The exercise will be performed in 2015 - 2017, including the part involving questionnaire studies focused on production data, and the part covering the analyses of manures in summer and winter.

6. Monitoring of manures – methodology

The logical setting of research methodology will include the following cause and effect sequence, illustrated by the formula:

Concentration of a nutrient = content in fodder x digestibility coefficient – concentration in raw materials obtained – losses in storage

Verification methodology takes into account various animal species, and the variable production intensities, maintenance systems, and storage methods. The species-related scope will include cattle, pigs, and poultry which constitute the largest population of livestock, namely almost 90% LU in Poland (40 % LU for cattle. 30% LU for pigs, and 20% LU for poultry). The above-listed superior factors determine the composition of manures, and the degree of their effect on the environment. In this context, the location factor is of secondary importance, as the farms with similar scale and concentration will show the same parameters independent of their locations. The regional factor can sometimes affect the feeding of ungulates whenever climatic conditions can involve the use of maize-silage or its supplementation with other feeding materials. Additionally other regional conditions, such as precipitation or air temperature can have affect the degree of metabolism of manures, and timing of their application, but only as a secondary effect after the intensity of animal breeding.

7. Analysis of manures – gathering data for the study

The principal data concerning the sampling of natural manures:

a) Material: (dairy cattle, beef cattle, pigs, broiler chickens, laying hens).

b) Manure types – solid and liquid (slurry). Systems – deep-bedding, shallow-bedding, non-bedding.

c) Sampling method – 30. 60. 90% of the manure heap/depth of tank, in three places in each – along the diagonal/tank diameter.

d) Potential scope of analyses: (dry matter, total nitrogen, organic nitrogen, mineral nitrogen, ammonium nitrogen, nitrate nitrogen, organic phosphorus, mineral phosphorus, potassium, total carbon, organic carbon, C/N, pH).

8. Analysis of manures – questionnaire studies

Along with collection of samples in each farm there will be interviews and questionnaire studies, including the following items: (location – voievodship, poviat, municipality, size of herd, animal housing system, productivity of animals, pasturing , composition of feed ration, summer/winter, food consumption, use of bedding, water consumption, protein content, energy content, % of fodder purchased vs. own fodder, method of manure gathering, duration of storage, size of manure production, size of available storage tanks, methods of manure management (for fertilizing, for energy use, for sale), dates of manure application, methods of manure application, amounts of mineral fertilizers used, dates of application of mineral fertilizers, amounts of yields).

9. Analysis of manures – setting up databases

All the data obtained from the analysis will be entered into digital databases. These databases will enable processing of data and obtaining characteristics for particular species, cultivars, regions, etc. It is estimated that given the current level of technological advancement the next verification exercise will be required after 10 years.