MANURE MANAGEMENT SYSTEMS IMPACT ON GHG EMISSIONS

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Abstract. *Greenhouse gas (GHG) emissions from manure management consist of methane (CH_4) and nitrous oxide (N_2O) gases from anaerobic and aerobic manure decomposition processes. According to FAO, livestock contributes 37% of CH_4 emission and 65% of total N_2O emission [1]. Globally, livestock manure management accounts for almost 10% of GHG emissions from agriculture emissions measured in CO_2 equivalent [2]. Paper discusses GHG emission output by manure management practices in two most important livestock breeding sectors in Latvia.*

Key words: *manure management, emissions, greenhouse gas.*

INTRODUCTION

Livestock manure handling, storage and application practices have an important impact on the greenhouse gas (GHG) emissions from livestock operations in Latvia, contributing about 10% of total agriculture emissions [3]. Emissions of methane CH_4 and nitrous oxide N_2O from livestock production are regulated as part of the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC). Inventory of GHG emissions from livestock management account for several emission sources, including CH_4 emission from enteric fermentation and manure management; N_2O direct and indirect emission from manure management, as well as, manure applying to soils.

CH_4 emission from internal fermentation is affected by animal weight, feeding situation, milk yield and fat content, duration of the grazing period and other parameters, but most significantly by feed digestibility. High-quality feed can reduce this type of emissions by 15-20% and more.

CH_4 emissions from manure management are linked to manure characteristics, including volatile solids and the maximum amount of methane able to be produced. Calculation of these emissions is based also on manure management system characteristics and climatic conditions.

Direct N_2O emissions from manure management characterize emissions during handling, storing and treating of manure. Emissions of N_2O are strongly related to nitrogen amount excreted by animal.

Indirect N_2O emissions from manure management include nitrogen votalization in forms of ammonia (NH_3) and nitrogen oxides (NO_x). Indirect N_2O emissions may also form as a result of nitrogen leaching.

Direct emissions of N_2O from applying manure to soil depend on the amount of nitrogen in manure incorporated into the soil after storage. Incorporated bedding material increase total nitrogen content and consequently emissions.

Indirect emissions of N_2O from applied manure to soil estimates losses of nitrogen due to votalization of ammonia NH_3 and NO_x. Indirect N_2O emissions from applied manure to soil also include nitrogen leaching emissions. Impact of GHG emission output by manure management practices in dairy and pig production sector in Latvia are discussed in the paper.

MATERIALS AND METHODS

The methodology for estimating national CH_4 and N_2O emissions from livestock is based on emission factors devised by *The Intergovernmental Panel on Climate Change* (IPCC) guidelines [4].

RESULTS AND DISCUSSION

Dairy farming sector

Analysis of total emissions outcome for all manure management systems used in Latvia was done under the IPCC methodology. According to the results obtained by using 2006 IPCC guidelines, manure storing in open anaerobic lagoons shows highest amounts of GHG emissions, but the smallest amounts of emissions refer to utilizing manure for production of biogas (Fig.1). Emission analysis shows that high percentage of GHG emission amounts in the dairy sector is directed to CH_4 emission by internal fermentation, resulting in 60% of total emissions. The highest methane emissions from manure management relates to uncovered anaerobic lagoons. Particularly high methane emissions from internal fermentation are forming in the grazing period. It is influenced by the total energy required during grazing.

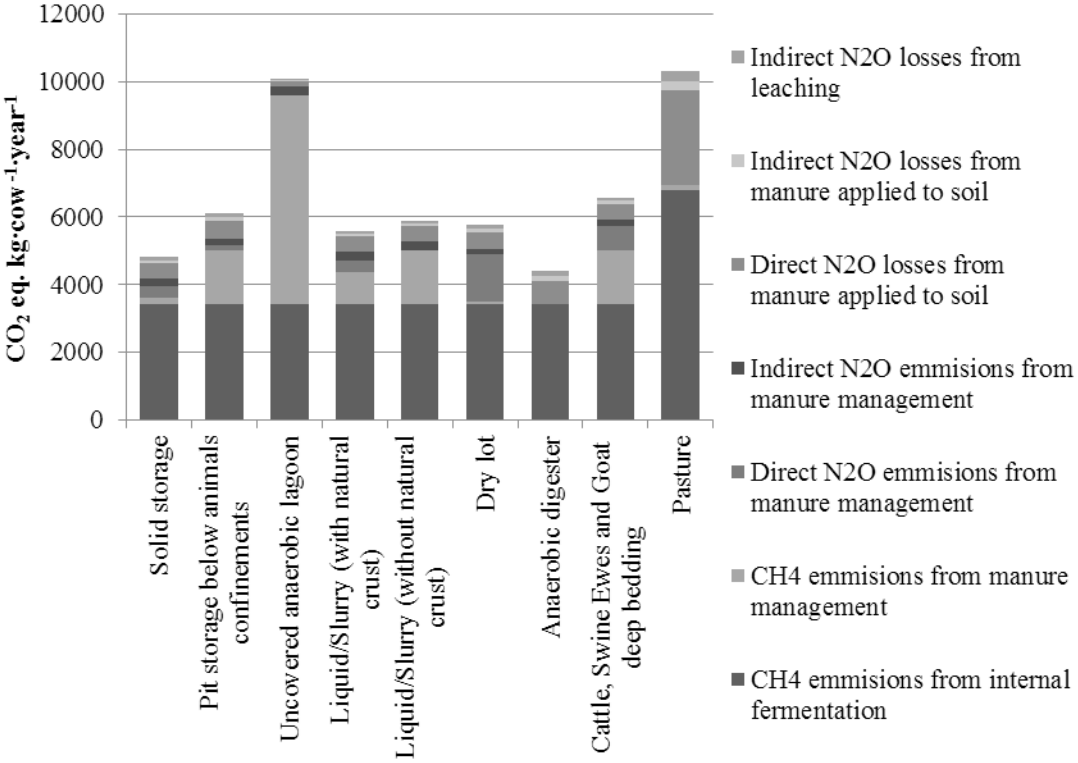

Figure 1. **Dairy sector GHG emissions from various manure management systems (60% digestibility)**

Different manure management systems are characteristic for dairy sector in Latvia, including solid, slurry based systems, anaerobic digester and pastures. Table 1 shows seven possible scenarios for manure management systems distribution.

Table 1

Scenarios of manure management systems distribution (MS), %

Manure management system	MS (1)	MS (2)	MS (3)	MS (4)	MS (5)	MS (6)	MS (7)
Slurry	20.3	28.3	34.0	44.0	50.0	60.0	70.0
Solid	55.0	50.3	48.3	41.9	40.0	34.2	28.2
Pastures	24.7	20.5	16.4	12.3	8.2	4.0	0.0
Anaerobic digester	0.0	0.9	1.3	1.8	1.8	1.8	1.8

In last year’s, dairy farming turn to liquid slurry management system, however liquid slurry produces more methane and promote increase of this kind of emissions. Emphasis on enlargement of the share of slurry based manure management systems consequently increases CH_4 emission during handling and storage period (Fig.2).

Swine Production Sector

Analysis of GHG emissions in the swine production sector at different manure management systems shows that the majority of emissions from a swine refer to manure management emissions. The lowest level of emissions results from the use of manure for biogas production (Fig. 3). Methane emissions from manure management process may be evaluated as 20-90% of the total GHG emissions.

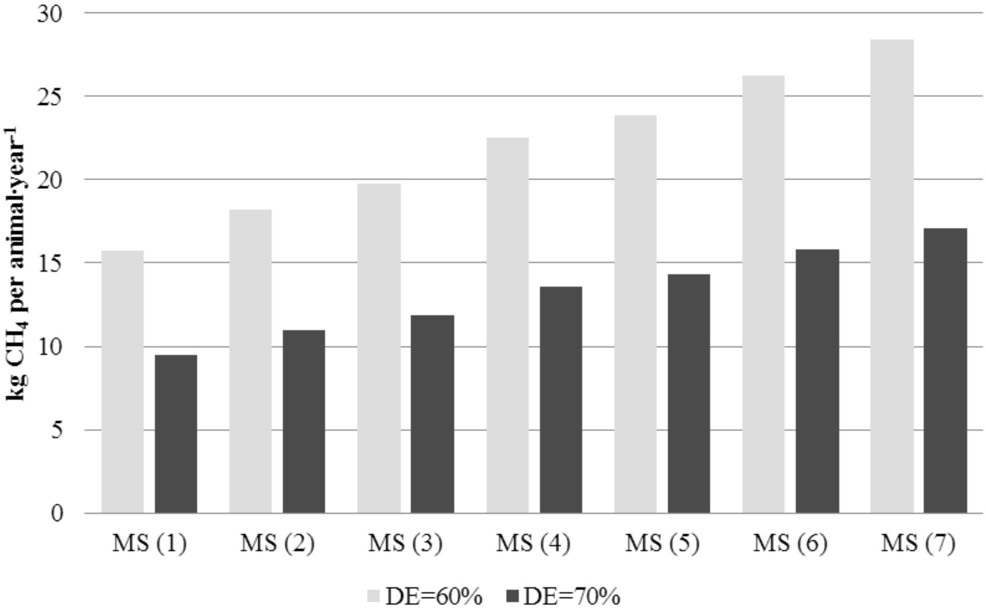

Figure 2. **CH_4 emission amounts under different scenarios of manure management system development**

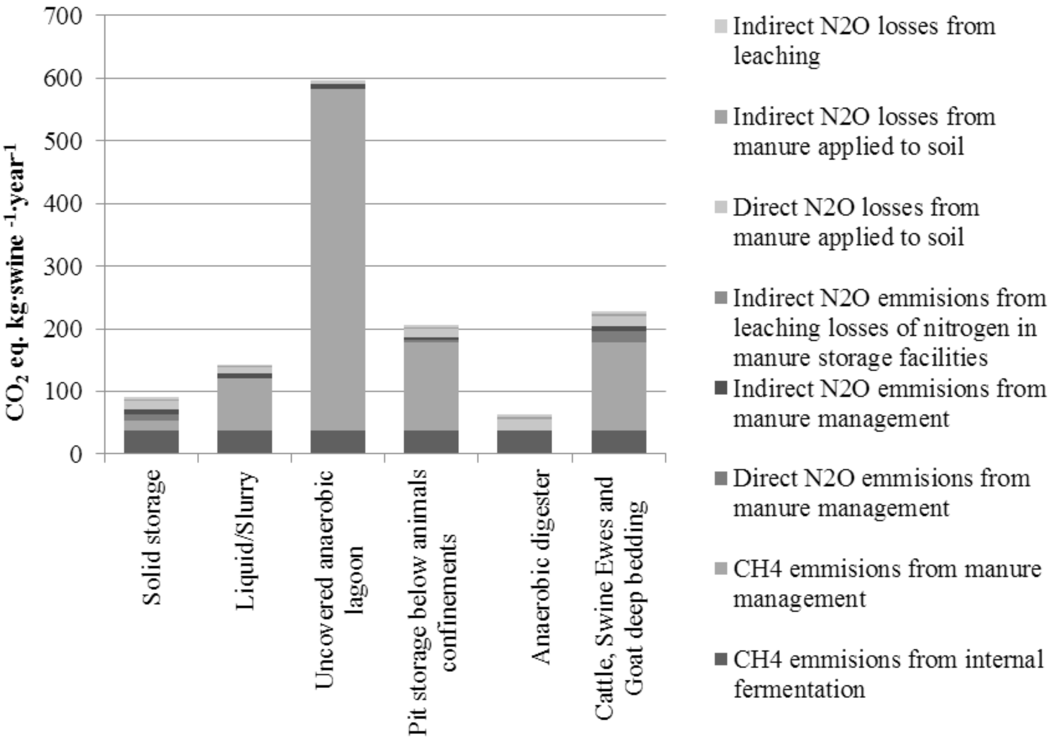

Figure 3. **Swine production GHG emissions from various manure management systems**

CONCLUSIONS

GHG emissions analysis in the dairy farming sector shows that the most important part of total emissions resulting from internal fermentation, which can be reduced by improving the feed quality and digestibility.

GHG emission reduction possibilities in swine production branch should be focused on manure management systems.

Highest emissions result from uncovered anaerobic lagoons, the smallest if manure is utilized for production of biogas.

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