Biosystems Engineering 2020
11th INTERNATIONAL CONFERENCE, 6-8 May

NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020
EIROPAS SAVIENĪBA
EIROPA INVESTĒ LAUKU APVIDOS
Eiropas Lauksaimniecības fonds lauku attīstībai
Agroresursu un ekonomikas institūts

Improving Options of Nitrogen Use Efficiency in Latvia's Crop Production

Ligita Melece, Ilze Shena

Institute of Agricultural Resources and Economics, Department of Bioeconomics, Struktoru 14, Riga, LV-1039, Latvia

Introduction

Nitrogen (N) loss from fertiliser has become a persistent environmental problem in the world, including European Union (EU). N fertiliser use in agriculture is associated with: (i) most common and widespread pollutant in groundwater water pollution via nitrate leaching; and (ii) occurrence of greenhouse gas (GHG) emissions, particularly nitrous oxide (N_2O). N_2O has a strong warming effect on climate change, because it is about 300 times more heating the atmosphere than carbon dioxide (CO_2).

Materials and methods

The principal **materials** used in the studies are as follows: various sources of literature, e.g., scholars' articles, the reports of institutions (esp. EU), etc. The data were obtained from Eurostat database and database of Central Statistical Bureau – CSB. The mixed methods, combining suitable qualitative research **methods** and quantitative research methods have been used.

Results

Gross nitrogen balance

Gross nitrogen balance (GNB)—balance between N added to agricultural land and that removed from it. Between 2000-2003 and 2012-2015, the GNB in most EU countries, i.e., the Baltic Sea Region countries, showed a decrease. Conversely, two of the Baltic Sea countries – Latvia and Poland show an increase (Fig. 1), although the average of allowed N dose still remain below.

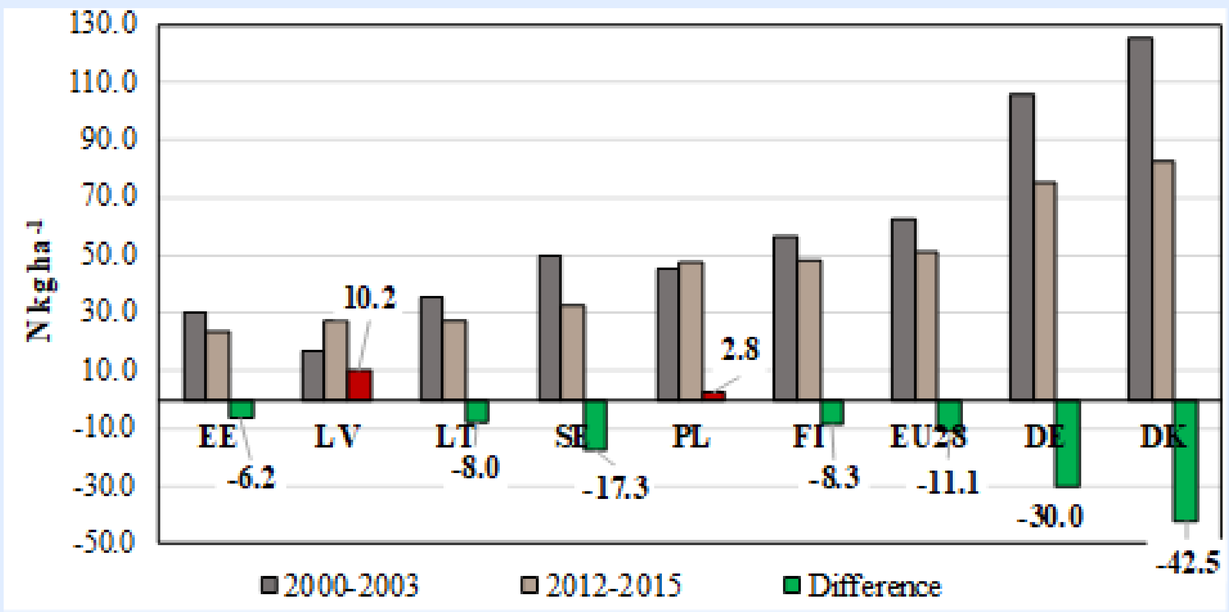


Fig. 1. GNB and it changes in the Baltic Sea countries, 2000-2003 and 2012-2015

Nitrogen use efficiency (NUE)

NUE—total N outputs (as yield) divided by total N inputs provides an indication of utilisation of N. The highest value of NUE does not mean the best result. Rates that may be close to or above 1.0 would indicate a risk of soil depletion, as the N uptake by crops exceeds the amount of N applied to the soil, and cannot be considered sustainable. NUE changes among the EU countries between periods 2000-2004 and 2010-2014 show that only in four countries, including Latvia, NUE decreases (Fig. 2).

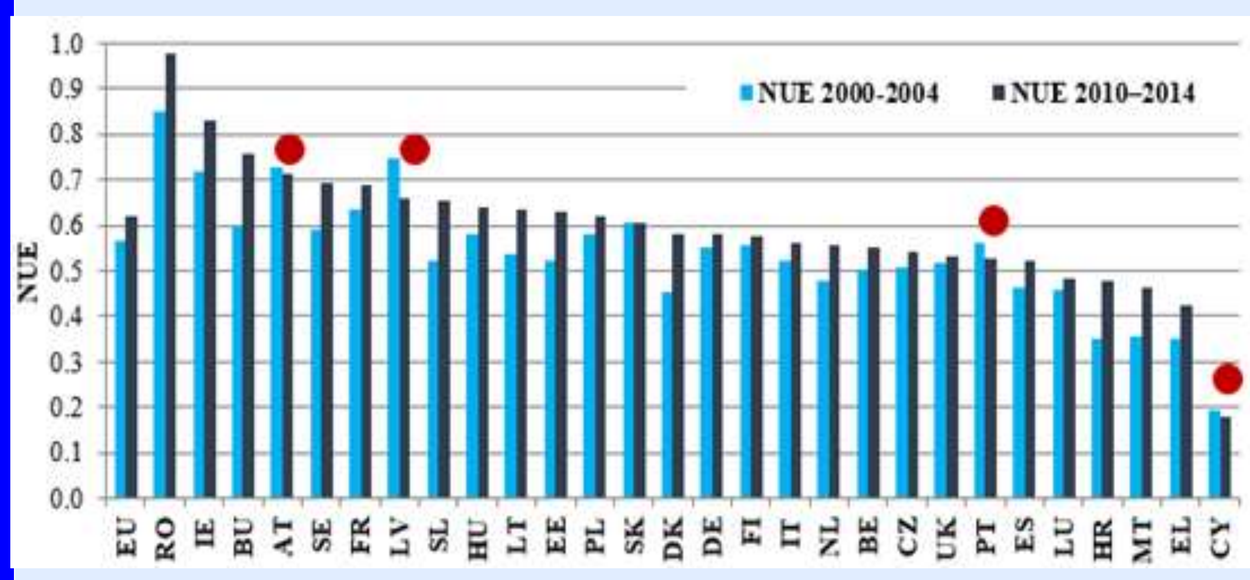
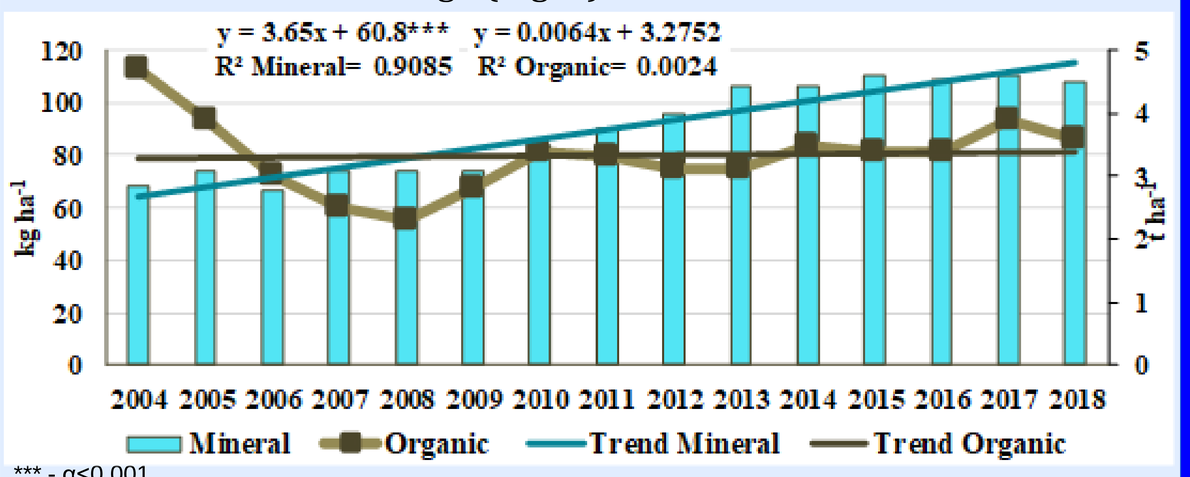


Fig. 2. NUE and it change in the EU countries, 2000-2004 and 2010-2014

In Latvia negative impact of agricultural intensification (i.e., monoculture, specialization of farming—crop farming, crop rotation disregard, decrease of crop diversity, etc.) causes significant increases of mineral N fertilizer usage (Fig. 3).



*** - α<0.001

Fig. 3. Usage of mineral N fertiliser (kg) and organic fertilizer (t) of per ha UAA and it trends in Latvia, 2004-2018

Increases of production of cereals, mainly winter wheat, industrial crops, i.e., rape, have increased consumption of nutrients, particularly mineral or inorganic N (Fig. 4).

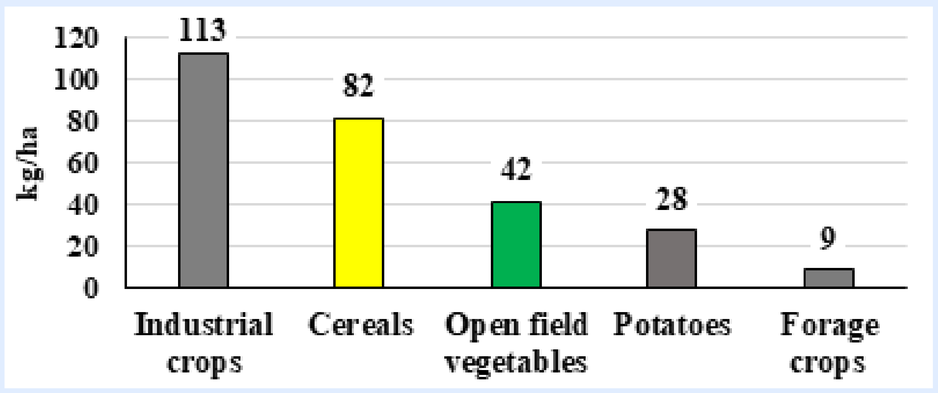


Fig. 4. Usage of mineral N fertiliser (kg ha-1) for various crops in Latvia, 2019

Nitrogen management strategy

N management is aimed to reduce and optimise usage of N fertiliser. Options & measures suggested for climate change mitigation & adaptation require a suitable N management strategy, which description and benefits are presented in the Table 1.

Table 1

Options and benefits of suitable nitrogen management strategy

Option	Description	Adaptation benefits	Mitigation co-benefits
Improved nutrient management	Site-specific, demand driven and balanced use of nutrients	Increased NUE Increased yields	Reduced N_2O due to high NUE
Use of efficient microbes	Use of microbes for enhancing soil fertility and crop productivity	Improved soil health Increased yields	Reduced CH_4 and N_2O C sequestration
Intercropping/ Mixed cropping	Growing more than one crop to increase productivity	Increased and stable production Higher efficiency of inputs	Reduced CH_4 and N_2O per unit production
Precision farming	Precise and site-specific management of inputs	Improved NUE Increased farm income	Reduced GHGs because of efficient use of agro-inputs
Intensifying crop production	Increasing crop production through intensive use of fertiliser and irrigation	Increased and stable production Higher efficiency of inputs	Reduced GHGs per unit production
Crop varieties with high use efficiency	Crop varieties with high nutrient uptake of shorter duration with high yield	Increased and stable production Saving of fertilisers	Reduced GHGs due to shorter duration and high NUE

Conclusions

Notwithstanding in all Baltic States the significant increase of nitrogen fertilizer's consumption is detected, a more obvious trend is observed in Latvia. Similar results are observed related to the nitrogen use efficiency.

Analysing recommended improving measures of efficient nitrogen management, it is concluded that main part of them are noted as mandatory or voluntary requirements under the Rural Development Programme (RDP) of Common Agriculture Policy (CAP).

ACKNOWLEDGEMENTS

The paper was partially supported by the Collaborative Project "Advanced farming systems for environmentally friendly and efficient crop production in Latvia" (No 19-00-A01612-000011) funded by EAFRD, supported by the Ministry of Agriculture and Rural Development Service.