Theme 4
Governance of soil fertility/soil nutrients

Governance of nutrient management in Bulgaria to reduce the risk of soil and water pollution

Biser Hristov*[1,2], and Tsetska Simeonova[2]

1-University of Forestry and 2-ISSAPP "N. Pushkarov" - Sofia, Bulgaria, (*e-mail: bisseru@gmail.com)

Introduction

Agriculture is defined as one of the most significant sources of anthropogenic pressure on soil and water. This is the reason for a number of negative effects and deterioration of the components of the environment, such as loss of biodiversity, soil acidification, erosion, salinization, pollution of surface and ground waters, eutrophication, gas emissions etc. Due to the listed environmental risks, there is a need to develop strategies, new standards for management and adoption of normative documents to regulate the protection of agro-ecosystems from pollution. One of the first EU acts of legislation aimed at controlling pollution and improving the quality of agricultural water was the nitrates Directive (91/676 / EEC), officially implemented in Bulgarian by year 2000.

Methodology

Soil monitoring points used to identify nitrate vulnerable zones are regulated by an order of the Minister of Environment and Water. Vulnerable areas in Bulgaria cover about 36% of the entire territory of the country and 68% of its arable agricultural land. The total number of sample points in the state is situated in the four river basin regions, as control and operational monitoring of surface and groundwater is performed (Fig. 2). The programs are implemented for a period of four years, except in cases where the content of nitrates in groundwater is less than 25 mg/l . In that case, the monitoring is eight years . Each year, 25% of the points are sampled each year. In 2019, 690 soil samples were taken from 115 points. The assessment of soil reserves is made on a five-point scale according to the content of organic C, total N, and P.

Fig. 1. Irrigation with groundwater – well in Tsalapitsa, Bulgaria.

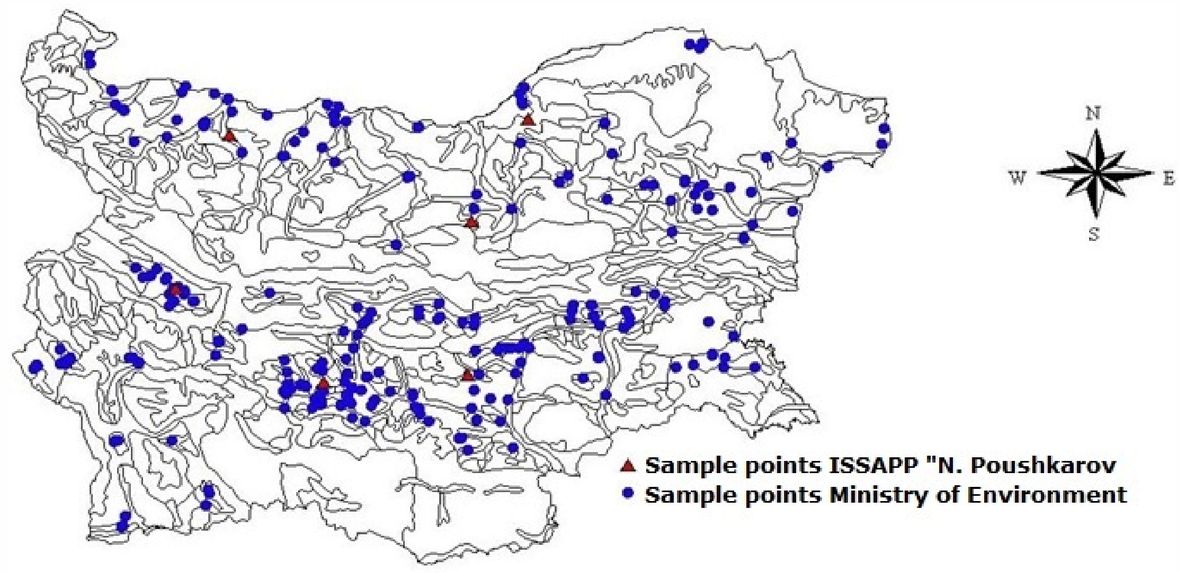

Fig. 2. Map of the wells for monitoring the composition of surface and lyzimetric waters from the Bulgarian National Monitoring (Ministry of Environment).

Results and Discussion

The most vulnerable zones to nitrate pollution are groundwater in areas where there is a combination of sandy or loamy soil texture, leaching water regime, high water table, intensive agriculture, which is associated with intensive irrigation and use of organic and mineral fertilizers. The main prerequisites for the loading of water with macronutrients are a consequence of the incorrect application of practices in agriculture and animal husbandry, including one-sided unbalanced nitrogen fertilization, underestimation of its stock in the soil and its content in manure used, non-compliance with the content of digestible forms of phosphorus and potassium, overestimation of expected yields, etc. Soil fertility in agricultural lands of Bulgaria contains an average of about 17.32 g/kg org. carbon, 1.6 g/kg total nitrogen, and 0.86 g/kg total phosphorous in the soil surface (0-20 cm).

Contemporary soil acidification of arable lands in Bulgaria is because of fertilization with ammonium sulfate, ammonium chloride, and ammonium nitrate. To limit the development of the acidification process in arable soils, it is necessary to apply appropriate fertilization models. Along with the acidification process, the mobility and availability of a number of soil elements changes, this has a direct and indirect impact on the soil-plant-human system.

Soil acidification is spread over the area of 2 million hectares, of which: 0.5 million ha with pH from 4.1 to 5.0 and 1.5 million ha with pH from 5.1 to 6.0. Other 4.3 million ha are potentially vulnerable to acidification. Most vulnerable soils to acidifications in Bulgaria are Planosols, Luvisos, Cambisols, Umbrisols, Phaeozems, Luvic Chernozems and Fluvisols. Usually, Calcic Chernozems, Veritsols, and Rednzinas are resistant to acidification, because of their high carbonate content and good buffer capacity.

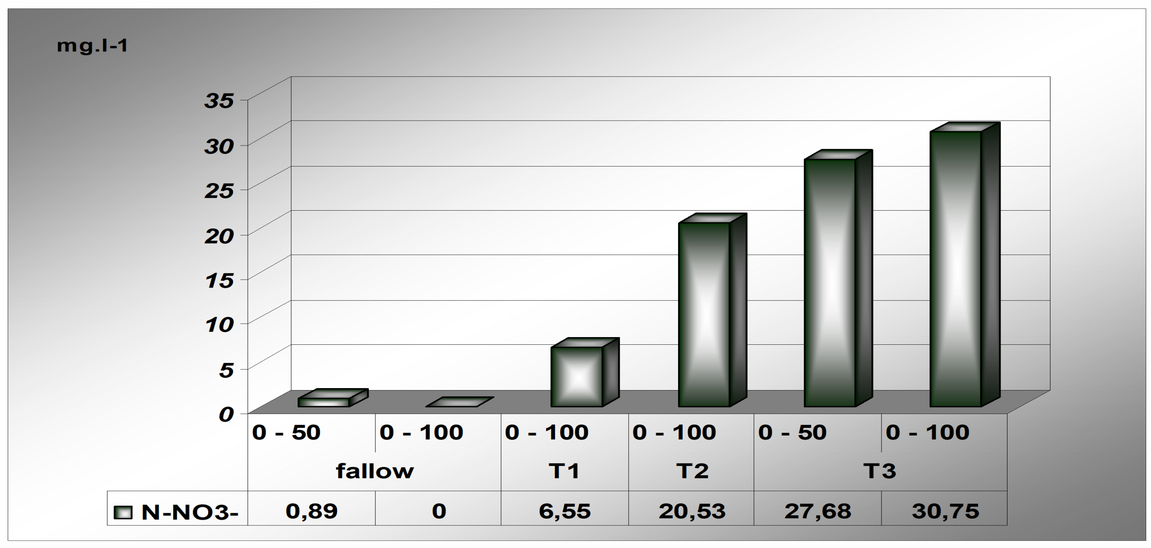

Fig. 3. Nitrate nitrogen content (mg.l^{-1}) in lysimetric waters, 2014 year – experimental field - Tsalapitsa, Bulgaria.

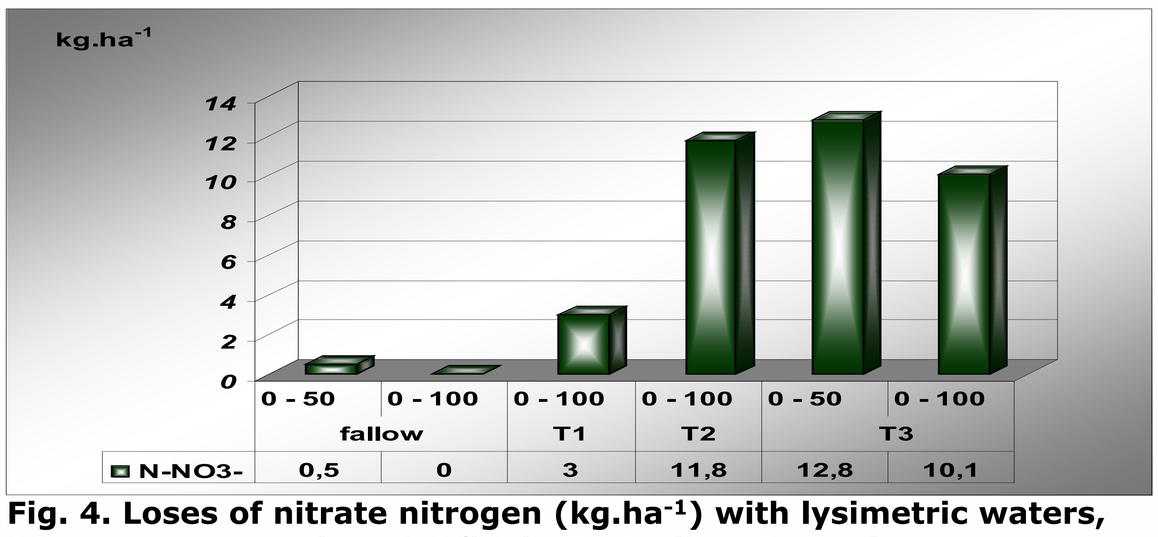

Fig. 4. Loses of nitrate nitrogen (kg.ha^{-1}) with lysimetric waters, 2014 year – experimental field , Tsalapitsa, Bulgaria.

Conclusion

Solving the problem of protecting the quality of soil and water is relevant not only for economic reasons but also because of its great social significance. Applying balanced fertilization, irrigation control, the knowledge of specific climatic conditions, soil type, and agricultural practices are ways to realize the productivity of crops and maximize the potential of soil resources. The objectives for maintaining the natural balance of the agro-ecosystem and its components include determining the sustainable use of nitrogen, phosphorus, and potassium fertilizers on agricultural lands.