Trakia Journal of Sciences, Vol. 23, Suppl. 2, pp 367-371, 2025
Available online at:
http://www.uni-sz.bg
ISSN 1313-3551 (online) **doi:10.15547/tjs.2025.s.02.055**

THE FARM TO FORK STRATEGY AND THE REDUCTION OF FERTILIZER USE IN BULGARIA

G. Aleksiev*

Faculty of Economics, Trakia University, Stara Zagora, Bulgaria

ABSTRACT
The goals set in the EU's Farm to fork strategy aim to improve the sustainability of agricultural production in the Union. The sustainable use of pesticides and fertilizers has been a long-standing part of the Common agricultural policy of the Union, but the new target of 20% reduction by 2030 is very ambitious.
The goal of this study is to analyze the potential impact of the reduction of fertilizer use by 20% in Bulgaria by 2030, as part of the Farm to Fork strategy of the EU. In order to reach this goal, the following tasks must be achieved: to present previous research on the impact of Farm to fork strategy on fertilizer use; to access the current use of fertilizers in Bulgaria; to study the potential impact of the reduction of fertilizer use for Bulgarian agriculture.

Keywords: agriculture, sustainability, policy, food production

INTRODUCTION

The Farm to Fork (F2F) Strategy, a cornerstone of the European Green Deal, outlines ambitious objectives for transforming the European food system into a sustainable model (1). A key component of this transformation focuses on reforming agricultural practices, particularly regarding the use of fertilizers, to mitigate environmental degradation and promote resource efficiency (2). Specifically, the strategy aims to reduce nutrient losses from fertilizers by 50% by 2030, a target that necessitates significant changes in farming techniques and nutrient management practices across the European Union (3). This reduction is intended to minimize the environmental pressures associated with agricultural runoff, such as eutrophication and greenhouse gas emissions, while simultaneously aiming for a 20% decrease in overall nutrient inputs without compromising soil fertility (1, 4). This ambitious reduction is designed to mitigate the negative environmental impacts of excessive nitrogen (N) application, such as soil and water contamination, greenhouse gas emissions, and biodiversity loss (1). The strategy further seeks to achieve these reductions in nutrient inputs and losses while simultaneously ensuring food security and maintaining the competitiveness of the agricultural sector, thereby presenting a complex challenge that requires innovative solutions and policy instruments (5). To this end, the F2F strategy particularly emphasizes minimizing nitrogen surpluses as a critical target for mitigating agriculture's impact on global change and environmental pollution (1).
The farm-to-fork (F2F) strategy is expected to have mixed economic effects on EU farmers. Overall, the strategy is projected to reduce agricultural production within the EU, which will likely lead to increased food prices and a decline in aggregate consumer surplus. This means consumers will face higher prices, while the overall welfare within the EU may decrease due to these higher costs and reduced production.

For farmers, some may experience income gains—particularly cattle producers—due to shifts in supply and demand, as indicated by studies highlighting increases in producer surplus in certain subsectors (5, 6). However, many crop producers and suppliers of inputs and food processors are expected to face negative income effects because of reduced output and market adjustments. Additionally, the net benefit to farmers depends heavily on technological and institutional developments; current technological limitations mean that the incremental costs of implementing changes may not be fully compensated by future gains,

***Correspondence to:** *Georgi Aleksiev, Faculty of Economic, Trakia University, Stara Zagora, Bulgaria, E-mail: georgi.aleksiev@trakia-uni.bg*

potentially leading to financial challenges for some. While a subset of farmers might see income improvements, the broader economic impact on EU farmers is likely to be negative or mixed, with reductions in production and welfare for many stakeholders along the supply chain (6).

Reducing fertilizer use can provide multiple environmental and soil health benefits. One significant advantage is the stabilization or improvement of soil pH; lower nitrogen inputs slow down soil acidification caused by nitrification processes, which helps maintain a more neutral soil environment. This shift enhances the availability of essential nutrients such as phosphorus, magnesium, calcium, and potassium, while also reducing the solubility of toxic metals like aluminum and manganese that can inhibit root growth and development (1). Additionally, lower nitrogen fertilization can promote an increase in soil organic carbon content. This occurs because reduced nitrogen levels slow microbial decomposition of organic matter, allowing carbon compounds to accumulate and thereby improve soil structure, fertility, and carbon sequestration over time. Furthermore, improved soil aeration results from increased organic matter and better soil aggregation, which enhances porosity and facilitates oxygen flow within the soil profile, supporting healthier root systems (1).

From an environmental perspective, decreasing nitrogen input significantly mitigates greenhouse gas emissions, particularly nitrous oxide (N_2O), and reduces nitrate leaching into water systems. Several studies have demonstrated that a 20% reduction in fertilizer application can lead to substantial decreases in N_2O emissions and nitrate leaching without adversely affecting crop yields, contributing to climate change mitigation and groundwater protection (7). In addition to environmental benefits, strategies focusing on optimized nitrogen management can lead to resource savings and reduced costs for farmers. Precision agriculture approaches that tailor fertilizer application to crop and soil needs improve resource use efficiency, which fosters sustainability and economic benefits.

DISCUSSION

The Farm to Fork Strategy aims to achieve sustainable nutrient management with specific goals related to fertilizer use. It targets a reduction in nutrient losses by at least 50% and a reduction in fertilizer use by at least 20% by 2030. The strategy focuses particularly on reducing the environmental pollution caused by unsustainable nitrogen (N) and phosphorus (P) management while ensuring soil fertility is maintained. To meet these objectives, the strategy promotes the extension of digital precision fertilization and sustainable agricultural practices through the Common Agricultural Policy (CAP). However, it is noted that the strategy primarily addresses symptoms of nutrient pollution rather than the root causes, such as high livestock intensity, which limits its overall steering effect (8). The strategy also emphasizes integrated nutrient management along the entire value chain but remains a non-binding communication, which may limit its enforcement and effectiveness.

The Farm to Fork Strategy aims to promote sustainable nutrient management by reducing nutrient losses by at least 50% and fertilizer use by at least 20% by 2030, with a particular focus on mitigating environmental pollution caused by unsustainable nitrogen and phosphorus management while maintaining soil fertility. This strategy encourages the adoption of digital precision fertilization and sustainable agricultural practices, supported through the Common Agricultural Policy, to optimize fertilizer application and reduce excess use. However, it primarily addresses the symptoms of nutrient pollution rather than root causes such as high livestock intensity, which limits its overall effectiveness (5).

Regarding the impact of reducing fertilizer use on agricultural production, research shows that a moderate reduction in nitrogen fertilization, around 20%, does not necessarily cause significant yield declines if fertilization is carefully balanced and tailored to plant needs using precision agriculture and advanced soil analysis. Crops can effectively utilize lower nitrogen amounts when fertilization is adapted to developmental stages and soil conditions, maintaining yield potential. In some cases, optimized nitrogen management with a 20% reduction combined with organic fertilizer replacement has even increased grain yield and

protein content, as observed in wheat. In temperate grasslands of the Alpine region, a 20% reduction in nitrogen fertilization led to a slight yield loss of about 5%, but this is expected to be offset by the positive effects of rising atmospheric CO2 levels in the future. For

certain crops like maize, even a 25% reduction in nitrogen did not reduce yields, indicating crop-specific responses (4).

Reducing fertilizer use also brings environmental and economic benefits. It lowers pollution such as nitrate leaching and nitrous oxide emissions, which are potent greenhouse gases. For example, a 20% reduction in nitrogen fertilization was associated with a 15% decline in nitrous oxide emissions and a 21% decline in nitrate leaching in grasslands (4). Additionally, lower fertilizer inputs reduce costs for farmers without sacrificing yield potential, improving profitability. Reduced nitrogen fertilization can enhance nitrogen use efficiency and soil health by increasing soil organic carbon, improving soil structure, stabilizing soil pH, and promoting beneficial soil microbial communities like nitrogen-fixing bacteria and mycorrhizal fungi, which support nutrient cycling and long-term fertility (1).

However, the success of fertilizer reduction depends on precise nutrient management, including digital precision fertilization and sustainable agricultural practices. There may be temporary nutrient imbalances affecting secondary nutrients such as phosphorus and potassium, which require careful management. The impact of fertilizer reduction varies by crop type, soil characteristics, and regional conditions, necessitating site-specific strategies (1, 4, 6).

A well-managed reduction in fertilizer use, especially nitrogen, can maintain or even improve agricultural production while delivering environmental and economic benefits. This requires precision in application, integration of sustainable practices, and consideration of crop and soil specifics to ensure long-term soil fertility and productivity.
To access the levels of fertilizer use in Bulgarian agriculture and its ability to comply to the Farm to fork strategy's goals the data on the three main products was analyzed - Nutrient nitrogen, Nutrient phosphate (P2O5) and Nutrient potash (K2O). The use of nitrogen was highest in 2016 at a 365 thousand tones and again in 2020 at 364 thousand **(Table 1)**. Throught the studied period – from 2015 to 2023 the levels of nitrogen fertilizer use ware steady at values form 329 thousand tones to 365 tones (9). Although there are some fluctuations, based on price variations and fertilizer demands, the use of nitrogen nutrient is steady.

Table 1. *Agricultural use of chemical fertilizers in Bulgaria (t.)*

Year	Nutrient nitrogen N	Nutrient phosphate P2O5	Nutrient potash K2O
2015	329546.0	65931.0	32714.0
2016	365913.0	82623.0	34012.0
2017	351120.0	67753.0	36909.0
2018	339329.0	76274.0	42917.0
2019	352486.0	76781.0	42917.0
2020	364335.0	78935.0	32700.0
2021	342890.0	72965.0	26400.0
2022	343254.0	73383.0	26700.0
2023	340801.0	79805.0	26700.0

Source: FAOSTATA Database

These tendencies are unlikely to change without an implementation of a larger strategic framework, such as the Farm to fork strategy, that will model the agricultural production within the whole European union, as agricultural productivity is closely related to fertilizer use (10, 3). The competitiveness of local farms is a key issue for Bulgarian economy and maintaining productivity is of upmost importance. If any changes to fertilizer use are to be introduced the CAP of EU has to be able to support any losses in productivity or the sector might run into the risk of loss of competitiveness and thus agricultural productions. In an effort to limit fertilizer use and especially nitrogen fertilizers the Ministry of agriculture and food of Bulgaria has introduced a new measure in 2024 – A program of measures to limit and prevent nitrate pollution from agricultural sources in

vulnerable areas for the period 01.01.2024 - 31.12.2027 (11). As a key part of the measure agricultural producers are pointed towards a suggested amount of fertilizer use per crop based on average productivity from previous periods. These types of norms for fertilizer use with a suggestive nature have been used in the past in Bulgaria with moderate success and can achieve some of the goals of the F2F strategy, but as the measure was just introduced a latter study on its impact has to be done.

The average fertilizer use per area of cropland in Bulgaria throughout the studied period is visualized in **Figure 1**. The levels shown are correlative and are in fact lower than the maximum suggested by the Ministry of agriculture and food. The trends for fertilizer use in Bulgaria are clearly visible, as the per area application maintains steady levels, with a slight decline in 2021 due to the impact of the COVID-19 pandemic on supply chains and fertilizer availability. It is important to notice here that the increase in fertilizer prices in 2022 did not impact their use in Bulgaria, as farmers tried to maintain production levels and passed the price increase to finished agricultural products and thus to the consumer. This global increase in food prices was a thoroughly studied topic in the last couple of years (9, 11, 12), as it impacted the global economy and policy making. The European union has used the opportunity of fertilizer price hikes to further indicate the necessity and impact of their use reduction in the future.

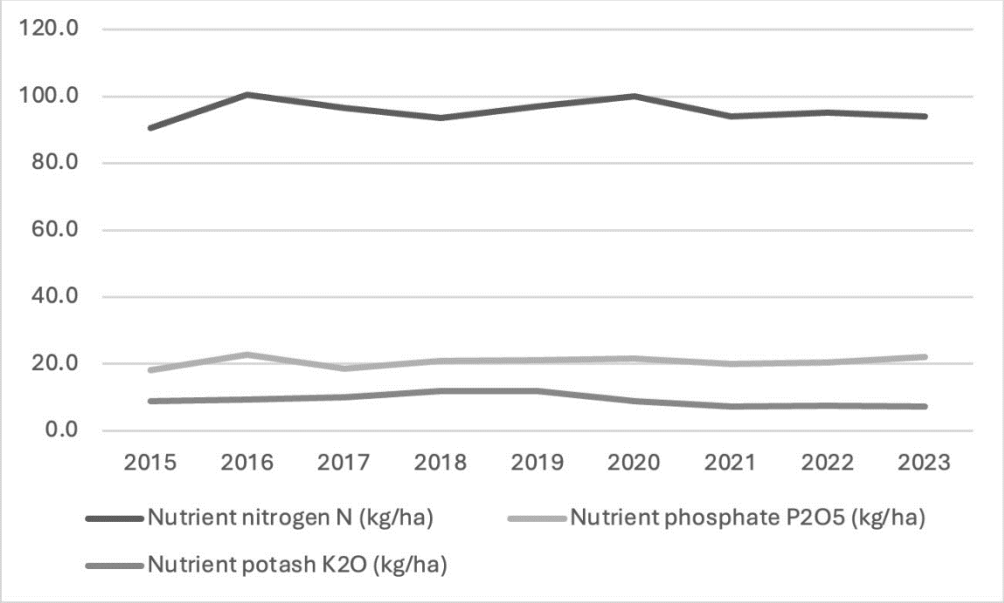

Figure 1. Agricultural use of chemical fertilizers per area of cropland in Bulgaria (kg/ha)
Source: FAOSTATA Database

The phosphate use in Bulgaria is much lower than nitrogen, which is typical for the region, soil types, economic efficiency of use of these two types of fertilizers and crops selected by farmers. With all these factors in mind the main element for fertilizer use reduction in Bulgaria is related to nitrogen fertilizer cutback goals of 20% decrease in 2030 compared to 2020. As of 2023 the achieved reduction of nitrogen use is 6% compared to 2020. If this pace is kept by Bulgarian farmers, and the country as a whole is on track to reach the goals of the Farm to fork strategy by no later than 2031 or 2032. This can only be achieved with further governmental measures as the current 5% to 6% reduction levels are maintained from 2021 to 2023 without improvement. Farmers have reacted to the new price model post COVID-19 and the current geopolitical uncertainty but have now adjusted and maintained the new position as a stable one. To improve on these settled levels of fertilizer use more efforts need to be put on a singular farm scale with more incentives for participating farmers. These positive incentives have proven to have better results in achieving the goals set in European strategies in Bulgaria.

CONCLUSION

Strategically managed reduction in fertilizer use—particularly nitrogen—has the potential to sustain or even enhance agricultural productivity in Bulgaria while concurrently delivering significant environmental and economic benefits. Empirical data from 2015 to

2023 indicate that nitrogen fertilizer use in Bulgaria has remained relatively stable, fluctuating between 329 and 365 thousand tons annually. Despite global disruptions, including the COVID-19 pandemic and the subsequent surge in fertilizer prices in 2022, fertilizer use did not experience a corresponding decline. This reflects the critical dependency of Bulgarian agricultural productivity on nitrogen inputs and the strategic choices made by farmers to prioritize yield upholding by transferring increased input costs to end products. Such resilience in input use underscores the importance of nitrogen in local production systems, where phosphate and potash application rates remain considerably lower, reflecting both regional agronomic practices and the economic efficiency of their use.

The recently introduced national measure for the period 2024–2027 to combat nitrate pollution represents a significant policy shift aimed at aligning national practices with EU sustainability frameworks, particularly the Farm to Fork strategy. The use of suggestive fertilizer application norms per crop, based on prior productivity data, is a continuation of past policy tools which have shown moderate success. However, for Bulgaria to meet its nitrogen reduction target of 20% by 2030 (relative to 2020 levels), more robust action is required. As of 2023, the reduction achieved stands at only 6%, with minimal change over the preceding two years, suggesting that progress has plateaued. Projections based on current trends indicate that the national target may only be reached by 2031 or 2032 unless further interventions are implemented. These must include farm-level incentives and tailored support measures that not only encourage participation but also drive behavioral change in fertilization practices. Ultimately, meeting the goals of the Farm to Fork strategy in Bulgaria will depend on the integration of technological, economic, and policy-driven instruments that ensure sustainable input use without jeopardizing competitiveness or productivity.

REFERENCES

1. Kagan, K.; Jonak, K.; Wolińska, A. The Impact of Reduced N Fertilization Rates According to the “Farm to Fork” Strategy on the Environment and Human Health. Appl. Sci. 14(22), 10726, 2024.
2. Purnhagen, K. P.; Clemens, S.; Eriksson, D.; Fresco, L. O.; Tosun, J.; Qaim, M.; Zilberman, D. Europe’s Farm to Fork Strategy and Its Commitment to Biotechnology and Organic Farming: Conflicting or Complementary Goals? *Trends Plant Sci.* 26(6), 600–606, 2021.
3. Schebesta, H.; Candel, J. J. Game-Changing Potential of the EU’s Farm to Fork Strategy. *Nat. Food*, 1(10), 586–588, 2020.
4. Wesseler, J. The EU's Farm-to-Fork Strategy: An Assessment from the Perspective of Agricultural Economics. *Appl. Econ. Perspect. Policy*, 44(4), 1826–1843, 2022.
5. Arndt, C.; Diao, X.; Dorosh, P.; Pauw, K.; Thurlow, J. The Ukraine War and Rising Commodity Prices: Implications for Developing Countries. Glob. *Food Sec.* 36, 100680, 2023.
6. dos Reis Martins, M.; Ammann, C.; Boos, C.; Calanca, P.; Kiese, R.; Wolf, B.; Keel, S. G. Reducing N Fertilization in the Framework of the European Farm to Fork Strategy under Global Change: Impacts on Yields, N_2O Emissions and N Leaching of Temperate Grasslands in the Alpine Region. *Agric. Syst*. 219, 104036, 2024.
7. Fiore, M.; Sauvée, L.; Wiśniewska-Paluszak, J. Opportunities and Challenges of EU Farm-to-Fork Strategy. Int. *Food Agribus. Manag.* Rev. 25(5), 703–707, 2022.
8. FAOSTAT Database. https://www.fao.org/faostat/en/#data (accessed 2025-08-11).
9. Leal Filho, W.; Fedoruk, M.; Paulino Pires Eustachio, J. H.; Barbir, J.; Lisovska, T.; Lingos, A.; Baars, C. How the War in Ukraine Affects Food Security. *Foods*, 12(21), 3996, 2023.
10. Pilvere, A.; Pilvere, I.; Upite, I.; Nipers, A. European Union Farm to Fork Strategy: Fertilizer Use Reduction Possibilities. *Int. Multidiscip. Sci. GeoConf. SGEM*, 5.1, 511–519, 2024.
11. Ordinance of the Ministry of Food and Agriculture of the Republic of Bulgaria, RD09-806 of 08.06.2024. https://www.mzh.government.bg/media/filer_public/2024/08/21/programa_2024-2027.pdf (accessed 2025-08-11).
12. Stoicea, P.; Dinu, T. A.; Tudor, V. C.; Gîdea, M.; Iorga, A. M.; Chiurciu, I. A.; Soare, E. The Impact of Implementing the Farm to Fork Strategy Regarding the Use of Fertilizers and Pesticides in the EU, 2022