Professional paper
Стручни рад
UDC 631.82:614.878.084
DOI 10.7251/AGREN1804309P

University of Banjaluka, Faculty of Agriculture
Agro-knowledge Journal

Agricultural Producers' Awareness about the Impact of Fertilizers Overuse on the Environment

Biljana Panin[1], Snežana Štrbac[1], Mira Pucarević[1], Nataša Stojić[1], Nataša Žugić Drakulić[1], Dunja Prokić[1]

[1]*EDUCONS University, Sremska Kamenica, Serbia*

Abstract

Overuse of fertilizers can have harmful effects on the environment. The Nitrates Directive aims to protect water quality by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. The paper is based on research about agricultural producers' awareness about the impact of fertilizers overuse on the environment. Data were collected by face to face interviews with farm owners on 39 farms in Serbia. Analysis of the collected data showed that all farmers use fertilizers. It is important to notice that 79.4% of farmers use chemical fertilizers more than recommended, and 87.1% use organic fertilizers more than recommended. Furthermore, 66.6% of farmers do not know specific harmful pollution effects of nitrates on soil and water. 71.7% of farmers have not heard about the Nitrates Directive. Therefore, it can be concluded that farmers are not sufficiently aware of fertilizers impact on the environment and it is necessary to provide education on this.

Key words: environment, fertilizer, awareness, agriculture, good agricultural practice, the Nitrate Directive

Introduction

Inefficient use of chemical fertilizers in agriculture causes a large number of environmental problems. Some of the problems caused by using fertilizers more than necessary can have an impact especially on water and soil pollution. The amount of nitrate may increase in drinking water and rivers as a result of high levels of nitrogen fertilizer use. The amount of phosphate may increase in drinking water and rivers as a result of the transport of phosphorous fertilizer in the surface flow (Savci, S., 2012).

Nitrate concentration in the surface water is normally low (0–18 mg/l). It can reach high levels as a result of agricultural runoff, refuse dump runoff or contamination with human or animal waste. The increasing use of artificial fertilizers, the disposal of waste (particularly from animal farming) and changes in land use are the main factors responsible for the progressive increase of nitrate levels in groundwater supplies.

In many European countries nitrate concentrations have gradually increased in the last few decades and have sometimes doubled over the past 20 years (WHO, 2011). The natural nitrate concentration in groundwater under aerobic conditions is a few milligrams per litre. It depends strongly on the type of soil and on the geological situation. As a result of agricultural activities, the nitrate concentration can easily reach several hundred milligrams per litre (WHO, 2011, WHO 1985).

The Nitrates Directive (1991) aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. The Nitrates Directive forms an integral part of the Water Framework Directive. It is one of the key instruments in the protection of waters against agricultural pressures (EU Commission). The directive involves: a) Monitoring water quality in relation to agriculture, b) Designation of Nitrate Vulnerable Zones, c) Establishment of (voluntary) codes of good agricultural practice and of (obligatory) measures to be implemented in action programmes for nitrate vulnerable zones (EU Commission). The Codes of Good Agricultural Practice include measures limiting the time when fertilisers can be applied on land in order to allow N availability only when the crop needs nutrients. These measures also limit the conditions for fertiliser application (EU Commission).

In the EU countries the total volume of nitrogen fertilizer consumption remained high in the 2006-2015 period, but it was significantly reduced in the 1990-2000 period (Eurostat).

This significant decrease in nitrogen fertilizer use is due to the introduction of the Nitrates Directive (ND) in 1991 and the introduction of the National Action programmes for designated Nitrate Vulnerable Zones (NVZs), and the Water Framework Directive (WFD) was introduced in 2000.

These developments contributed to the decrease in nitrogen mineral fertilizer consumption from 1990 to 2010 by 19 % (Eurostat). The total consumption of phosphorous decreased by 19 % from 2006 to 2015 (Eurostat). As Serbia is part of Europe and strives to become an EU member country, it would be extremely important for it to reduce fertilizers use and to make its farmers become more familiar with these important EU Directives.

Farmers make decisions based on utility maximization. Farmers' subjective assessments of agricultural technologies are also important in influencing their adoption behaviour (Zhou et al, 2010, Kivlin and Fliegel, 1967; Nowak, 1992). Level of education is one among the variables that plays a significant role in the development of the cognitive level of farmers about the use of fertilizers (Hameed, Sawicka, 2017). It is very important to educate farmers about the vital importance of fertilization which is based on adequate soil analysis (Sumelius et al, 2005).

The goal of this paper is to present data obtained from the research regarding Serbian agricultural producers' awareness about the impact of fertilizers overuse on the environment. The hypotheses of this research were as follows: a) farmers overuse mineral and organic fertilizers, b) farmers are not informed about the Nitrates Directive.

Material and Methods

The paper is based on the research about the agricultural producers' awareness regarding the impact of fertilizers overuse on the environment. This research was done for the purpose of the project ″Implementation of cross border joint actions toward environment protection in agriculture (IMPACT ENVI)". To analyse the farmers' awareness about fertilizers influence on the environment, 39 farms in Serbia were visited and the farm owners were interviewed. Data were collected from July to August 2017. The farms are located in the border areas of Serbia with Croatia (North Backa, West Backa, South Backa, Macva, and Srem).

Data were collected by face to face interviews. A questionnaire was prepared in advance. It had 90 questions, which were open-ended, closed-ended, and multiple choice types of questions. The data were analysed in MS Excel Programme by summarizing answers and calculating average means, and, also, by analysing descriptive answers.

Results and Discussion

The results of the empirical study will be presented in this section. Out of 39 farms that were visited in Serbia, 10% are in the North Backa district, 41% in the South Backa district, 23% in the West Backa district, 13% in Macva, and 13% in the Srem district. Their structure is as follows: 87% are family agricultural farms, 5% are agricultural holdings, and 8% are registered as other types of legal entities. 79% of interviewed farm owners are male and 21% are female.

Only 8% of the interviewed farmers obtained agricultural education at university and 33% from high school. The others do not have any agricultural education or they have ″family tradition″ experience. Such a high percentage of farmers without agricultural school education is significant, as, according to literature, education levels are linked with levels of environmental concern (Clery, Rhead, 2013). People with lower education have lower awareness about environmental problems and protection (Ostman, Parker, 1987).

Generally, in the Republic of Serbia 60% of managers of agricultural farms only have farming knowledge gained through experience, whereas 2.5% have an agricultural faculty degree (Official Gazette).

The 63% of the farms are mostly oriented towards animal production, while 35% mostly deal with plant production.

This research showed that all farmers use fertilizers. Furthermore, 79.79% of farmers use chemical fertilizers more than recommended (Figure 1).

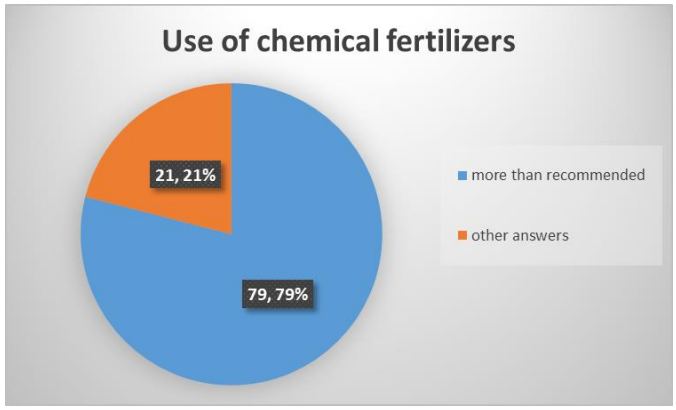

Figure 1. Use of chemical fertilizers

The 87.87% of farmers use organic fertilizers more than recommended (Figure 2).

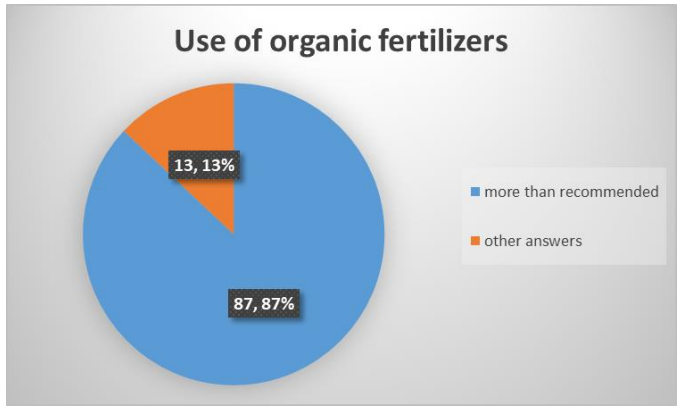

Figure 2. Use of organic fertilizers

As mentioned before, inefficient use of fertilizers can have harmful impacts on the environment, especially on soil and water. The farmers are not sufficiently aware which adverse effects could occur because of the overuse of fertilizers. 66.6% of farmers do not know specific harmful pollution effects of nitrates on soil and water. This could be linked with the level of agricultural education they have, as it is at a low level. Besides, one third of the sample do not consult agricultural advisory services. The farmers mostly use the following chemical fertilizers: KAN, AN, urea, and NPK 15:15:15. The 12.8% of farmers do not provide soil analysis. The others analyse soil, but more than half of them (59%) do that less than it is recommended. 35.9% of farmers have never done the Nmin analysis. The 71.7% of the interviewed farmers have never heard of the Nitrate Directive (Figure 3).

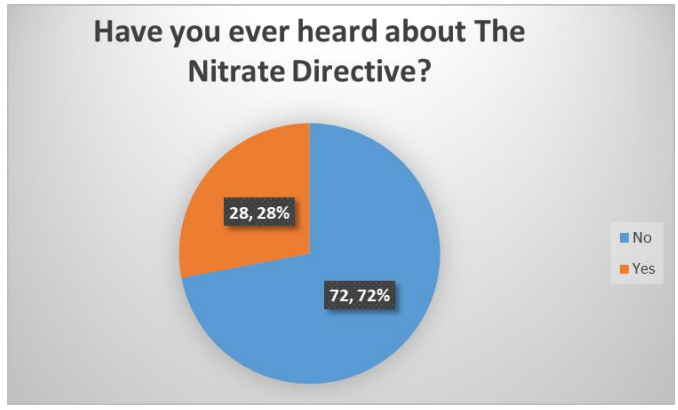

Figure 3. Knowledge about the Nitrate Directive

It is necessary to promote the Nitrate Directive more. It can be done by agricultural advisory services. As only two thirds of the sample consult advisory services, other promotional methods should be used as well.

Participatory training, demonstration of nutrient management planning software, on-farm water quality testing with mobile kit, accompanied by Web pages, demonstration videos, posters, leaflets, etc. have been shown to be powerful tools to demonstrate the link between water quality and agricultural practices (Znaor, 2011). Making policy makers and the public at large aware of costs and of potential savings by practising water friendly farming methods can foster the adoption of the EU Nitrate Directive (Znaor, 2011).

The awareness about the Nitrates Directive is in positive correlation with education level. The Pearson correlation coefficient has the value of 0.7749, which shows strong positive correlation. Besides, the awareness about negative impacts of higher concentration of nitrates in soil is also linked with the level of education. The Pearson correlation coefficient has the value of 0.8276, which shows strong positive correlation. Based on these results, it can be concluded that people with higher level of education are more informed about the Nitrates Directive and negative impacts of higher concentrations of nitrates in soil.

Conclusion

The results of this research show that agricultural producers in Serbia use both chemical and organic fertilizers more than recommended. Besides that, they are not sufficiently aware of the impact of fertilizers overuse on the environment. The reason for this could be a low level of farmers' agricultural education and information. Agricultural advisory services should reach more farmers and provide more information about harmful effects regarding fertilizers overuse on the environment.

Moreover, good agricultural practice should be promoted more. Farmers in Serbia are not sufficiently informed about the Nitrates Directive.

This directive should be presented to farmers by using different promotional tools.

Acknowledgment

This investigation has been financed under CBC IPA RS 182 Implementation of cross-border joint actions toward environment protection in agriculture (Acronym IMPACT-Envi).

References

Clery, E., Rhead, R. (2013): Education and attitudes towards the environment, Background paper prepared for the Education for All Global Monitoring Report 2013/4, UNESCO, http://unesdoc.unesco.org/images/0022/002259/225928E.pdf

Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources, Official Journal L 375 , 31/12/1991 P. 0001 – 0008, available online http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31991L0676

Hameed, T.S., Sawicka, B. (2017): Farmers' knowledge of fertilizers' practices on their farms, IX International Scientific Symposium "Farm Machinery and Processes Management in Sustainable Agriculture", Lublin, Poland, 2017, https://depot.ceon.pl/bitstream/handle/123456789/14827/FMPMSA2017_119Hameed%20%20Talal_Sawicka.pdf?sequence=1&isAllowed=y

Eurostat statistics (2018). http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_mineral_fertiliser_consumption

FAO (2018). http://www.fao.org

Kivlin, J.E., Fliegel, F.C., 1967. Differential perceptions of innovations and rate of adoption. *Rural Sociology*, 32: 78-91.

Nowak, P., 1992. Why farmers adopt production technology. *Journal of Soil and Water Conservation*, 47: 14-16.

Ostman, R., Parker, J. (1987): Impact of Education, Age, Newspapers, and Television on Environmental Knowledge, Concerns, and Behaviors, *The Journal of Environmental Education*, 19(1): 3-9.

Savci, S. (2012): Investigation of Effect of Chemical Fertilizers on Environment, Conference: International Conference on Environmental Science and Development (ICESD 2012), 5-7 January 2012, Hong Kong At: Hong Kong, available online https://www.researchgate.net/publication/271211981_Investigation_of_Effect_of_Chemical_Fertilizers_on_Environment

Strategy of agriculture and rural development of Republic of Serbia for period 2014-2024, Official Gazette 85/2014.

Sumelius, J., Mesic, M., Grgic, Z., Kisic, I., Franic, R. (2005): Marginal abatement costs for reducing leaching of nitrates in Croatian agriculture, *Agricultural and Food Science*, 14: 293-309.

World Health Organization (2011): Nitrate and Nitrite in Drinking-water Background document for development of WHO Guidelines for Drinking-water Quality, available https://www.who.int/water_sanitation_health/dwq/chemicals/nitratenitrite2ndadd.pdf

Zhou, Y., Yang, H., Mosler, H.J., Abbaspour, J. (2010): Factors affecting farmers' decisions on fertilizer use: A case study for the Chaobai watershed in Northern China, *The Journal of Sustainable Development*, 4(1): 80–102.

Znaor, D., Karyotis, T. (2011): Capacity building and public awareness raising on Nitrates Directive in the countries aspiring to EU accession. In: Karyotis, T.; Gabriels, D. and Noulas, C. (Eds.) Proceedings of the 6th International Congress of the European Society for Soil Conservation "Innovative Strategies and Policies for Soil Conservation", National Agricultural Research Foundation, Athens, pp. 172-173.

Перцепција пољопривредних произвођача о утицају претјераног кориштења ђубрива на животну средину

Биљана Панин[1], Снежана Штрбац[1], Мира Пуцаревић[1], Наташа Стојић[1], Наташа Жугић Дракулић[1], Дуња Прокић[1]

[1]*EDUCONS Универзитет, Сремска Каменица, Србија*

Сажетак

Претјерана употреба ђубрива може имати штетан утицај на животну средину. Директива о нитратима има за циљ заштиту квалитета воде, спријечавањем загађења подземних и површинских вода нитратима из пољопривредне производње, као и промовисањем употребе добрих пољопривредних пракси. Рад се заснива на истраживању познавања пољопривредних произвођача о утицају прекомјерне употребе ђубрива на животну средину. Подаци су прикупљени путем директних интервјуа са власницима фарми на 39 фарми у Србији. Анализа прикупљених података показала је да сви пољопривредници користе ђубрива. Важно је примјетити да 79,4% пољопривредника користи хемијска ђубрива, а 87,1% користи органска ђубрива у количини већој од препоручене. Такође, 66,6% пољопривредника не познаје специфичне штетне ефекте загађивања тла и воде нитратима. 71,7% пољопривредника није чуло за Директиву о нитратима. Стога, може се закључити да пољопривредници нису довољно упознати са утицајем ђубрива на животну средину, због чега је неопходно обезбједити њихову едукацију у овој области.

Кључне ријечи: животна средина, ђубриво, перцепција, пољопривреда, добра пољопривредна пракса, Директива о нитратима

Biljana Panin
E–mail*: biljana.panin@yahoo.com*

Received: February 28, 2018
Accepted: January 19, 2019