THE INFLUENCE OF AGRICULTURAL ACTIVITIES ON THE QUALITY OF GROUNDWATER IN MEHEDINTI COUNTY

Virginia-Simona MARIAN (ILIE) [1], Laura ȘMULEAC [2], Cristina TULBURE [2]
[1]"Tudor Vladimirescu" Technological High School Șimian
[2]Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara
Corresponding author: laurasmuleac@usab-tm.ro

Abstract. *Groundwater accounts for 97% of the world's freshwater resources, with the exception of glaciers and ice caps, making it the world's largest supplier of freshwater. The other 3% is represented by lakes, rivers, swamps, ie surface waters, and soil moisture. The notion of groundwater must thus be seen as a valuable resource for the environment, not only as a source of drinking water supply, thus imposing the protection of groundwater, being particularly important for the environment. The case study presented in this paper, has as main objective of the research, the monitoring of quality parameters regarding groundwater in the southwest of the country, respectively Devesel commune and Chilia village, belonging to Devesel commune. The water samples used in this case study were taken from the wells of these two rural areas, from Mehedinți county, Devesel commune and Chilia village, belonging to Devesel commune. In zone 1 D (Devesel commune) we took water samples from the wells of 4 families, having a well in the yard, a clayey area (which we noted well 1, 2, 3, 4), located at a distance of about 200 meters and water samples from 4 fountains, located outside the courtyards of the inhabitants of Devesel commune, located at a distance of 1km from each other, (which we noted fountain 5, 6, 7, 8). In area 2 C (Chilia village) we took water samples from 4 wells located outside the people's yards. Two of the fountains are at a distance of about 200 meters and we noted fountain 1 and fountain 2. And we also took two water samples from two fountains located along the road, which we noted well 3 and well 4, the distance between the two wells being about 300 meters. For the analysis of the water in the wells, the following quality parameters were observed: nitrogen ion content, nitrite ion content, phosphate ion content, ion content ammonium, chloride content, iron content, manganese content, sodium content, potassium content, chemical oxidability expressed by CCO-Mn, pH, hardness. The quality parameters we followed were analyzed, according to standardized methods.*

Keywords: *groundwater quality, rural wells, water samples, quality parameters, groundwater quality in rural areas.*

INTRODUCTION

Although groundwater is regarded only as a source of water supply, it is necessary to protect it, being particularly important for the environment. Groundwater also plays an important role in the hydrological circuit, being essential for the preservation of wetlands and overflow into rivers, functioning as a buffer zone during dry days (FOSTER et all. 2002, LATO et all. 2013).

Increasing the urban population, developing industries, creating of the irrigation systems for agricultural lands have led to an accelerated rise in water demand and consumption, both from surface sources and from underground sources. At present, water sources are relatively well known, both quantitatively and qualitatively, while underground water resources, although locally were studied and detailed, have not been evaluated as a water balance based on hydrogeological potential determination of the basin. Underground water has a large share, but it must be taken into account, that the more we exploit this water category, the more we will impoverish the future water reserves. Because groundwater flows slowly through the basement, the impact of human activities can affect them for a long time. This means that pollution that occurred decades ago – either in agriculture, or in industry or other human activities - can still threaten water quality today or in some cases will continue to do so for some future

generations. Agricultural activities can cause serious diffuse water pollution problems due to nutrient losses (nitrogen and phosphorus) to surface water and/or underground waters. The main effect of nitrate pollution of groundwater is represented by the decrease of water potability. In Romania, the percentage of the population using drinking water the water from the free groundwater aquifer (water from wells) as a source of drinking water is significant (LI et all. 2018, MĂLĂESCU et all. 2019).

Regarding the surveillance and control activity of groundwater pollution, as well as the restoration of their quality, one may notice that this activity is a difficult one, in relation to that of the surface waters, because they are considered "enigmatic resources" (TAFT et all, 2016, RUNKEL et all. 2016). This enigmatic feature leads to the impossibility of their location and the correct identification of the pollution, as well as the damages caused by the pollution, leading to a lack of awareness and/or risks determination (ȘMULEAC et all. 2017, POPA et all, 2016).

Through the research perspective of the present work, the fundamental principle of the Framework Directive for water, obtaining the "good status" regarding the groundwater in Mehedinti county, is pursued.

As a result of the arguments made regarding the importance of groundwater quality, the study of the research presented in the paper has as main objective the supervision of the parameters of groundwater quality in Mehedinti County, namely Devesel commune and Chilia village, belonging to the commune Devesel.

MATHERIAL AND METHODS

Mehedinți County, located in the southwestern part of Romania, comprises a territory of 4,900 km2. representing approx. 2.1% of the country's surface.

The water samples used in this case study were taken from two rural areas, from Mehedinți county, Devesel commune and Chilia village, belonging to Devesel commune (figure 1).

The locations of the wells in Devesel commune

The locations of the wells in Chilia village

Fig. 1. Location of the wells

In zone 1 D (Devesel commune) we took water samples from the wells of 4 families, having a well in the yard, a clayey area (which we noted well 1, 2, 3, 4), located at a distance of about 200 meters and water samples from 4 wells, located outside the courtyards of the

inhabitants of Devesel commune, located at a distance of 1km from each other, which I noted:

- ✓ fountain 5 to the hill, Devesel commune cemetery - northern part; sandy area;
- ✓ fountain 6 located in the middle of the village, clayey area;
- ✓ fountain 7 located at the edge of the village, to the east, to the communal dispensary;
- ✓ fountain 8 located at the exit from Devesel commune, towards Jiana commune - southern part, clayey area.

In area 2 C (Chilia village) we took water samples from 4 wells located outside the people's yards. Two of the fountains are at a distance of about 200 meters and we noted fountain 1 and fountain 2. And we also took two water samples from two wells located along the road, which we noted :

- ✓ fountain 3, at the edge of Devesel Commune, on the main road to Chilia, west side, sandy area.
- ✓ and fountain 4, also on the edge of Devesel Commune, on the main road to Chilia.

The distance between the two fountains is about 300 meters. The quality parameters we followed were analyzed, according to standardized methods.

The way of collecting the water samples as a result of the specifics of the water source, regarding the case study carried out in Devesel commune, was done as follows:

- ✓ from the wells with the bucket, the collection was done by inserting the bucket 10-30 cm below the water mirror, then we poured water into the collection bottle.

The following methods of analysis were used to determine the quality parameters of groundwater: determination of water pH; determination of water hardness; determination of chlorides in water; determination of organic substances (oxidability by CCO-Mn); sodium determination; determination of potassium; determination of phosphates; determination of ammonia; determination of nitrates; nitrogen determination; determination of iron; determination of manganese.

RESULTS AND DISCUSSIONS

According to the graphic representations, regarding the quality parameters of the groundwater samples from the rural environment in zone 1 D (Devesel commune), it is found that in no well the maximum allowed concentration of nitrate, nitrite and ammonium is exceeded. In all wells the concentrations of phosphate, potassium, iron, manganese, chloride and sodium ions do not exceed the CMA. There are also no exceedances of the CCO-Mn value, and the pH is within the limits allowed in all 10 wells (figures 2-11).

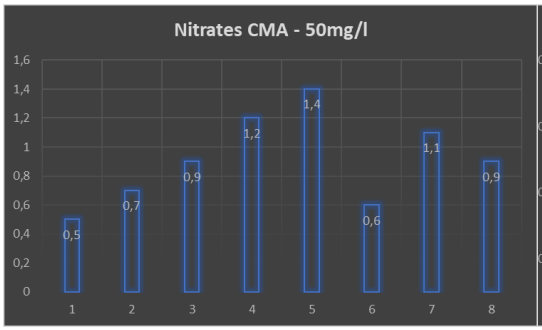

Fig. 2. Values of nitrates in Devesel comune

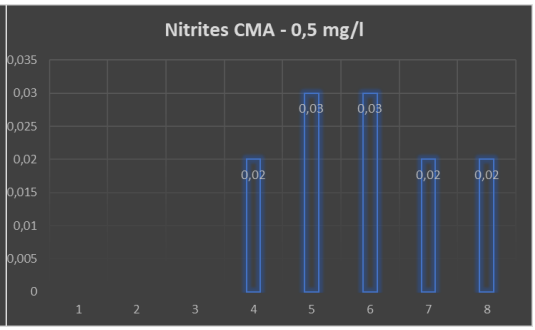

Fig. 3. Values of nitrites in Devesel comune

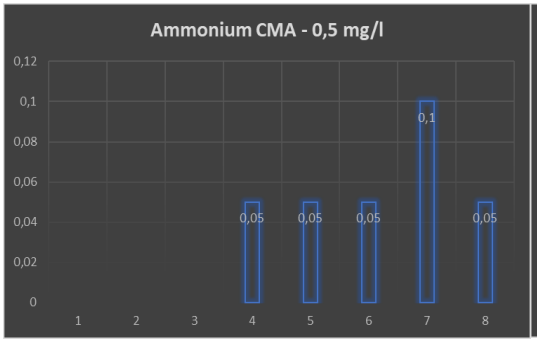

Fig. 4. Values of ammonium in Devesel comune

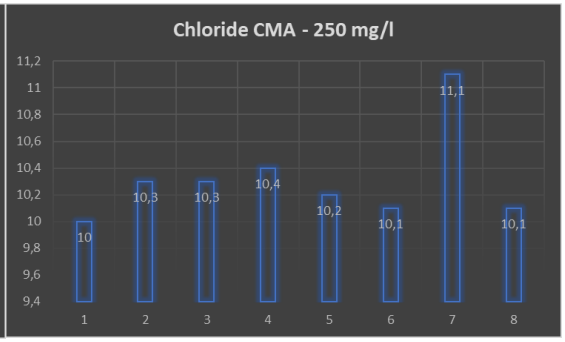

Fig. 5. Values of choride in Devesel comune

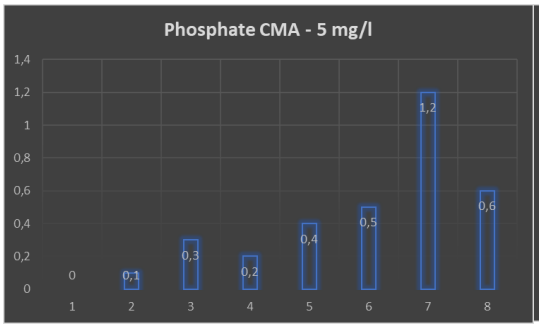

Fig. 6. Values of phosphate in Devesel comune

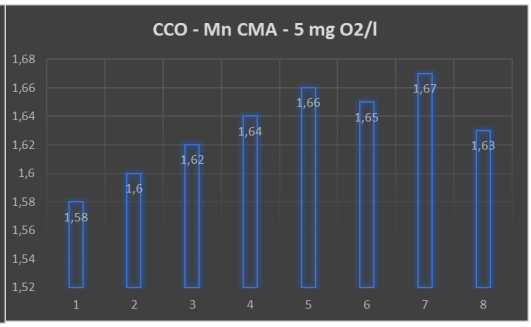

Fig. 7. Values of CCO - Mn in Devesel comune

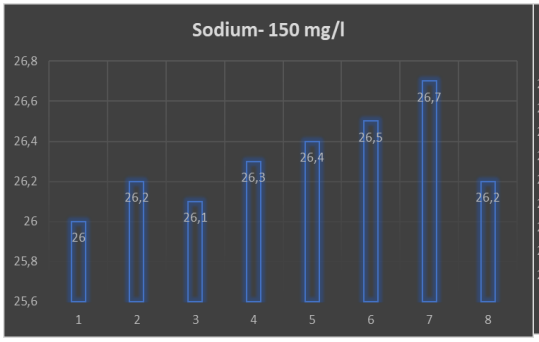

Fig. 8. Values of Sodium in Devesel comune

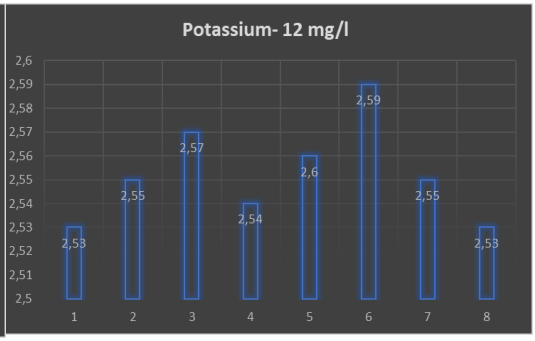

Fig. 9. Values of Potassium in Devesel comune

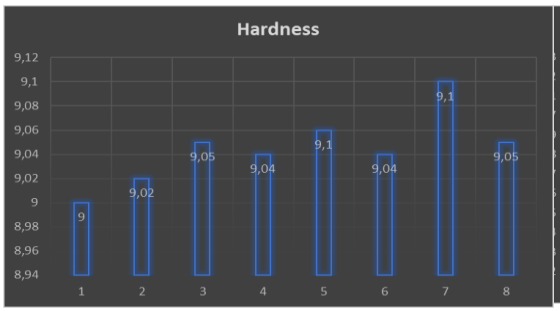

Fig. 10. Values of Hardness in Devesel comune

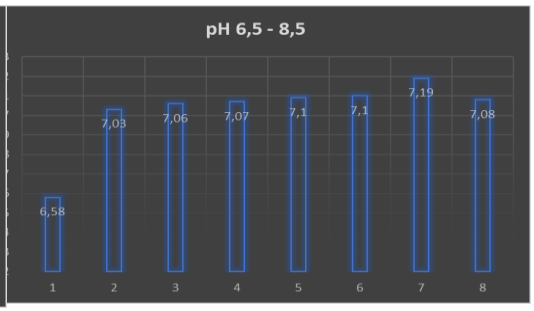

Fig. 11. Values of pH in Devesel comune

It is further observed that following the sampling in area 2 C (Chilia village): in wells no. 3 and 4 the nitrate concentration exceeds the maximum allowed limit; the concentration in wells 3 and 4 of nitrite is exceeded; In wells 3 and 4 the chlorides exceed the CMA; there is thus the possibility of water pollution with animal manure; The CMA for phosphate, manganese and sodium ions is not exceeded in any of the wells analyzed; in wells no. 3 and 4 the concentration of ammonium ion exceeds the allowed limit; the iron ion concentration exceeds the limit allowed in wells no. 3 and 4; in wells 3 and 4, the CCO-Mn value exceeds the allowed limit; The pH is within the limits allowed in all 4 wells; in wells 1 and 2, the concentration of potassium ion is within the permissible limits; at wells 3 and 4, the maximum permissible concentration is exceeded (figures 12 - 21).

We consider that the waters from the analyzed wells whose values for chemical oxidability and ammonium ion concentration exceed the maximum allowed concentration are polluted due to infiltrations of animal manure, most likely due to the existence at some point of a cattle breeding complex in the area.

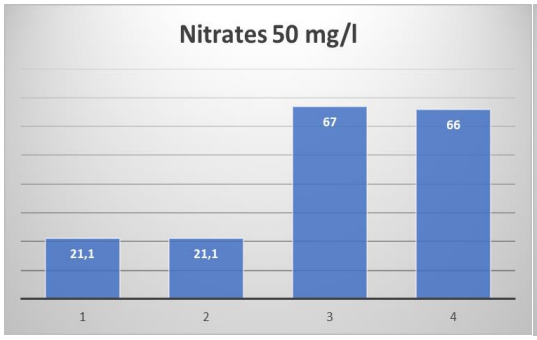

Fig. 12. Values of nitrates in Chilia village

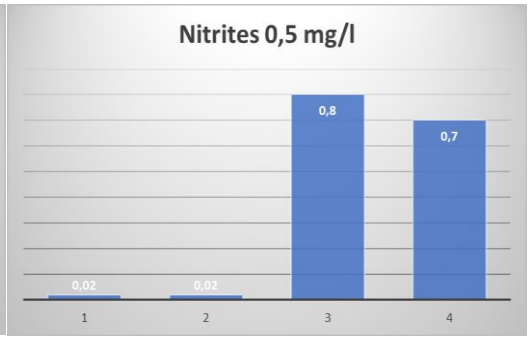

Fig. 13. Values of nitrites in Chilia village

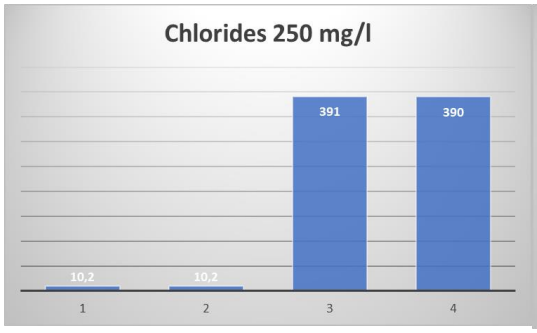

Fig. 14. Values of chlorides in Chilia village

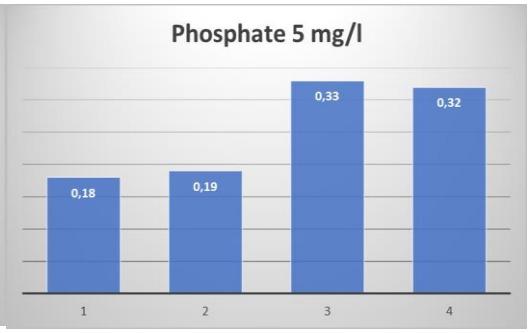

Fig. 15. Values of phosphates in Chilia village

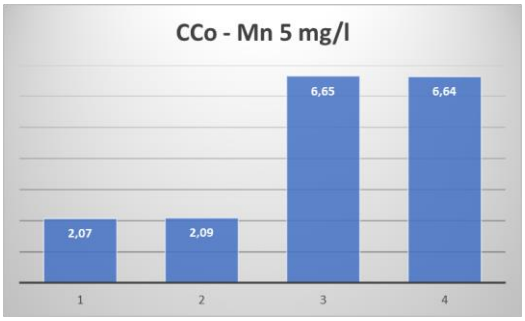

Fig. 16. Values of CCo-Mn in Chilia village

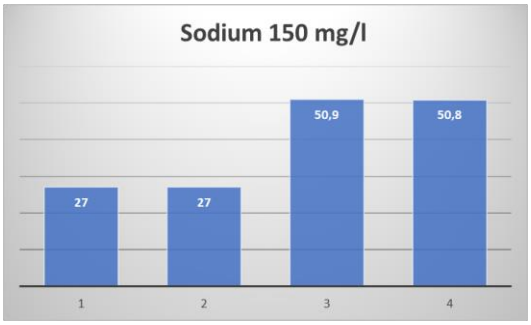

Fig. 17. Values of sodium in Chilia village

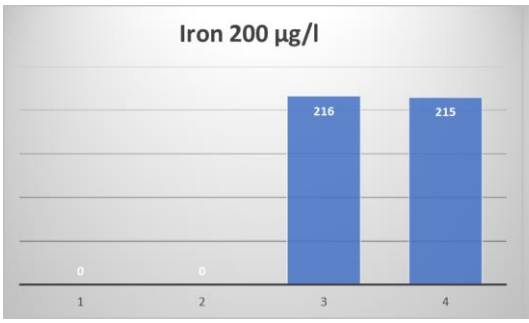

Fig. 18. Values of iron in Chilia village

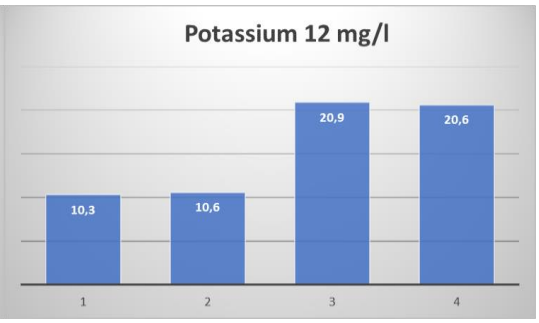

Fig. 19. Values of potassium in Chilia village

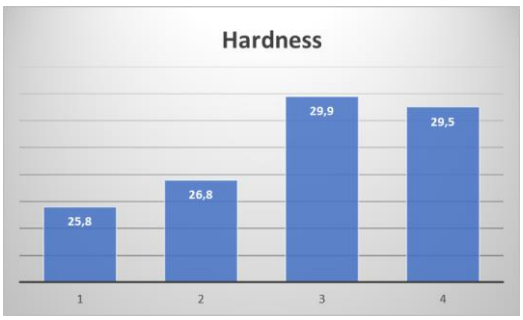

Fig. 20. Values of hardness in Chilia village

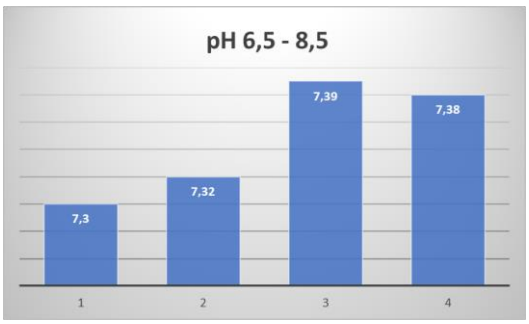

Fig. 21. Values of potassium in Chilia village

CONCLUSIONS

In the case study performed, experimental data are reported on the monitoring of certain quality parameters of groundwater in rural areas. The sampling of water used in the study was done in two rural areas, from wells, respectively zone 1D (Devesel commune) and zone 2C (Chilia village, belonging to Devesel commune).

In zone 1D we did not find exceedances regarding the maximum allowed concentrations, at the parameters observed at the wells in the area.

In zone 2C we found exceedances regarding the maximum allowed concentrations for nitrate, nitrite, ammonium, chloride, CCO-Mn, potassium and iron in wells 3 and 4.

The wells where we found exceeding the maximum allowable shrinkage for chemical oxidability, ammonium ion concentration, nitrates, nitrates are polluted as a result of

infiltrations resulting from animal manure. This is due to the fact that in the area where exceedances of the monitored parameters were recorded, there was a Cattle Fattening Complex. It is no longer functional, but the effects are felt years away. The most affected are the fountains located along the road (fountain number 3 and 4).

Another finding in zone 2C is that the waters from the wells monitored are very hard, with a hardness higher than 20 ° G.

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