THE IMPACT OF AGRICULTURAL ACTIVITIES ON WATER QUALITY IN OBREJA COMMUNE, CARAŞ-SEVERIN COUNTY

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Abstract. *Water is an essential element for life on earth and measures to prevent pollution must be a priority. Sources of pollution can be systematized or unsystematized that produce pollution through the uncontrolled introduction of substances into the waters: seasonal sources without sewage; discarded waste without proper storage; pesticides, fertilizers from agriculture. In this paper, the impact of agriculture in Obreja and the neighboring communes is investigated, given that the basic occupation of the inhabitants was and remains agriculture and animal husbandry. In order to determine the water quality in the Obreja commune area, the following harvesting points have been established: 1 Bistra River, 2. Obreja Fountain, 3. Obreja Basin, 4. Iaz Basin and 5. Basin Var. Indicators followed in this paper are: pH, Oxidation, Ammonium, Nitrates, Nitrites, Iron, Chlorine, Total hardness, Number of Coliform Bacteria, Calcium and Magnesium content. 10 water samples were analyzed, collected from 3 localities: Obreja, Iaz and Var in the period 2020-2021. The results obtained by analyzing the water samples in the laboratory revealed that: the nutrient content include water within the second class of quality for the Bistra River, which is due to the agricultural activities in the area; in most areas of collecting the maximum accepted iron limit is exceeded; at some collecting points there are increases above the maximum permissible hardness limit; all the microbiological indicators analyzed were within the limits established by law.*

Keywords*: water quality, agriculture impact, pH, oxygen regime, nutrient regime*

INTRODUCTION

Life without water does not exist, starting from this premise we must be aware of the problems that water pollution can generate. Water resources prone to pollution are: surface waters (rivers, rivers, lakes, etc.) and groundwater (aquifer layers, springs, etc.). There are two categories of pollution sources: *systematized sources* that produce pollution following the evacuation of substances into waters through installations intended for this purpose, such as sewerage, discharges from industries or livestock farmers, etc., *unsystematized sources* that cause pollution through uncontrolled ingress of substances into water: seasonal sources without sewage; waste thrown away without proper storage; pesticides, fertilizers from agriculture.

An important source of water contamination is the landfills or of various solid residues, placed on the ground, under the open sky, in unreasonably located and organized dumps. Contamination from these deposits may be produced by direct entrainment of residues in the flowing waters by precipitation or by waters which drain, by infiltration, into the soil (Gurung, 2022).

Particularly serious can be the cases of contamination caused by the salt dumps located in the major riverbeds of the watercourses and driven by their floods. The most widespread landfills of this kind are those of city garbage and industrial solid waste, especially ashes from coal-burning thermal power plants, various metallurgical, sterile slags from mining preparations, sawdust and wood waste from sawmills, etc (Matthews et all., 2022).

Also, deposits of sludge from sugar factories, chlorosodium substances or other chemical industries, as well as those from wastewater treatment plants, can be classified in the same category of contaminant sources. Sources of accidental pollution can also be mentioned, but they are mostly related to industrial risk problems.

Some of the most common water pollutants, both surface and underground, are nitrates. Nitrates, along with nitrites, are some natural components of the soil that come from the mineralization of nitrogenous organic substances of vegetal and animal origin, under the action of microorganisms existing in the soil, being sources of increasing the vegetal production in agriculture (Radulov, 2016). Part of nitrates and nitrites is absorbed by the roots of plants and serves as a raw material for the synthesis of proteins and other nitrogen compounds, and another part is driven by surface waters or those that infiltrate the soil, causing water pollution (Smuleac et all. 2014, 2019).

The following measures are proposed to reduce water pollution by substances used in agriculture: the first option of reducing pollution is to improve water purification methods; the second variant refers to: avoiding the use of some products, the correct storage and use of various chemicals to reduce the level of water pollution; practicing the rotation of agricultural crops, which reduces the amount of chemical fertilizers used (Evans et all., 2019, Li et all. 2020). Also in agriculture it is advisable to reduce the use of chemical fertilizers, by replacing them with natural fertilizers; reducing the intensity of the phenomenon of eutrophication by phosphates or organic nutrients. Avoiding the elimination of fermentation liquids from animal manure (urine, feces) or from the fermentation of stored feed because, they determine the increase of the eutrophication phenomenon. Moreover, these fermentation liquids can be used in a "constructive" sense, that is, by converting them into unconventional energy sources (modern biotechnologies).

MATERIAL AND METHODS

The research was carried out in Obreja commune, consists of the villages Obreja, Ciuta, Iaz and Var, is located in the north-east of Caras-Severin county, at a distance of 9 km from Caransebes on DN 68, on the lower course of Bistra Valley (figure 1). From the administrative point of view, the commune includes the villages Obreja - the commune residence with a population of 1727 inhabitants, Iaz village - a locality belonging to a population of 748 inhabitants, Var village - a locality belonging to a population of 429 inhabitants, Ciuta village - a locality belonging to a population of 348 inhabitants. The total common inhabitants is 3252. The basic occupation of the inhabitants was and remains agriculture and animal husbandry (Table 1).

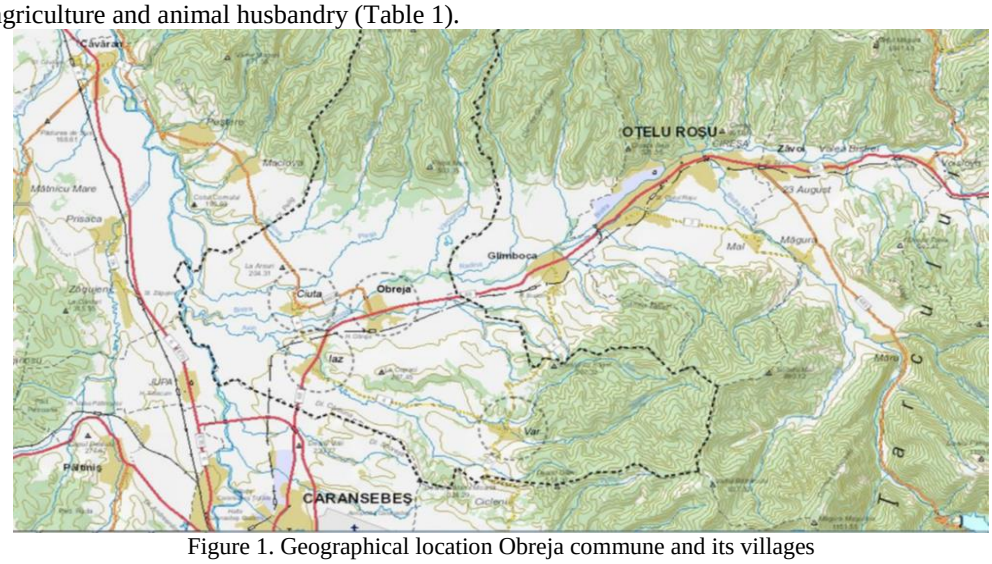

Figure 1. Geographical location Obreja commune and its villages

Table 1.

Main indicators of agricultural activities

Agricultural area by way of use	Unit of measurement	No
-arable area	ha	1 389
-the area of orchards and agricultural nurseries	ha	329
-the area of pastures	ha	2 765
-grassland surface	ha	1131
-the area under wheat and rye	ha	225
-total wheat and rye production	tons	590
-the area under maize	ha	600
-total maize production	tons	1730
-area under potato cultivation	ha	100
-total potato production	tons	1100
-the area under vegetable cultivation	ha	90
-total production of vegetables	tons	1 324
-total fruit production	tons	671
-cattle	heads	1 470
-swine	heads	530
-sheep	heads	7 150
-birds	heads	12000
-meat production	tons	348
-cow's milk production	hl	18381
-wool production	kg	14000
-egg production	pcs.	960

In the area of Obreja commune, there are 2 departments of mechanization of agriculture, belonging to AGROMEC Caransebeș. Animal husbandry was carried out in the private sector in households. In the northern part of the village in the immediate vicinity of Agromec, there is the phytosanitary section. Obreja is located in terms of agricultural production in the grain-meat area. Forestry – Within the area of Obreja commune, there are 5 876 ha of forest.

The wood processing units were set up in the private sector, by placing sawmills in the livestock farms, by refunctioning the existing stables. Also in the area of the village there is a carpentry workshop, mechanical workshop, grain grinding mill, bakeries. In the area of the C.F.R. station there is a grain warehouse. Bordering the Obreja-Ciuta county road is an O.G.A. canton.

In order to determine the water quality in the Obreja commune area, the following harvesting points have been established: 1 Bistra River, 2. Obreja Fountain, 3. Basin Obreja, 4. Basin Iaz and 5. Basin Var.

The indicators followed in the present paper are: pH, Oxidation, Ammonium, Nitrates, Nitrites, iron, Chlorine, Total hardness, Number of coliforms, calcium and magnesium content. There were analyzed 10 water samples, collected from 3 localities: Obreja, Iaz and Var (figure 1). The analyses were carried out by the Laboratory for monitoring the quality of drinking water within the Public Health Directorate of Caras-Severin County, and the results were interpreted and compared with the main parameters of physico-chemical quality indicators, from Law 458 of 2002 republished in 2011 on the quality of drinking water.

RESULTS AND DISCUSSIONS

From the analysis of the water quality in relation to the general indicators, in the period January – December 2020 on the **Bistra River** downstream of Oţelu-Roşu it was determined that the flow varies between 4.93 and 17.5 cubic meters/s, with an average of 8.2 cubic meters/s. The pH of the water is 6.8-7.9, with an average of 7.4 which places the water as neutral. Dissolved oxygen is between 6.93 and 11.4 mg/l, with an average of 8.76 mg/l – quality class I also resulting from Biochemical oxygen demand (BOD) of 1.74 mg/l and Chemical oxygen demand (DOC) of 2.81 mg/l. In terms of ammonium nutrient regime is 0.21 mg/l, nitrite content – 0.009 mg/l, nitrates – 1.02 mg/l, organic nitrogen 0.79 mg/l and total nitrogen 2.04 mg/l, orthophosphates 0.04 mg/l and phosphates 0.079 mg/l which includes water in class II quality. For general salinity ions (Cl, Ca, Mg, Na, Fe, Mn, Ba) water is in class I of quality.

At **the collecting point Fountain Obreja** in 2020 it resulted that: there are no exceedances of the concentration of nitrites, nitrates and ammonium; the pH is within the limits allowed by law (7,34); the Total Iron CMA is exceeded (267 µg/l), and for all other quality indicators analyzed are within the limits established by law. The microbiological analysis showed that no bacteria and other biological indicators are found in the water sample.

At the **Obreja Basin** location in 2020 there are no exceedances of the concentration of nitrites, nitrates and ammonium; the pH is within the limits allowed by law (7.31); the CMA for Total Iron (250 µg/l) is exceeded, and for all the other quality indicators analyzed are within the limits established by law. The microbiological analysis showed that no bacteria and other biological indicators are found in the water sample.

For 20202, at the collection point **Iaz Basin,** the pH is within the limits allowed by law (7.34); there are no exceedances of the concentration of nitrites, nitrates and ammonium; the CMA for Total Iron (25 5 µg/l) is exceeded, and for all other analyzed quality indicators are within the limits established by law. The microbiological analysis showed that no bacteria and other biological indicators are found in the water sample.

The same conclusions resulted for **the Var Basin** for 2020: there are no exceedances of the concentration of nitrites, nitrates and ammonium; the pH is within the limits allowed by law (7.25); the CMA for Total Iron (271 µg/l) is exceeded, and for all the other quality indicators analyzed are within the limits established by law. The microbiological analysis showed that no bacteria and other biological indicators are found in the water sample.

After analyzing the samples taken from the **Bistra River** in 2021, it was determined that the pH of the water is 6.9-7.5, with an average of 7.2 which places the water as neutral. Dissolved oxygen is between 7.02 and 1 2.3 mg/l, with an average of 9.02 mg/l – quality class I also resulting from Biochemical oxygen demand (BOD) of 1.85 mg/l and Chemical oxygen demand (COD) of 2.73 mg/l. As regards the regime of ammonium nutrients is 0.11 mg/l,

content of nitrites - 0,01 mg/l, nitrates - 1,1 mg/l, organic nitrogen 0,81 mg/l and total nitrogen 2,15 mg/l, orthophosphates 0,06 mg/l and phosphates 0,082 mg/l, which are under quality class II for water. For general salinity ion parameters (Cl, Ca, Mg, Na, Fe, Mn, Ba) the water is in class I quality.

In 2021, following the sample collected from **the Obreja fountain**, it resulted that there are no exceedances of the concentration of nitrites, nitrates and ammonium; the pH is within the limits allowed by law (7.56 units. pH); the CMA for Total Iron (309 µg/l) and free residual chlorine (1.3 mg/l) is exceeded; all other quality indicators analyzed are within the limits established by law.

For **the Obreja Basin** harvesting point in 2021, it resulted that there are no exceedances of the concentration of nitrites, nitrates and ammonium; the pH is within the limits allowed by law (7.0 1); the Total Iron CMA is exceeded (370 µg/l), and for all other quality indicators analyzed are within the limits established by law.

At **Iaz Basin**, Iaz locality, Obreja Commune in 2021 revealed that there are no exceedances of the concentration of nitrites, nitrates and ammonium; the pH is within the limits allowed by law (7.09 unit pH); the CMA for total iron (641 µg/l) and hardness (8.36 German degrees) is exceeded. all other quality indicators analyzed are within the limits established by law.

For **The Var Basin**, Var locality, Obreja Commune in 2021 revealed that there are no exceedances of the concentration of nitrites, nitrates and ammonium; the pH is within the limits allowed by law (7.64 unit pH); the CMA for Total Iron (114 µg/l) and Hardness (8.4 German degrees) is exceeded . All the other quality indicators analyzed are within the limits established by law.

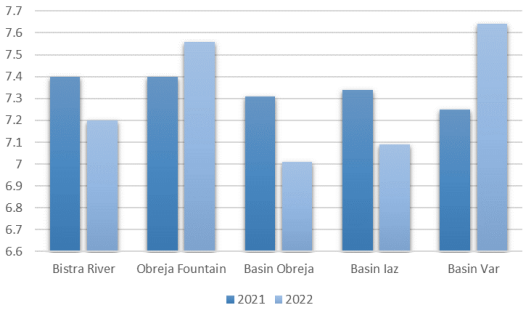

Figure 2. Evolution of pH

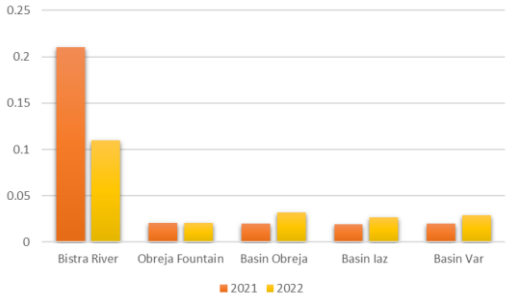

Figure 3. Content of amonium (mg/l)

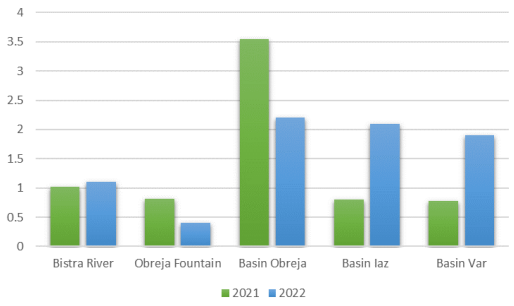

Figure 4. Content of nitrates (mg/l)

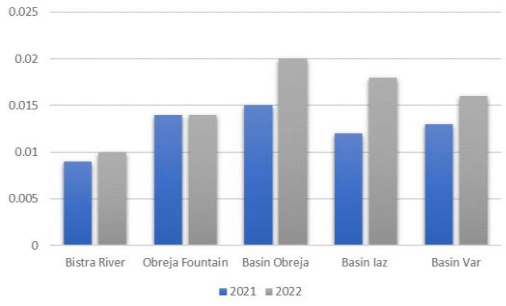

Figure 5. Content of nitrites (mg/l)

Microbiological analysis at all harvesting points showed that no bacteria and other biological indicators are found in the water sample.

CONCLUSIONS

The present work follows the quality of water in Obreja commune, Caras-Severin County during 2020-2021 and the impact of agriculture on it. In order to determine the water quality in the Obreja commune area, the following harvesting points have been established: 1 Bistra River, 2. Obreja Fountain, 3. Obreja Basin, 4. Iaz Basin and 5. Var Basin. From the multitude of physical, chemical and biological characteristics that can be established by laboratory analysis, a limited number was practically used, indicators considered more significant: pH, Oxidation, Ammonium, Nitrates, Nitrites, iron, Chlorine, Total hardness, Number of coliform bacteria, calcium and magnesium content. There were analyzed 10 water samples, collected from 3 localities.

The results obtained by analyzing water samples in the laboratory revealed that:

- The nutrient content falls into the second quality class for the Bistra River, which is due to agricultural activities in the area.
- in most collecting areas the maximum accepted iron limit is exceeded;
- at some collecting point are increases above the maximum permissible limit for hardness.
- all microbiological indicators analyzed are within the limits established by law

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