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MONITORING AND ESTIMATION OF BUNA RIVER WATER QUALITY USED FOR IRRIGATION AND ITS IMPACT ON THE SOIL

Përmbledhje: Lumi i Bunës është një lum me impakt të konsiderueshëm në bujqësi. Ky studim synon që krahas monitorimit dhe vlerësimit të cilësisë së ujit të Lumit Buna që përdoret për ujitje në bujqësi, gjithashtu të vlerësojë edhe impaktin që ai ka në tokat bujqësore. Studimi është kryer në vitet 2005–2008 në tokat dhe mostrat e ujit në zonën e Olikës, Dajçit, Urra e Baçallëkut dhe Bushat. Nëpërmjet një proçesi të monitorimit analitik të mostrave, qëllimi i këtij studimi ka qënë vlerësimi i parametrave optimale të nevojshëm për cilësinë e ujit që përdoret për ujitje si dhe impaktit të makro dhe mikroelemetëve, që depozitohen në tokat bujqësore që mund të shëfrytëzohen nga bimët në zonat e ujitura me ujin e Lumit Buna.

Fjalë kyç: *parametra, ushqyes, ujitje, prodhimi bujqësor*

Abstract: Buna River is of a considerable impact in agriculture. This paper aims to both supervise and estimate the water quality of Buna River used for irrigation purposes and the impact it has on soil. The period covering the years 2005–2008 marks the monitoring process of the indices in water and soil samples in Oblik, Dajç, Ura e Bacallëkut and Bushat. Through an analytic monitoring process of samples, the purpose of our study is to assess optimal parameters in useful to evaluation of quality of irrigation water, and the impact on the macro and microelements available for plants in the irrigated land.

Key words: *parameters, nutrient, irrigation, agricultural production*

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INTRODUCTION

The hydrographic system of „Shkodra Lake – Drini River – Buna River" collects the waters of sub-basin with a total surface of 19.582 km^2. This surface of a high and sharp mountainous relief characterized by an intensive rainfall and a particular litologic construction, mainly of penetrable carbonates formations is distinguished from a high potential and variable water quality characteristics.

The *Bojana* or *Buna*, is a 41 km long river in Albania and Montenegro flowing into the Adriatic Sea. (Banja, 1984). Buna is one of the biggest and most important rivers of the Mediterranean basin. (Pano & Abdyli, 2002) Regarding to the position and its characteristics, the Buna River has always been part of agricultural and environmental strategies of Albania. The river in the hydrological map of the Republic of Albania is one of 6 bazens reservoir of our country DNCW No. 5 dated 22. 12. 1998, amended by DNCW No. 5 dated 16. 04. 2004. Under irrigation, soil and water compatibility is very important. If they are not compatible, the applied irrigation water could have an adverse effect on the chemical and physical properties of the soil. A basic understanding of soil/water/plant interactions would help irrigators to efficiently manage their crops, soils, irrigation systems and water supplies.

MATERIALS AND METHODS

The monitoring process of Buna river and land surrounded has been carried out for 4 years (2005–2008) in the middle valley where this water is been used for irrigation of agriculture land. The water and soil sampling locations were Oblik, Dajç, Ura e Baçallëkut and Bushat. Water and soil sampling were monitored from2005 to 2008.

The soil samples testing were implemented according to ISO 10381–1993 method standard. For parameter measures we have used contemporary determination methods such as: spectrometric method, Atomic Absorption Spectroscopy (ASS) and interfrequently classical standard methods of analysis. Determination of effective cathions exchange, capacity and base saturation level is been done using barium chloride solution (ISO 11260–94). The water quality sampling was implementing according to ISO 5667–3: 200.3

Investigated Area

Albania has a Mediterranean climate with the coastal plains faced to hot and dry summers, and frequent thunderstorms during the autumn and winter.

RESULTS AND DISCUSSION

The water and soils samples were analyzed to determinate various parameters. Samples of waters have different pH amount, varying from 7.4 to 7.7. Lowest value was 7.4 in the M_2 Dajç (2005–2008), whereas highest pH value was 7.7 in M_1 Oblik (2005–2008). The average electrical conductivity of the river irrigation water range from 0.326 to 0.469 dSm^{-1} (Table 1). All the water samples were found non-saline and will not contribute any harmful effect to agricultural land and crop. (Hameed *et*

Figure 1: Buna River (Google Earth Map)

Figure 2: View of Buna River

al., 1966) stated that waters having electrical conductivity of 1.5 dSm^{-1} were safe for irrigation, those having 1.5 to 3.0 dSm^{-1} were marginal and waters having EC values more than 3.0 dSm^{-1} were unsafe.

In 2006, the values of dry residue varied 0.16 g/L (M_1 Oblik) in 2005 to 0.258 g/L (M^3 Ura e Baçallëkut).

Sodium concentration in water (Chart 1, 2, 3) has been in M_2-Dajç 0.18 mg/L (2005–2008) and in M_1-Oblik 0.2 mg/L (2005–2008). The mean value it has been 0.19

Table 1. Physic parameters of water samples

Years				2005			2006			2007			2008		
Parameters	Symbol	Unit	Limits	M1	M2	M3	M1	M2	M3	M1	M2	M3	M1	M2	M3
Conductivity	ECW	ds/m	0–3	0.330	0.364	0.326	0.469	0.364	0.445	0.39	0.370	0.386	0.390	0.384	0.326
Acidity	pH	- log [H^+]	6.0–8.5	7.7	7.4	7.5	7.7	7.4	7.5	7.7	7.4	7.5	7.7	7.4	7.5

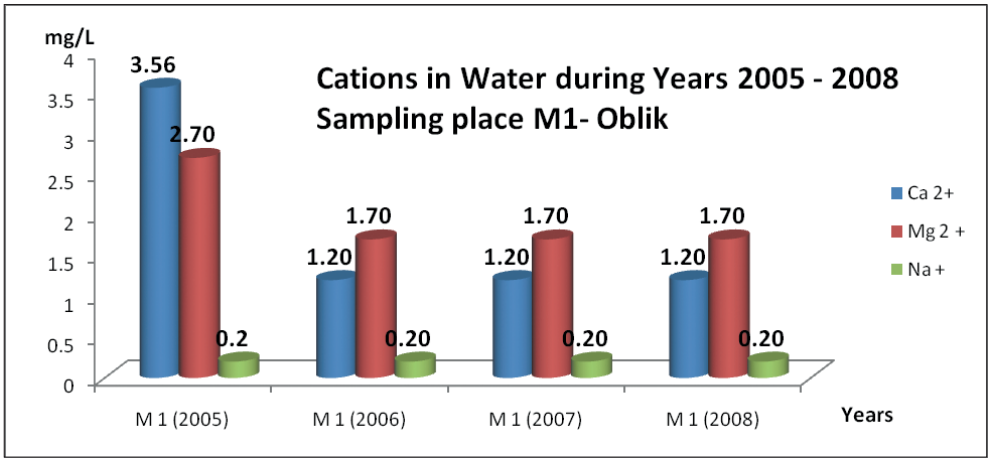

Chart 1 Calcium, Magnesium and Sodium concentrations in M_1-Oblik

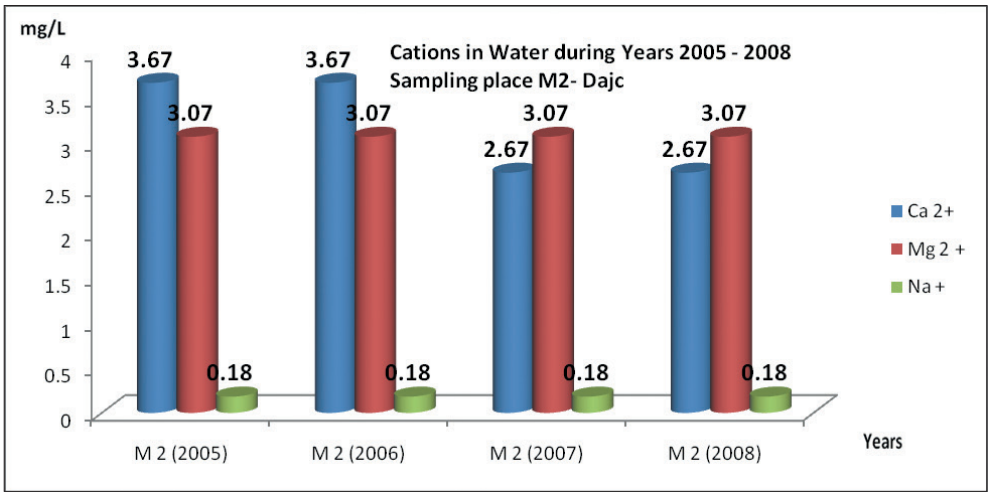

Chart 2 Calcium, Magnesium and Sodium concentrations in M_2-Dajç

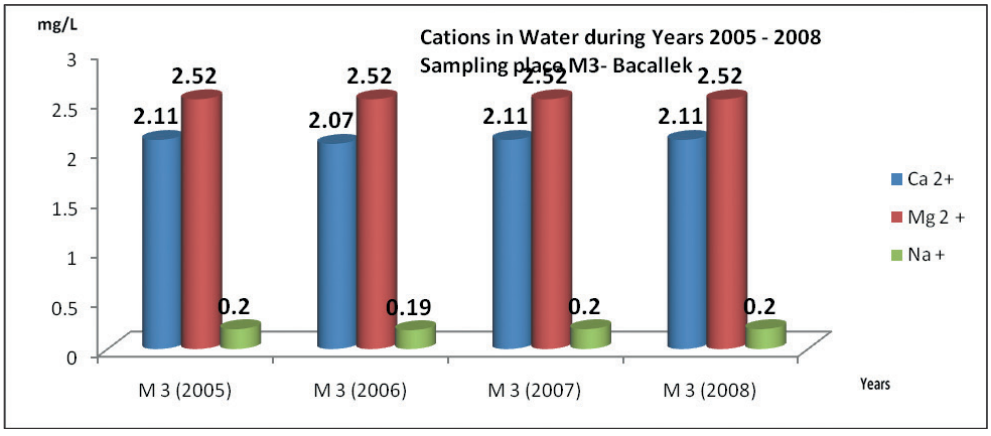

Chart 3 Calcium, Magnesium and Sodium concentrations in M_3-Ura e Baçallëkut

mg/L. *Calcium concentration* in water (Chart 1, 2, 3) of River Buna it has been from 1.20 mg/L to 3.67 mg/L. The lowest value 1.2 mg/L has been in M_1 Oblik (2008), whereas the highest value 3.67 mg/L has been measured at M_2 Dajç (2005 & 2006). The mean value has been 2.34 mg/L. *Magnesium concentration* in water (Chart 1, 2, 3) has been from 1.7 to 3.07 mg/L. Lowest value 1.7 mg/L has been in M_1 Oblik (2006–2008), whereas the highest value 2.07 mg/L has been measured at M_2 Dajç (2005–2008). The mean value has been 2.5. Medium to high levels of sodium in water with low levels of calcium and magnesium can result in toxicity of some sensitive plants such as fruit trees and woody ornamentals. Annual crops are usually not affected except for sodium's affect on salinity and sodium build up in soil.

Anions concentration

Levels of anions in water (Chart 4, 5, 6) are determined: The concentration of sulfate ions in water was in high levels, such as 10.9 m. e/L in M_2 in Dajç (2005) and lowest was 1.63 m. e/L in M_3 Ura e Baçallëkut (2005). Concentration of hydrogen carbonate ions, in water was high 2.97 m. e/L in M^3 Ura e Baçallëkut (2005) and lowest was 1.05 m. e/L in the M_1 Oblik (2005). Concentration of carbonate ions in water are calculated to be in high levels, such as 0.8 m. e/L in M_1 Oblik (2005) and lower 0.02 m. e/L) in M_3 Ura e Baçallëkut (2005). Concentration of chlorine ions in water was higher (0.89 m. e/L) in M_2 Dajç (2005–2006) and lower (0.2 m. e / L) in the M_1 Oblik (2006–2008).

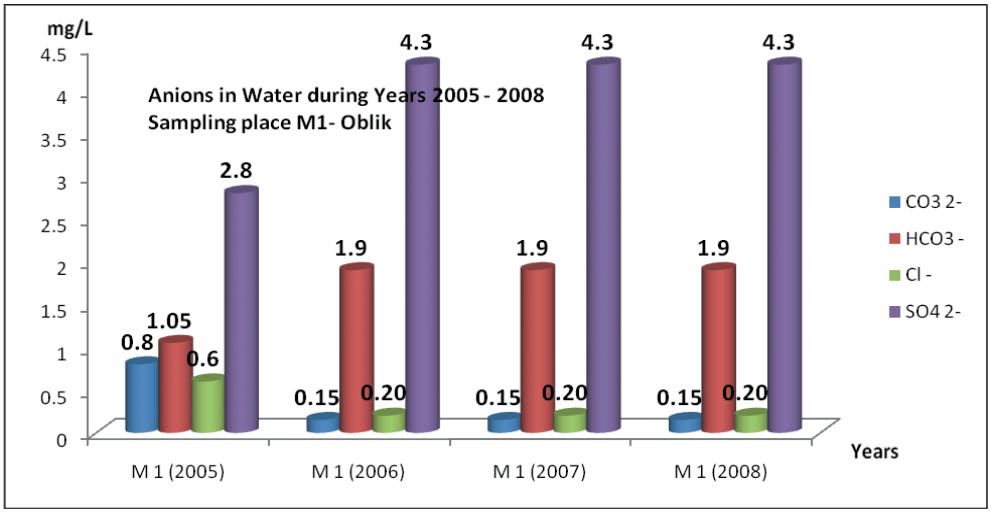

Chart 4. Anions concentration M_1 Oblik

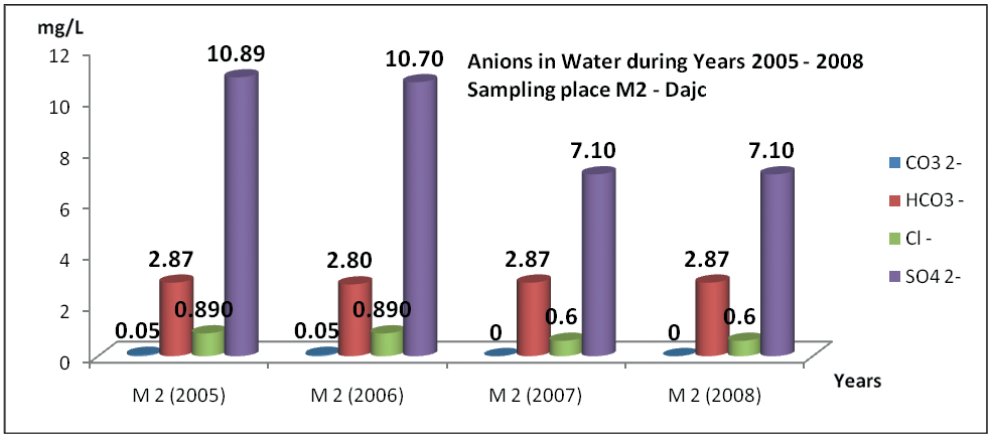

Chart 5. Anions concentration M_2 Dajç

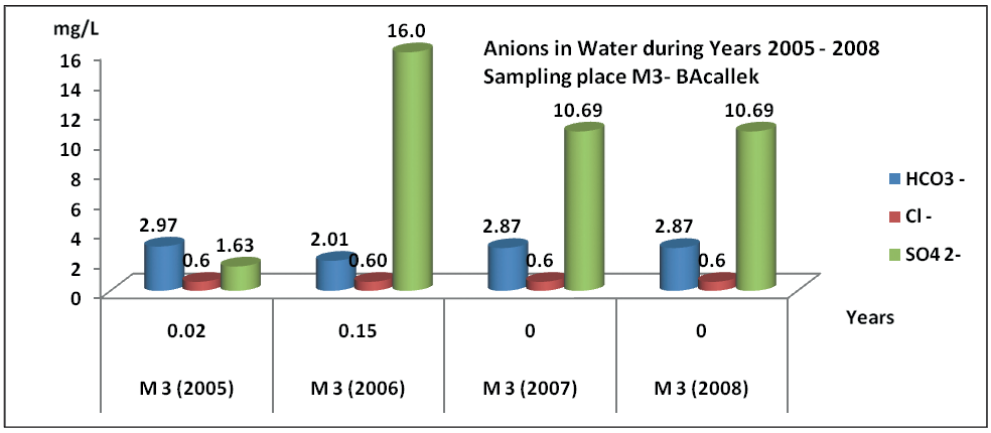

Chart 6. Anions concentration M_3 (Ura e Baçallëkut)

Nutrient elements

Levels of nourishing elements (Chart 7) in generally were low, for NO_3^--N (the average is 2.12 mg/L), for N – $NH\,4^+$ (the average is 2.74 mg/L), PO_4^{3-} (0.63 mg/L) and K^+ (the average is 1.96 mg/L). Concentration of potassium ions in water, in different samples analysis were calculaded to be in high levels 3.8 & 3.17 mg/L (over the standards) such as in M_1 Oblik (2005, 2007 & 2008). Regarding to the phosphates concentration, they were calculaded to be near the standard limits.

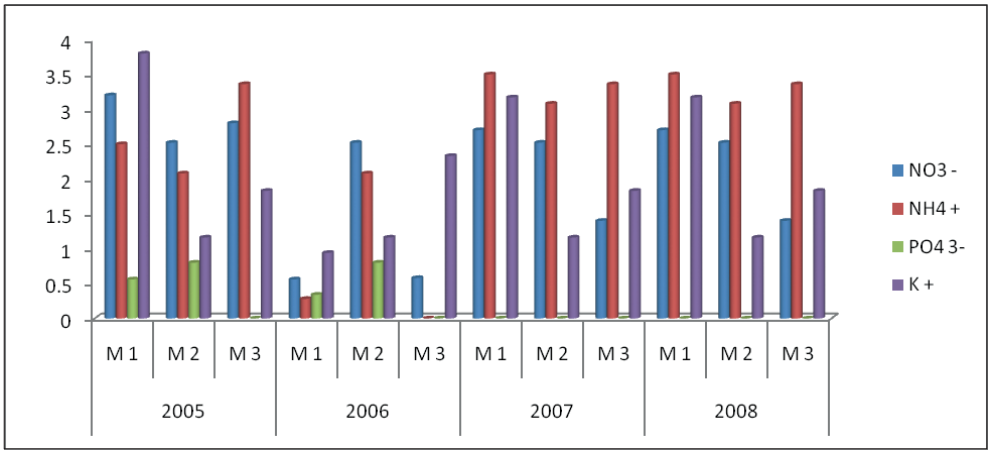

Chart 7. Nutrient levels in Buna river waters covering the years 2005–2008 (mg/L)

Results in the soil samples

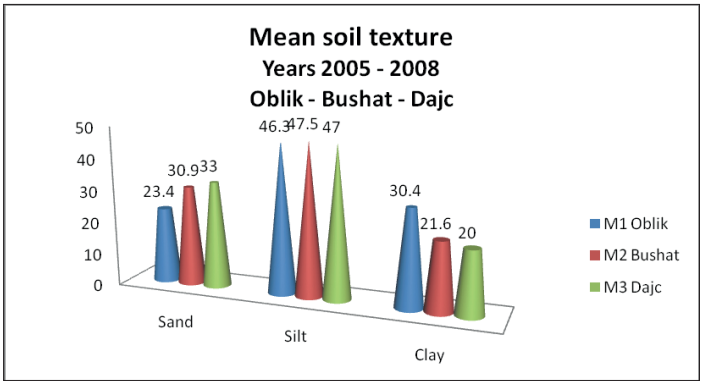

Chart 8. Soil Texture

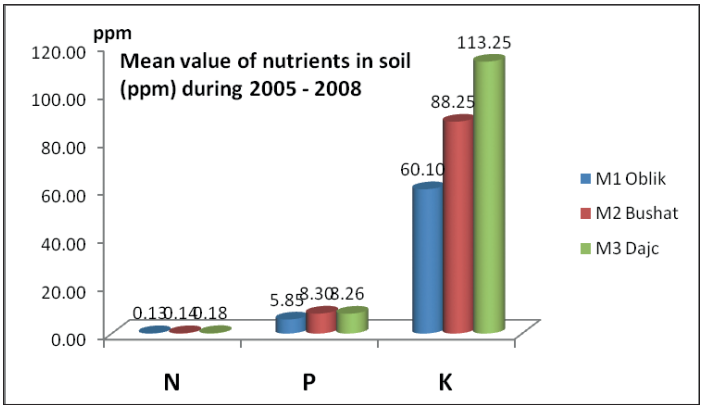

Chart 9. Mean value of nutrients in soil (2005–2008)

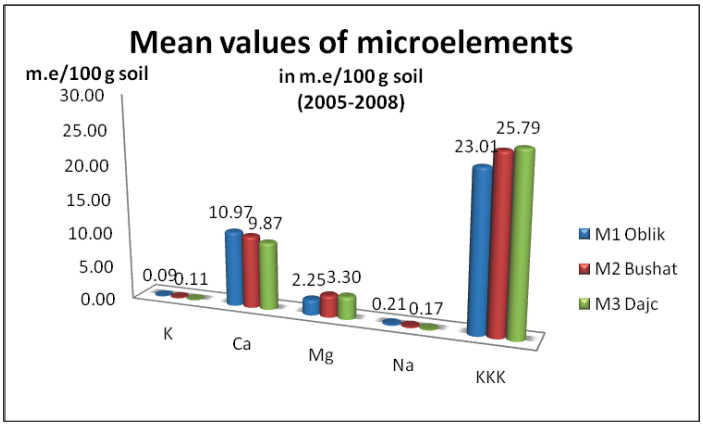

Chart 10. Microelements in the soil in mg/kg

CONCLUSIONS

The aim of the study was to determine the impact of irrigating water on the soils in the area near the Buna River. Referring to different guides (Ayres *et al*., 1976) and standards of FAO, EU and the U. S., (Ayers *et al*., 1994) we are able to determine not only the (physical/chemical) water conditions and its impact on land, but also to recommend the required plants that can be grown in those characteristized soils (Follett, 1999).

Analysis performed (texture) in our land have resulted relatively light silt-sand soil (Chart 8), so they can support calculated pH values. In accordance with the cations capacity, they result in sodium tendency. In general these soils have deficiency in nourishing elements (Chart 9). Sulfate in water exists as negatively charged ions. It contributes to the total salt contents. The highest level is calculated in the Bacallek (16 m. e/L) in 2006.

According to water analysis, the pH has been relatively neutrals with acid trend. The maximal value is 7.7.

A nutrient level of water in the Buna in the three places of the samples, in years (2005–2008) has „bad" or „very bad" status according to the NIVA classification (Bratli, 2000).

The recommended required plants that could be grown in these characteristiced soils will be according to the state of EC (ds/m) (Bauder, 2007) 0.95–1.9 so in water or soil salinity rating „Low" and „Moderately sensitive crops".

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