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Evaluation of Irrigation Water Quality in the Central Albanian Regions of Kavaja and Kruja

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Abstract
The purpose of the study was the monitoring of water quality (water resources) used for irrigation in the regions of Kavaja and Kruja. The study was carried out during 2009-2010. The samples were collected over a two-week period (1 June - 31 August) and were analyzed according to USEPA methodology at Institute of Earth Studies, Tirana. The samples were analyzed in terms of parameters such as pH, t ºC, TDS, EC, chemical parameters Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}, Cl^{-}, $CO_3^{2-,}$ HCO_3^{-}, SO_4^{2-}, nutritional elements $N\text{-}NO_3$, $N\text{-}NH_4$, and $PO_4\text{-}P$. The results have indicated a relatively high content of ions Na^{+} and Cl^{-} in the water resources in the region of Kavaja (Qeret area) that might lead to toxicity for the sensitive plants and contents within the limits as determined by Albanian Standard Catalogue and FAO, 1989 in the region of Kruja. Based on the findings obtained the water resources analyzed are classified under 2nd class [1]. The continuous monitoring of water resources is indispensable as a result of the proliferation of pollution from industrial and agricultural activities and the discharge of urban waste in these regions.

Keywords: Monitoring, water quality, water irrigation

I. Introduction

Albania is situated in the south-western part of the Balkan Peninsula enjoying wide exposures to the Adriatic and Ionian seas. The entire length of the border is in the region of 1094 km with 657 km being of land borderline and the remaining 316 km in sea border. The effective average annual temperatures fluctuate between 7,5°C in the north and 17-18°C in the south (Riviera). The absolute maximum temperatures waver on average from - 2°C to - 3°C up to - 25.8°C in Sheqeras, (Korça district)[2]. Albania is rich in waters and boasts roughly 49.000 km of hydraulic networkwhich combined discharge a total of average annual precipitations of 41 km^3 water into the sea. Albania is also under the possession of a number of artificial lakes such as Shkodra, Ohrid, Prespa, etc., which are regarded to be a very important water reserve. A significant part of several rivers such as Shkumbini and Fani are polluted due to industrial discharges [3]. A good part of the river is used for irrigation purposes in agriculture. Thus its treatment prior to agricultural uses should be a permanent objective to be fulfilled. The evaluation of the water qualities that is being used for irrigation of various agricultural crops is based on the criteria of salinity and toxicity of chemical elements [4],[5],[6]. The soluble salts (TSS), are yet another criterion to be considered when evaluating the quality of water used for irrigation. The salts influence the plant well-being by mounting the osmotic pressure of water, making the plant suffer in relation to absorption of water from the soil [7]. The salt concentrations with off-limits contents might be able to influence, prevent, and stunt the plant development. [8].

II. Material and method

The evaluation of water quality has been conducted on waters used for irrigating areas in Kavaja and Kruja (total area equal to 25000 acres). The evaluation of water quality has been done for the water resources covering the entire area. This study was conducted over the period 2009-2010. The sampling was done during the irrigation period (from 1-30th of August, every two weeks). The sampling was done based the same method as applied by US Environmental Protection Agency(USEPA) [9]. The analysis of elements was made possible in the laboratory at Institute of Soil Survey, Fushe-Kruje. The elements being subject to analysis include a variety of them from pH, dry status, CE (electrical conductivity), SAR (sodium adsorption ratio), Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, CO_3^{2+}, HCO_3^{-} $N\text{-}NO_3$, P, K, Cl-, and SO_4^{2-}. In order to carry out a final analysis of the water quality that are used for irrigation, the findings for each water resource are compared against the criteria as set out in the Albanian Standard Catalogue 2 [10], the classification norms of Norwegian Institute for Water Research (NIVAS)[1]and the Food and Agriculture Organizationof the United Nations (FAO) [11].

III. Results and discussion

The results that were produced from the analysis of the data indicate that there is a high quality in the water resources that are utilized for irrigation of agricultural crops in the area (citrus, seed-bearing plants, nut trees, vines, maize, peas, carrots, clover, onion, spinach, tomatoes and alfalfa). In all of the water resources analyzed CE is under the limit when matched and compared against the norms as defined by ASC(Albanian Catalogue Standarts) and FAO 1989 (3ds/m) and that does not precipitate issues in the salinity of soils, which falls short of impacting the crop yield in the area. The water resources analyzed in general appear to be poor in salts (Table 1) and do not cause any problems in the salinity of soils. The low values of Ca^{2+}, Mg^{2+} and Na^{+} observed in the study (within the norms established by ASC. The impoverishment in salts makes these waters attain corrosive traits because in the majority of cases they secure the calcium from the top ground layer of the soil by damaging in so doing the soil structure and by creating a crust embedding the surface area. In the case of cultivation of various crops this phenomenon is a real problem because the forming of the soil crust keeps the seeds from sprouting by reducing the propagation rate of the crops. The water resources analyzed do not create toxicity issues because the toxic contents of the soil prove to be within the norms as defined by FAO 1989 for the irrigation waters. The high content of ions NO_3-N in the pumping station of the Nikel area (5.9 mg/l) and Budull (5.5 mg/l) will have to be taken into consideration when calculating the nitrogen fertilization balance. The results have demonstrated a high content of bicarbonates in all of the water resources being the focus of the study and in particular in Vorioni (3.5 mg/l), Bilaj (4.5 mg/l) and Rinas (max= 4.7 mg/l). The irrigation of the crops based on the rain method (if applicable) with these waters, influences the reduction of the commercial value of crops in the area. .

Table1.Biannual average results of water resources that serve as irrigation in the Krujaregion

Natural Resources	ECW (ds/m)	Ca^{2+} (me/l)	Mg^{2+} (me/l)	Na^{+} (me/l)	CO_3^{2-} (me/l)	HCO_3^{-} (me/l)	Cl^{-} (me/l)	SO_4^{2-} (me/l)	NO_3-N (mg/l)	NH_4-N	P-PO_4 (mg/l)	K^{+}(mg/l)	pH (-log H^{+})	(SAR) (me/l)
Tapize	0.4	2.3	3.4	0.5	0.3	2	0.6	0.2	1.5	0.5	1.2	0.1	7.1	0.3
Gjole	0.5	2.4	3.2	1.1	0.4	2.5	0.7	0.3	1.75	1.5	0.8	0.2	7.0	0.6
Rinas	1.0	3.8	5.85	1.2	0.3	4.7	1.0	0.35	1.8	1.5	10.5	1.2	7.2	0.6
Nikel	0.5	2.0	2.7	0.5	0.2	1.8	0.6	0.2	5.9	14	8.6	0.8	7.3	0.4
Budull	0.6	1.8	2.6	0.8	0.15	2.8	1.0	0.2	5.5	1.9	13	1.1	7.2	0.5
Bilaj	0.8	2.2	4.2	1.3	0.5	4.5	0.7	0.25	1.2	2.1	6	0.9	7.2	0.7
Vorioni	0.5	2.0	3.9	0.7	0.1	3.5	0.4	0.25	1.05	0.5	6.01	0.9	7.2	0.3

The water resources of Kavaja area in general prove to have a much higher content in terms of the indicators analyzed as opposed to those of Kruja. The high content in salts in these waters triggers light salinity problems that run to average in the areas irrigated from the water resources of Stryme Channel, Karpen, Harizaj. That proves to be even more dangerous for areas of Qerretit and Hidrovor. The water resources of Bedenit and Ballaj (from the analysis of indicators) fail to produce any salinity issues, but the water resources of Ballaj might be able to create problems up the average because of infiltration. The high content in sodium ions in the Qerreti reservoir (65 mg/l), and in Hidrovor (41 mg/l), might be enough to cause toxicity problems. Toxicity might increase (specifically in the sensitive plants) in the case of water utilization by the rain-like method, as a consequence of the high content of Sodium and Chlorine ions (Qerret 70 mg/l).

The waters in Kavaja area are characterized in general by the high content of ions Mg^{2+}. The high content to be seen in the Stryme Channel (7.8 mg/l), in the Beden reservoir (8.5 mg/l) and in the Qerret area (30 mg/l), are likely to prevent the absorption of calcium from the plants. The relatively high content of carbonates and bio-carbonates (max 7.5 mg/l, Hidrovori), Harizaj (7.1 mg/l), leads to the creation of crust in soils, the destruction of the soil structure and influences negatively the value of crops in the area. The low content of sodium and chlorine,within the limits as defined by the State Standard Catalogue (with the exception of Qerret and Hidrovor) are not known to cause any toxicity problems in the crops cultivated in the area.

Table 2. Biannual average results of water resources that serve as irrigation in the Kavajaregion

Natural resources	ECW (ds/m)	Ca^{2+} (me/l)	Mg^{2+} (me/l)	Na^{+} (me/l)	CO_3^{2-} (me/l)	HCO_3^{-} (me/l)	Cl^{-} (me/l)	SO_4^{2-} (me/l)	NO_3-N (mg/l)	NH_4-N	P-PO_4 (mg/l)	K^{+}(mg/l)	pH (-log H^{+})	(SAR) (me/l)
K. Strymes	1.05	3.0	7.8	2.5	1.5	5.2	1.5	0.3	2.9	1.4	1	0.5	7.2	1
Re. Beden	1.00	1.49	8.5	3.9	1.2	2.9	2.2	0.31	1.7	1.0	4.9	0.1	7.1	2.0
Po.Qerretit	1.3	8.99	30	65	1.2	6.79	70	18.2	6.3	3.5	23.9	2.2	7.1	14
Sta.Ballaj	0.4	1.94	3.3	0.34	1.3	2.19	0.19	0.1	3.75	3.6	0.4	0.5	7.2	0.4
Karpen	1.5	3.2	8.7	8.4	1.3	6.55	2.3	1.41	1.75	1.3	0.4	0.5	7.2	3.4
Hidrovori	5.3	3.2	18.5	41.0	1.6	7.5	35	0.7	1.75	1.3	0.5	10.7	7.0	12.8
Po. Harizaj	1.0	2.5	8.9	1.0	0.9	7.04	1.2	1.4	1.7	1.2	0.8	0.2	7.1	0.4

Based on the criteria as defined in the State Standard Catalogue (SSC) and in the NIVAS classification (Bratli et al., 2001), the waters contained in water resources of the area as analyzed in here fall under the second category (2^{nd} class). Since these waters find themselves under the direct impact of the waste discharges (because of the population migration shifts) the evaluation of such waters should persistently carry on into the future

IV. Conclusions

Based on the results achieved in the evaluation of the quality of the irrigation waters in Kavaja and Kruja area set against the norms as defined in the State Standard Catalogue, the irrigation waters falls under the second class (2^{nd} Class). The waters analyzed in Kruja area appear to be poor in salts, do not create any salinity or toxicity issues, and are very likely to create light infiltration water by reducing its speed.

The water resources of Kavaja area appear to be richer in salts and might create salinity issues in soils (Qerretit and Hidrovor areas). The utilization for irrigation purposes of the waters in Beden reservoir, Karpen pumping station, and Qerret area, based on the results of the study might be able to bring about toxicity issues as a result of the high contents of Na^{+} and Cl^{-} ions.

Taking into account the persistent pollution of these waters because of the waste discharges it's important to carry out studies of the kind even into the future.

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