

Assesment of Irrigation Water Quality of Some Provinces of Turkey

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ABSTRACT: *Yozgat and Tekirdag are important agriculture center for Turkey. In these cities, agriculture is still important. On the other hand, the water resource is polluted by agriculture facilities day by day. In this study, some important physio-chemical parametres of surface water of Yozgat and Tekirdag were evaluated for the criteria of irrigation water quality. The water samples were taken from sampling points in July 2012. The contents of the samples have been analysed. In addition to the ratios of nitrite, nitrate and phosphore were determined. Hence, these results are compared with the water quality criterias.*

Keywords: *Irrigation water, pollution, quality.*

I. INTRODUCTION

The massive growths of human populations and economic development have resulted in the current worldwide deterioration in water quality. Agriculture can have an important impact on the quality of surface water. Fertilizer consumption has strongly increased in all developing countries. In addition to, it effects water quality negatively.

Nitrogen is comprised of the forms: soluble organic N, NH₄-N (ammonium), NO₃-N (nitrate), NO₂-N (nitrite), and N associated with sediment as exchangeable NH₄-N or organic-N. Total phosphorus levels of 100 or more ppb categorize lakes as highly eutrophic, with high nutrient and algae levels [1].

Nitrates in aquatic systems increase the amount of algae and other green plants that cover the water surface, resulting in an increased consumption and reduction of dissolved oxygen in the aquatic environment. This reduction further results in a decrease in the amount of incident solar radiation penetrating to greater water depths. These two phenomena result in a reduction of depuration and photosynthetic capacity of aquatic organisms [2], leading to eutrophication [3].

Eutrophication has been recognized as the main cause of water quality impairment. Phosphorus has been identified as the primary limiting nutrient causing eutrophication of many surface waters. The main sources of the potentially mobile P are fertilizers, manure, including that in pastures and that associated with confinement facilities, animal litter, plant residue, soil P and atmospheric deposition. The potentially mobile P that is actually transported by the various hydrologic pathways to surface waters is called total transported P [4]

Yozgat is a city in Turkey. The city is located at an elevation of 4,380 ft (1,335 m), situated 105 mi (170 km) east of Ankara, near the head of a narrow valley through which the Ankara–Sivas road runs. Like much of the Anatolian Plateau, the lands around Yozgat have been deforested over thousands of years of human habitation. According to 2009 census, population of the district is 113,614 of which 73,835 live in the city of Yozgat [5]. The main income is agriculture in the city. The important streams around Yozgat City are Cekerek Cayi, Egrioz Suyu, Karasu, Kanaksuyu and Delice River.

Egrioz Suyu is collected in Gelingulu Dam. These streams are generally used for irrigation of the agricultural areas around Yozgat [6].

The second study area is Tekirdag that it is a city in the Marmara Region of Turkey. Tekirdag is located at the northern shores of the Marmara Sea. It is 135 km from İstanbul. It is an agriculture trade center. Also it is the trading center of an agricultural region producing cereals and crops raised for oils. According to 2009 census, population of the district is 783,310 in the city [7]. The intensive agriculture in the regions is also associated with extensive use of fertilizers and pesticides, which has polluted water. Karaidemir Dam is serves for irrigation and flood control in Tekirdag region. 11840 ha is currently being irrigated [8]. Figure-1 shows that Karaidemir Dam in Tekirdag.

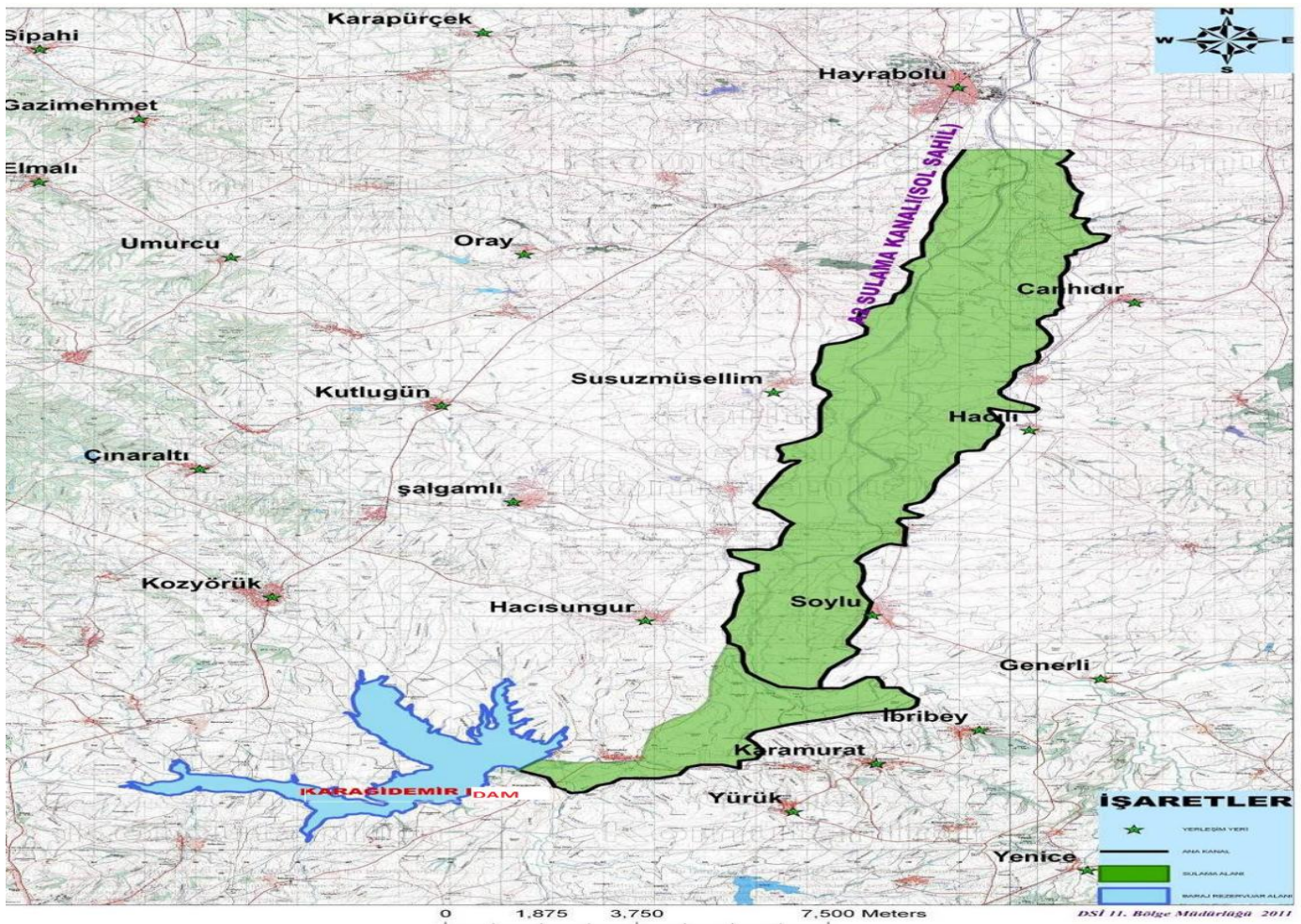


FIGURE-1 Karaidemir Dam-Tekirdag [8]

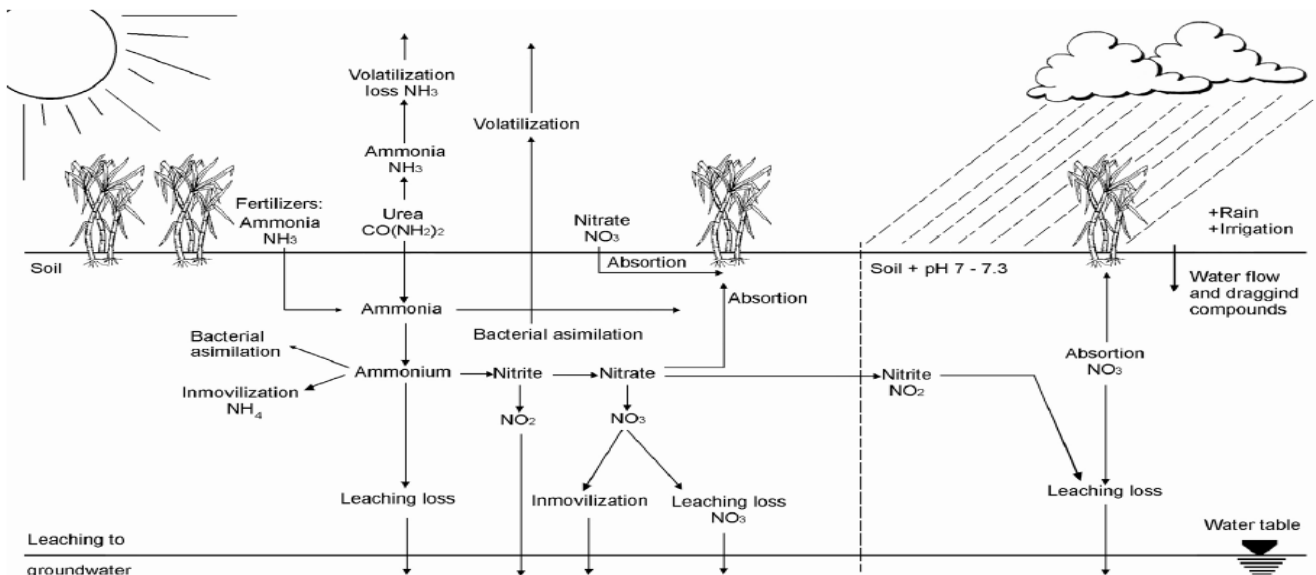


FIGURE 2-Forms and mobilization of nitrogenous compounds in the environment [9]

Nitrogenous fertilizers can be transformed to nitrites directly when they are applied to soils with pH 7.0-7.3 (Figure 2). An excess of nitrites in water is particularly harmful for humans and animals [9].

II. MATERIAL AND METHODS

A field research was conducted to evaluate the suitability of surface water for irrigated agriculture of Yozgat and Tekirdag. A total of 18 surface water samples were collected from various region in July 2012. Samples were collected from 12 ponds, 5 canals and 1 dam. The high density PVC bottles were used for sampling. They were thoroughly cleaned by rinsing with 8N HNO₃ and deionized water followed by repeated washing with water samples [10]. Various determinants, such as Nitrite-Nitrogen (mg NO₂⁻-N/L), Nitrate-Nitrogen (mg NO₃⁻-N/L) and The Total Phosphorus (mg P/L) of the samples were measured. The analysis for the physico-chemical parameters of the samples were carried out following the established analytical methods. Nitrite-Nitrogen was determined TS7526 EN 26777:1996, Nitrate-Nitrogen was determined SM 4500 NO₃ E: 2005 and The Total Phosphorus was determined SM 4500 PBC:2005. All of experiments were carried out in Ecosystem Environmental Analysis Laboratory (Adana). It has got an environmental measurement and analysis certificate of competency issued by T.C. Environmental and Urban Ministry.

III. RESULTS AND DISCUSSION

Table 1 represents the results of physico-chemical parameters of the irrigation water samples of the studies area of Yozgat and Tekirdag, while Table 2 and 3 show the suitability of water quality for irrigation purposes. According to Table 1, Nitrite-N was found in concentrations ranging from <0.04 to 0.61 mg L⁻¹; Nitrate-N concentrations ranged from 0.9 to 6.9 mg L⁻¹ and the total phosphorus concentrations ranged from < 0.1 to 0.28 mg L⁻¹ in Yozgat. The Nitrite-N was found <0.04 mg L⁻¹ for Fakıbeyli, Uzunlu, Aşağı Sarıkaya, Özlüce and Gelingüllü in Yozgat. According to Table 2, they are I. or II. Quality classes. In addition to, The Nitrite-N was found 0.05 mg L⁻¹ for Musabeyli and Topçu in Yozgat. According to same table, they are III. Quality classes. Finally The Nitrite-N was found 0.61 mg L⁻¹ for Paşaköy in Yozgat. It means IV. Quality classes. The Nitrate-N was found <5 mg L⁻¹ Fakıbeyli, Uzunlu, Gelingüllü, Musabeyli, Topçu and Paşaköy in Yozgat. According to these results, there are I. Quality class water. On the other hand, The Nitrate-N was found >5 mg L⁻¹ for A.Sarıkaya and Özlüce in Yozgat. Both of them are II. Water quality classes. In addition to, there are increasing problem in both of them according to Table 3. The total phosphorus was found <0.16 mg L⁻¹ for Fakıbeyli, Paşaköy, Uzunlu, Gelingüllü and Musabeyli in Yozgat. They are I. Water Quality Standards. The total phosphorus was found > 0.16 mg L⁻¹ for A. Sarıkaya, Özlüce and Topçu in Yozgat. It means they are III. Water quality classes.

Table 1-Physico-chemical properties of irrigation water of the study area

| Wat. Smp No | Sampling area | Source of sample | Nitrite-Nitrogen (mg NO ₂ ⁻ -N/L) | Nitrate-Nitrogen (mg NO ₃ ⁻ -N/L) | The Total Phosphorus (mg P/L) |
|-------------|---------------------|------------------|---|---|-------------------------------|
| 1 | Fakıbeyli, Yozgat | Pond | <0.04 | 1.5 | 0.14 |
| 2 | Uzunlu, Yozgat | Canal | <0.04 | 1.9 | <0.1 |
| 3 | A.Sarıkaya, Yozgat | Pond | <0.04 | 6.9 | 0.23 |
| 4 | Özlüce, Yozgat | Canal | <0.04 | 6.5 | 0.17 |
| 5 | Gelingüllü, Yozgat | Canal | <0.04 | 1.9 | <0.1 |
| 6 | Musabeyli, Yozgat | Canal | 0.05 | 1.6 | <0.1 |
| 7 | Topçu, Yozgat | Pond | 0.05 | 1.0 | 0.28 |
| 8 | Paşaköy, Yozgat | Canal | 0.61 | 0.9 | 0.11 |
| 9 | Bıyıklı, Tekirdag | Pond | 0.25 | 2.9 | 0.34 |
| 10 | Bayrampaşa, Tkd. | Pond | 0.09 | 1.5 | 0.8 |
| 11 | Temrezli, Tekirdag | Pond | <0.04 | 2.5 | 1.6 |
| 12 | Çerkezmusellim, Tk | Pond | <0.04 | 1.9 | 0.8 |
| 13 | Karababa, Tkd. | Pond | 0.5 | 0.8 | 0.8 |
| 14 | Karaıdemir, Tkd. | Dam | <0.04 | 1.02 | <0.1 |
| 15 | Küçükhdır, Tkd. | Pond | <0.04 | 2.4 | <0.1 |
| 16 | Yazır, Tekirdag | Pond | 0.16 | 3.1 | 0.8 |
| 17 | Nusratlı, Tekirdag | Pond | 0.42 | 2.35 | <0.1 |
| 18 | Kırıkkepenkli, Tkd. | Pond | <0.04 | 3.2 | <0.1 |

The second study area is Tekirdag region. According to Table 1, Nitrite-N was found in concentrations ranging from <0.04 to 0.5 mg L⁻¹; Nitrate-N concentrations ranged from 0.8 to 3.2 mg L⁻¹ and the total phosphorus concentrations ranged from < 0.1 to 0.34 mg L⁻¹ in Tekirdag. The Nitrite-N was found <0.04 mg L⁻¹ for Temrezli, Çerkezmusellim, Karaıdemir, Küçükhdır and Kırıkkepenkli in Tekirdag. According to Table 2, they are I. or II. Quality classes. In addition to, The Nitrite-N was found >0.05 mg L⁻¹ for Bıyıklı, Bayrampaşa, Karababa, Yazır and Nusratlı. Table 2. Water Pollution Control Regulation, quality criteries according to classes of inland water sources. According to same table, they are IV. Quality classes. The Nitrate-N was found < 5 mg L⁻¹ all of the samples for Tekirdag region. It means I. Water quality classes for them. In addition to, there isn't any problem for them according to Table 3. The total phosphorus was found <0.1 mg L⁻¹ for Karaıdemir, Küçükhdır, Nusratlı and Kırıkkepenkli. They are I. water quality classes. The total phosphorus was found >0.65 mg L⁻¹ for Bayrampaşa, Temrezli, Çerkezmusellim, Karababa and Yazır. They are IV. Water quality classes. Finally, the total phosphorus was found 0.34 mg L⁻¹ for Bıyıklı. It means II. Water quality classes.

Table 2-Water Pollution Control Regulations, 1988 [11]

| Water Quality Parameters | Water Quality Classes | | | |
|---|-----------------------|------|------|-------|
| | I | II | III | IV |
| Nitrite-Nitrogen (mg NO ₂ ⁻ -N/L) | 0.002 | 0.01 | 0.05 | >0.05 |
| Nitrate-Nitrogen (mg NO ₃ ⁻ -N/L) | 5 | 10 | 20 | >20 |
| The Total Phosphorus (mg P/L) | 0.02 | 0.16 | 0.65 | >0.65 |

Table 3-Guidelines for interpretation of water quality for irrigation [12]

| Irrigation Problem | Degree Of Problem | | |
|---|-------------------|--------------------|----------------|
| | No Problem | Increasing Problem | Severe Problem |
| Miscellaneous Effects (effects susceptible crops) NO ₃ -N (or) NH ₄ -N (mg/L) | <5 | 5-30 | >30 |

IV. CONCLUSION

The paper investigated determinants of water quality in rivers, canals, ponds and dam in Yozgat and Tekirdag regions. Data on water quality (water class) for 18 monitoring points for a month was used for the analysis. Different physico-chemical properties of irrigation water of Yozgat and Tekirdag cities were compared with the national and international water quality standards set for irrigation. According to standards, there are increasing problem of Nitrate-N for A.Sarikaya and Özlüce in Yozgat.

Proper agricultural management practices need to be introduced avoiding over-irrigation by farmers. Here, environmental benefits and economic benefits for farmers due to more efficient fertilizer use could go hand in hand [13]. To minimize potential risks associated with canal water irrigation, the proper use of canal water as well as efficient and economic methods to reduce chemical loads in chemically contaminated water used for irrigation needs to be implemented.

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