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A Research on Irrigation Water Quality of Çanakkale, Ezine and Lapseki Provinces

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Abstract

This research was carried out to determine the irrigation water quality of Çanakkale, Ezine and Lapseki provinces. Irrigation water samples were collected from surface waters, reservoirs and well waters in the research area, during the Irrigation period. EC, pH, temperature, NO_3^- , NO_2^- , CO_3^{2-} , HCO_3^- , SO_4^{2-} , Cl^- , K^+ , Na^+ , (Ca+Mg), RSC and SAR measurements were carried out at all samples.

The data obtained from the research results showed that all samples collected from surface waters, reservoirs and well waters were suitable for irrigation purpose, except, three samples from Halileli Village, Yeni Mahalle and Umurbey well waters contained high levels of NO_3^- , which is not suitable for a sustainable irrigation. Even though the results of the measurements indicate that surface water is better than ground water in terms of chemical quality, surface water is more likely to be contaminated with domestic and industrial disposals especially when big settlements are close to the stream.

Key Word: Irrigation Water, Water Quality, Çanakkale Region

Introduction

Total agricultural farm lands are 333 573 hectares in Çanakkale Region. 120 000 hectares of this land is suitable for irrigation but only 60 000 hectares are under irrigation today. This research was carried out Çanakkale, Ezine and Lapseki provinces which covers 79 050 hectares of agricultural land which is approximately 24 percent of the total agricultural area of the Çanakkale Region. Generally mesothermal climate prevails in the region, which is relatively dry and hot in the summer, cool and rainy in winter. Relative humidity is about 64 percent in summer month and 78 percent in January, yearly average is 71 percent. The annual average temperature is 14.8°C. The average monthly maximum and minimum temperatures are 24.6°C in August and 6.2°C in January. The average annual rainfall is 610 mm in Çanakkale province (Anonymous,2001).

Since the irrigated area has been increasing every year in the region, utilization of the lower quality surface and ground water is also increasing. But this situation creates salinity and toxicity hazards for agricultural crops and soils (Ayyıldız, 1976). The aim of this research was to determine the quality and suitability of surface and ground waters used in irrigation in Çanakkale region and then if there were salinity or toxicity problems to inform the farmers and extension service people, to take necessary precautions.

Materials and Methods

This research was carried out on the samples collected from dams, creeks and farmers' well waters used for irrigation in Çanakkale, Ezine and Lapseki provinces. Two monthly samples were collected during irrigation period (June-July) from 22 locations in 2000. Samples from wells were collected after the pump had been running for at least twenty four hours and samples from streams was taken from running water. At the time of collection, a label bearing a short identifying description was attached to the bottle. Name of the farmer, location, irrigated crops, temperature of the water, farmers observation on the source of the irrigation water (possible contamination reasons) were also recorded (US Salinity Lab. 1954).

K^+ , Na^+ , $(Ca^{++} + Mg^{++})$, CO_3^{--} , HCO_3^- and pH according to Tüzüner (1990) and other parameters (EC, Cl^- , Nitrite, Nitrate, Sulfate) were determined with La Motte Smart Colorimeter.

The data collected from water analysis compared with standard water quality parameters.

Results and Discussion

Irrigation water analysis results given at table 1 compared and evaluated according to standard irrigation water quality criteria (Anonim, 1991 and US Salinity Lab. 1954). Also chemical composition of some irrigation water in Çanakkale Region analysed by State Hydraulic Works Laboratory are given at table 2 for comparison. Some well waters of the farmers evaluated according to drinking water standards (Anonim, 1991).

Evaluation of the research results is the following; Sarıçay Creek water salt content was rather high at the down stream and classified as C_4S_1 . SO_4^{--} content varied from 240 to 340 ppm and considered 3rd class irrigation water (Şener, 1983) (sample no:1). But at the upstream of the same stream conductivity is very low (465 micromhos / cm) and classified as C_2S_1 (numbered, 18). The main pollutants for the downstream of Sarıçay creek might be industrial waste waters and discharge waters from settlements.

Water analysis results showed that; Irrigation water samples collected from the locations (numbered; 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22) were suitable for irrigation when compared with standard parameters mentioned above. But on the other hand well waters from Halileli Village (numbered 3 and 4), and Umurbey area (numbered 10) showed high NO_3 and NO_2 contents especially in the water samples collected in July. Almost two to three times more NO_3 and NO_2 levels at the end of irrigation season showed that overuse of well waters during the summer period caused to lower water levels in the wells and as a result of seepage from the sewers and other organic pollutants nearby increased the NO_3 and NO_2 contents of the well waters. These kinds of waters should not be used continuously for irrigation.

pH values from 6,5 to 8,4 are considered permissible range for irrigation waters and pH values of the waters sampled varied from 7,2 to 8,0 which is suitable for the most crops (Tok, 1997; Hoffman at all 1992).

Temperature of irrigation waters is an important factor for germination of the seeds and for the plant development. Irrigation water temperatures lower than 10°C and over than 30°C may retard growing and cause some hazardous developments in most crops (Ayyıldız, 1983). Temperature values of the waters sampled, varied from 13°C to 18°C in the well waters and 21°C to 25°C in the surface waters (table 1).

Evaluation of the water quality measurements at table 1 and table 2; show that surface waters are mostly have low salt and toxic material content and suitable for irrigation in Çanakkale Region. But some of the ground waters are contaminated with organic pollutants and should not be used continuously for a sustainable irrigation.

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Table 1. Water Quality Measurements of Çanakkale, Ezine and Lapseki Provinces.

No	Location, water sampled	Date	T °C	pH	E.C. mmhos/ cm	NO ₃ ⁻ ppm	NO ₂ ppm	SO ₄ ppm	Cl ⁻ ppm	CO ₃ ⁻ me/l	HCO ₃ ⁻ me/l	(Ca+ Mg) me/l	RSC me/l	K me/l	Na me/l	SAR	Class of Water
1	Sarıçay Creek	28.06.00	23	7,5	2080	0.56	0,02	340	0,04	-	3,9	17,8	-	0,72	10,7	3,59	C ₃ S ₁
		25.07.00	23	7,3	2380	-	0,02	240	0,00	0,6	3,1	9,3	-	4,4	15,64	7,25	C ₄ S ₂
2	Kepez Irrigation Canal	27.06.00	17	7,8	435	0.26	0,03	160	0,08	-	1,8	4,7	-	0,08	0,57	0,37	C ₃ S ₁
		24.07.00	18	7,5	454	-	0,00	210	0,01	0,4	1,3	3,7	-	0,07	0,8	0,59	C ₃ S ₁
3	Halileli Well Water	27.06.00	16	7,7	1462	34.8	0,04	200	0,00	-	11,5	23,7	-	0,12	1,92	0,56	C ₃ S ₁
		24.07.00	16	7,2	1446	703	0,19	260	0,00	1,6	9,1	18,5	-	0,08	4,8	1,57	C ₃ S ₁
4	Yeni Mahalle Well Water	27.06.00	17	7,8	1916	15.0	0.03	280	0.00	-	11.5	23.7	-	0.12	1,92	0,56	C ₃ S ₁
		24.07.00	17	7,2	1886	45.5	0,26	360	0,02	1,6	9,1	18,5	-	0,08	4,8	1,57	C ₃ S ₁
5	Dümrek Dam	27.06.00	21	7,8	472	0,06	0,04	9	0,01	0,4	3,8	5,3	-	0,05	0,48	0,29	C ₂ S ₁
6	Kumkale Diversion	27.06.00	25	7,6	651	0,25	0,03	25	0,01	-	3,8	5,4	-	0,14	1,91	1,18	C ₂ S ₁
		24.07.00	25	7,7	543	-	0,01	25	0,00	0,8	2,2	3,5	-	0,07	1,78	1,35	C ₂ S ₁
7	Pınarbaşı Well Water	27.06.00	17	7,8	610	1.20	0,06	26	0,01	-	5,1	7,2	-	0,07	0,80	0,42	C ₂ S ₁
		24.07.00	18	7,5	614	2.26	0.02	32	0.01	1.2	3.2	5.5	-	0.05	1.04	0.63	C ₃ S ₁
8	Üvecik Well Water	27.06.00	18	7,5	1045	9.21	0,01	29	0,00	-	5,3	8,4	-	0,12	4,35	2,14	C ₃ S ₁
		24.07.00	18	7,3	1001	18.5	0,05	28	0,01	1,0	3,7	6,1	-	0,07	4,27	2,44	C ₃ S ₁
9	Umurbey Creek	28.06.00	25	7,3	934	0.56	0,01	180	0,03	-	5,5	10,0	-	0,12	1,87	0,83	C ₃ S ₁
		25.07.00	25	7,6	1261	-	0,00	210	0,00	1,2	2,8	9,0	-	0,16	3,08	1,45	C ₃ S ₁
10	Umurbey Well Water	28.06.00	15	7,3	1253	0.84	0,08	150	0,04	-	9,1	15,5	-	0,17	1,91	0,69	C ₃ S ₁
		25.07.00	17	7,4	1362	53.3	0,48	230	0,00	1,2	7,0	11,7	-	0,12	2,53	1,04	C ₃ S ₁
11	Alpagut Well Water	28.06.00	13	7,7	481	0.72	0,13	28	0,06	-	3,0	4,7	-	0,10	1,04	0,68	C ₂ S ₁
12	Adatepe Well Water	Dried out															
		28.06.00	13	7,5	557	0.47	0,01	81	0,01	-	3,1	6,2	-	0,06	0,70	0,40	C ₂ S ₁
		Dried Out															

Table 1. Water Quality Measurements of Çanakkale, Ezine and Lapseki Provinces (Continued).

No	Location, water sampled	Date	T °C	pH	E.C. mmhos/cm	NO ₃ ⁻ ppm	NO ₂ ppm	SO ₄ ppm	Cl ⁻ ppm	CO ₃ ⁻ me/l	HCO ₃ ⁻ me/l	(Ca+Mg) me/l	RSC me/l	K me/l	Na me/l	SAR	Class of Water
13	Kösedere Dam	27.06.00	25	7,9	831	0,02	0,03	370	0,05	0,3	2,4	10,0	-	0,15	0,83	0,37	C ₃ S ₁
14	Bahçeli Creek	27.06.00 Dried Out	23	7,9	528	0,15	0,02	61	0,01	0,3	3,1	6,2	-	0,12	0,78	0,44	C ₂ S ₁
15	Uluköy Dam	27.06.00	25	7,6	518	0,52	0,23	33	0,07	-	2,8	4,4	-	0,15	0,79	0,53	C ₂ S ₁
16	Bayramdere Creek	28.06.00	21	8,0	475	15,0	0,03	15	0,00	-	4,1	5,5	-	0,05	0,57	0,34	C ₂ S ₁
17	Umurbey Dam	28.06.00	24	7,6	576	0,09	0,02	170	0,02	-	3,2	6,7	-	0,12	0,87	0,48	C ₂ S ₁
18	Atikhisar Dam	28.06.00	25	7,6	465	0,04	0,05	160	0,01	-	2,0	4,7	-	0,09	0,61	0,40	C ₂ S ₁
19	Dümrek Dam	24.07.00	21	7,9	418	0,06	0,01	10	0,04	1,0	2,0	3,5	-	0,04	0,7	0,53	C ₂ S ₁
20	Sarmısakçı Creek	24.07.00	18	7,4	618	0,35	0,06	26	0,00	1,0	2,5	4,0	-	0,07	2,02	1,42	C ₂ S ₁
21	Alpagut Dam	25.07.00	15	7,5	489	0,02	0,02	39	0,21	0,4	1,9	3,2	-	0,07	1,58	1,25	C ₂ S ₁
22	Adatepe Well Water	25.07.00	18	7,2	448	-	0,00	39	0,00	0,6	1,9	3,7	-	0,04	0,74	0,54	C ₂ S ₁

