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COMPARATIVE ANALYSIS OF SUITABILITY OF SURFACE AND GROUNDWATER QUALITY FOR IRRIGATION: OKE OYI IRRIGATION SCHEME

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ABSTACT

This paper presents the results on the comparative analysis of both surface and groundwater of Oke-oyi Irrigation scheme; it was done in order to provide comparative information on the suitability of surface and groundwater system within the scheme. Water samples were tested for its physicochemical quality for Agricultural purposes. The physicochemical analysis were carried out on, pH, EC, TDS, Boron (B), Iron (Fe), Nitrate (NO_3), Sulphate (SO_4), Bicarbonates (HCO_3), Chlorine (Cl) and SAR. Atomic Absorption Spectrophotometry was used for cations and conventional titration for anions, using standard procedures (APHA, 1998). The suitability of both waters for irrigation purposes was being assessed using FAO water quality standard. The result of the surface and ground water quality remains within the safe limit for irrigation purposes. However, there is need to continuously monitor and assess the surface and groundwater quality for irrigation purposes.

KEY WORDS: Irrigation, groundwater, physicochemical, water quality, Comparative.

1. INTRODUCTION

Water quality is a key environmental issue faced by the agricultural sector as well as it is very important for every agricultural use, as it cuts across activities such as, irrigation to livestock, from family household safe drinkable water on farms, etc. Agricultural water sources may be

of poor quality because of natural causes or contaminations, and this often requires quality assessment before it is acceptable for a given use.[1]

Crops require certain amount of water at certain fixed intervals throughout its period of growth and this water can either be through rainfall (natural) or artificial (irrigation). Thus irrigation is supplementary to rainfall when it is either deficient or irregularly. Poor water quality can affect crop, fruit and vegetable production as all ground and surface waters contain dissolved mineral salts of various kinds and quantities. And one major way is to determine water quality is by conducting physicochemical assessment, which will provide information on irrigation water quality.[2; 3; 4; &5]

2. MATERIALS AND METHODS

Overview of the Study Area

Oke-Oyi scheme is located between latitudes 8˚30`N and 8˚45`N and longitudes 4˚40`E and 5˚00`E, of Ilorin East Local Government of Kwara State. It's one of the small scale irrigation schemes of the federal government initiated in 1994, the land area (250ha) has an average height of about 360 m above sea level and a slope of less than 10 degrees.[6] Two climatic seasons exist annually: the dry and wet seasons. The wet season falls within April-October, while dry season runs from November - March of each year.

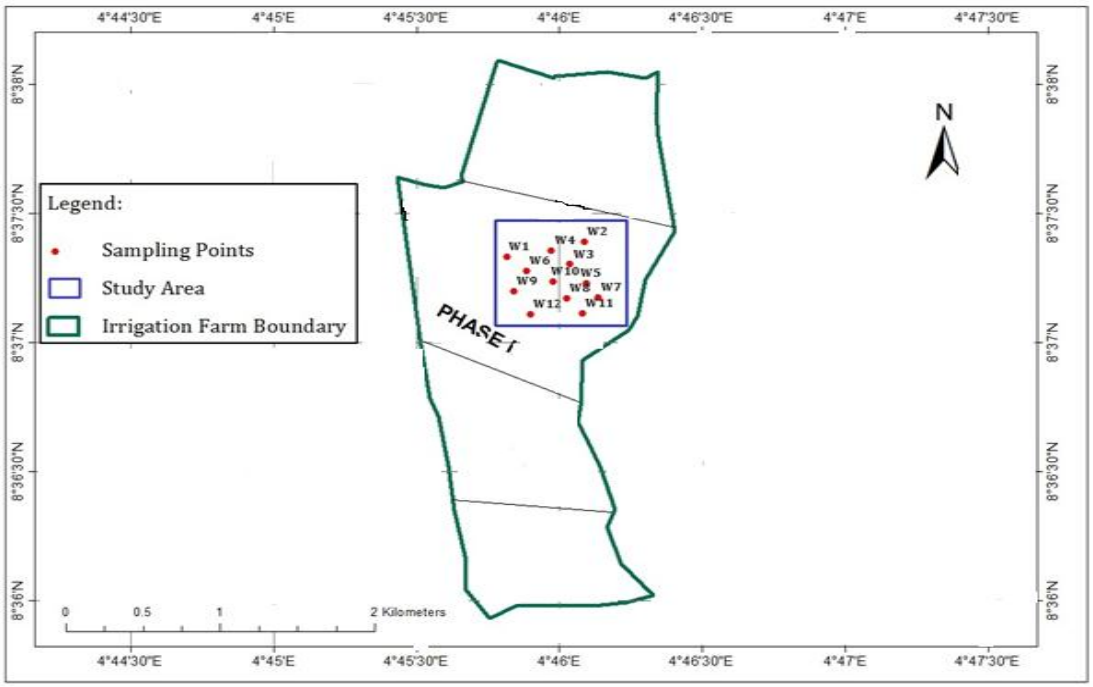

Figure 1: Groundwater sample collection points in Oke-Oyi irrigation scheme.

3.0 Methodology

Water samples were collected from along Oshin river which is the main source of water for irrigation, at both upstream and downstream of Phase II and III. While the ground water samples were randomly collected for the groundwater quality assessment within the irrigation field. The water samples was collected in a clean 1.0 liter plastic bottle after being properly rinsed and label, it was iced packed and transported to the laboratory for analysis. Physical parameters tested for are pH, electrical conductivity and total dissolved solids were immediately determined on the field using a potable multipurpose probe meter. The chemical analysis was carried out on nine major parameters which were, Calcium (Ca), Magnesium (Mg), Sodium (Na), Iron (Fe), Nitrate (NO_3), Sulphate (SO_4), and Bicarbonates (HCO_3) using standard procedures (APHA, 1998).[7]

4.0 RESULT AND DISCUSSION

The results (Table 1) of the surface and groundwater assessment obtained from the various analyses are presented; the mean pH values for surface and groundwater were 6.65 and 9.24. As the surface water tends towards neutral scale while the groundwater was slightly alkaline, suggesting a low tendency on the availability of trace and heavy metal within the scheme, thus reducing risk of heavy metal uptake by crops.[6] FAO recommends a pH value of 6.5-8.4 as being moderate and good for irrigation therefore both water sources are good for irrigation purposes. The chloride mean values was 0.36me/l for surface and 0.63me/l for groundwater and as compared with FAO standard, both values were within acceptable limits. Electrical conductivity (EC) mean values of 0.15 and 0.583 dS/m were for both surface and groundwater, while TDS mean values were 79.74mg/l and 1099.90mg/l respectively. Dissolution of mineral salts, temperature, sewage and salt concentration, runoff, sewage, environmental changes, rainfall and other human activities within the scheme might be responsible for such changes.[8] Comparing with USSL (1954)[9] and FAO standard, both values correspond to the class of water with good quality.

Bicarbonates mean values were 2.25mg/l and 0.6mg/l for both surface and groundwater although these values are below the acceptable limit of FAO which is 10 mg/l. This implies that both water sources are safe for irrigation purpose as recommended by FAO standard. The Nitrate values obtained for both water sources were 0.47 meq/l and 4.52 me/l which are within acceptable value of FAO (5 meq/l), thus sensitive crops might be affected by nitrogen concentration above this values. Water high in Nitrate can cause quality problem in crops

such barley, maize and sugar beets and also causing excessive vegetative growth in some vegetables.[10, 11] Sulphate concentration in both sources were 0.29meq/l and 1.32meq/l, this mean values are below the prescribe FAO value, indicating that both sources are safe for crop production. High sulphate will affect crops and cause corrosion in sprinkler systems and clogging of emitters.

The mean surface and ground water boron values were 0.15 mg/l and 0.92mg/l. although boron is a soluble micro element, which is very important to plant growth but high concentration may pose greater risk. When compared with FAO standard for Boron of 0 – 2.00 mg/L, this indicate that the mean boron concentration at the study area fall within the recommended standard and is safe for irrigation. Surface and groundwater mean Iron values were 0.35mg/l and 0.90 mg/l respectively. Ferrous Iron is commonly found in many rocks, soils and water which are essential trace element for plant and animal growth.[12] Both results were within FAO standard for irrigation water quality.

Sodium adsorption ratio (SAR) is important for the determination of its suitability, and in terms of sodium hazard; it assesses the potential for infiltration problem due to a sodium imbalance in irrigation water. The current results indicate that surface water is suitable for irrigation with SAR value of 2.25meq/l while the ground water had higher value of 30.30meq/l which is above FAO and USSL, (1954)[9] recommendation. As this difference might be due to various factors such as Na^+ ions found in feldspars and other salts which easily disintegrate during weathering thereby affecting groundwater resources, the use fertilizers and other sodium rich chemicals. High value of sodium may lead to difficulty in meeting the crop water demand Very high sodium hazard range might not be suitable for irrigation.[13, 14]

Table 1

Sample	Current Data (Mean)	FAO	Current Data (Mean)	FAO
	pH		**Chloride me/l**	
Surface Water	6.65	6.5-8.4	0.36	4
Ground Water	9.24	6.5 - 8.4	0.63	4
	EC dS/m		**TDS mg/l**	
Surface Water	0.15	< 0.7	255.3	< 2000
Ground	0.583	< 0.7	1099.9	< 2000

Water				
	Bicarbonates meq/l		**Nitrate meq/l**	
Surface Water	2.25	10	0.47	5
Ground Water	0.6	10	4.52	5
	SAR meq/l		**Sulphate meq/l**	
Surface Water	2.25	9	0.29	20
Ground Water	30.3	9	1.32	20
	Boron mg/l		**Iron mg/l**	
Surface Water	0.15	0-2.00	0.35	0-5
GroundWater	0.92	0-2.00	0.9	0-5

5.0 CONCLUSION

From the findings of this study, the following conclusions could be drawn;

Most of the surface and groundwater physicochemical parameters were within FAO 1990[15] standard for irrigation, aside groundwater pH and SAR values which were found to be slightly above the recommended standard. When compared, the tested surface water parameter were found to be more suitable than the groundwater qualities as this might be due to human activities, pollution, run off, leaching, the use of agricultural chemicals etc.

The following recommendations could be drawn from the study. There is the need for constant monitoring of all human and agricultural activities going on within the scheme. Periodic monitoring of the groundwater quality and level should be carried out regularly at the irrigation scheme.

CONTRIBUTION TO KNOWLEDGE

This study has contributed to the available data on surface and groundwater quality of Oke-Oyi Irrigation scheme of Kwara State, Nigeria, by providing baseline information and awareness on the state of both waters within the scheme.

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