IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 10, Issue 6 Ver. III (Jun. 2016), PP 48-51
www.iosrjournals.org

Assessment of Suitability of Oshin River Water for Irrigation: Case Study of Oke-Oyi Irrigation Scheme, Nigeria.

Adejumobi M.A[1], Alonge T.A[1], Mufutau B.A[1]and Jatto M.F[2].
1 Department of Agricultural Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.
2. Lower Niger River Basin Development Authority, Ilorin, Nigeria

Abstract: *Irrigation water quality is a major problem faced by agricultural sector and this may be due to natural causes and contamination. The research was carried out to analyze the suitability of Oshin River in Oke-Oyi irrigation scheme of Lower Niger River Basin Authority for irrigation purposes. Water samples were collected from different section of Oshin River along irrigated lands. The samples were analyzed for both physical and chemical properties, the result were compared with FAO standard to determine their effect on the irrigated field. Sodium Adsorption Ratio (SAR) was determined and the results obtained was analysed statistically with SPSS. The result indicated that the pH ranged between5.12 and 7.29, Sodium Adsorption Ratio ranged 0.11to 0.17me/l, Chloride ranges from 0.11to 0.9me/l, for Carbonates from 1.6to 3mg/l, Copper (Cu), 0.00 to 0.58 mg/l and potassium 0.9 to 2.2 mg/l. Copper, potassium ,and carbonate were above FAO standard. Statistically, Cl is not significant ($P < 0.05$) within the group while $K^+$and Cu are significant. The water used for irrigation is moderately saline therefore water source must be used with caution and regular water analysis is recommended on the source.*
Keywords: *Irrigation, irrigated field, suitability,water quality*

I. Introduction

Water is the most important input required for plant growth in agriculture production. Irrigation water comes from a number of different sources and its quality varies [1]. Dams, bores, wells, rivers, channels and recycled water are common sources of water for irrigation. Problem of salinity, sodium, carbonates, and pH can occur in any of these sources, especially near the seashore [2].High salinity makes it more difficult for the seed to imbibe water and the germination rate is reduced [3]. Water need for plant growth is met with soil water storage on plant root zone. Under rain fed conditions, soil water storage is continuously replenished with natural rainfall; however, irrigation is essential in arid and semi-arid climates to maintain soil water storage at an optimum level to get higher yield. All water sources used in irrigation contain impurities and dissolved salts irrespective of whether they are surface or underground water. Water quality affects plants, as well as soils and irrigation equipment. However water which can be considered good quality for household use may not be ideal for irrigation [4]. It is therefore important to identify and correct water quality problems that may leads to salinity.

Irrigation transport water to crops to increase yield, it also keeps crop cool under intense heat condition and also prevent freezing. Irrigated agriculture is dependent on an adequate water supply of usable quality. It can be said that no water is pure or clean owing to the presence of some quantities of gases and minerals. However, for all practical purposes, pure water is considered to be that which has low dissolved or suspended solids and obnoxious gases as well as low in biological life, such high quality of water may be required only for drinking purposes while for other uses like agriculture and industry, the quality of water can be quite flexible and water polluted up to certain extent in general sense can be regarded as pure [5]. Irrigation water quality is determined by the total amounts of salts and the types of salts present in the water.

II. Material and Method

2.1 Description of the Study Area

The study was conducted at the Oke-Oyi irrigation project site of the Lower Niger River Basin Development Authority (LNRBDA) Ilorin, Oke-Oyi, the headquarter of Ilorin East Local Government Area of Kwara state, Nigeria. It is about 25km away from Ilorin town along the old Ilorin-Jebba road [6]. Oke-Oyi irrigation project is a medium irrigation project of the authority located along Oshin River. The project area is a viable small-medium irrigation scheme which became fully operational in 1994.The land is characterized by intermittent water courses giving rise to prominent depression within the project area (Fig. 2). The climate is Tropical wet and dry climate. The wet season is observed from May to October. The Dry season begins in

November and end in March [7]. Rice, cowpea, maize, soya beans, guinea corn and rice are planted in the rainy season while Okra, cowpea, maize,

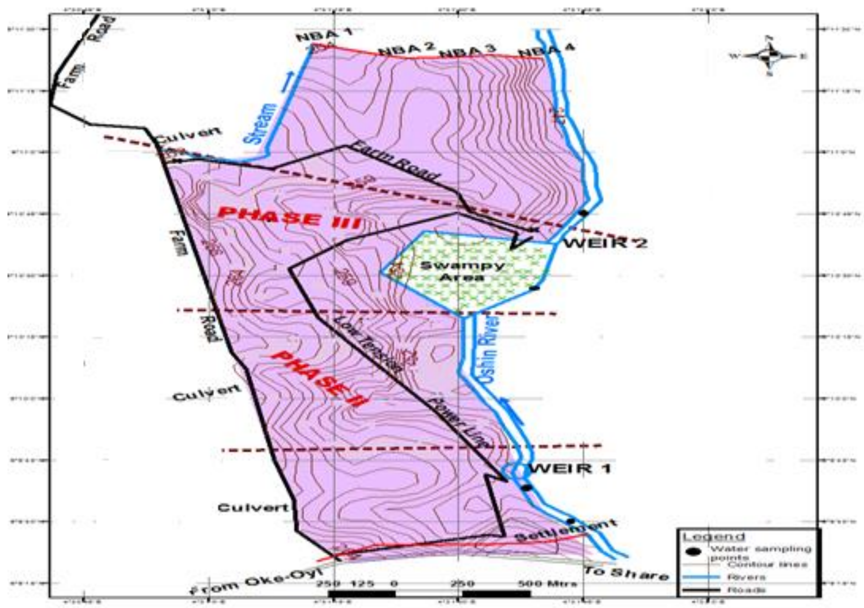

Figure 2: Oke Oyi Irrigation Scheme and Water Sampling Points

vegetables and rice are planted in the dry season. Oke-Oyi scheme has a 47m long concrete weir constructed on Oshin River to impound water for irrigation.

2.2 Methodology

Water samples were collected from four points in the year 2014/2015 of the irrigation scheme which includes both the upstream and downstream of phase II and phase III of the irrigation scheme at each sampling point, 2 samples were taken using sterilized plastic labelled bottle for the purpose of water analysis identification. The sample bottle was submerged and allowed to fill completely without air to mix with the sample. The samples were taken to laboratory for chemical analysis. The result was compared with FAO standard and the statistical analysis of the result was carried out using SPSS to show correlation coefficient between the result obtained and FAO standard.

III. Results and Discussion

The current concentration of chloride and pH values in Oshin River compared to concentration of chloride and pH of FAO standards for irrigation water were presented in Table 1. Water sources at phase III have pH values between 7.02 and 7.29 for upstream and downstream respectively. This indicated that the water source is alkaline and also there was an increase in pH at the downstream. This can cause calcium and magnesium to precipitate from the soil and affect plant growth. As a result of the water alkalinity at phase III, elements like copper and zinc, may also be less available to the plant in this situation. In phase II, the pH value of 5.15 at the upstream showed that the water source was acidic but increased to 7.29 at the downstream (DS) of phase III. The result of analysis showed that the water is saline. The acidic nature of the water could be due to the human activities carried on along the upstream that includes laundry, and refuse disposal which have a detrimental effect on plant growth, particularly causing nutritional problems. The FAO standard recommends a pH value of 6.5-8.4 as being moderate and good for irrigation purposes.

Table 1: Concentration of Chloride and pH in Oshin River

Sample	[8] me/l	Current Data (2015) me/l	[8] me/l	Current Data (2015) me/l
	Chloride		pH	
Upstream phase II	4	0.9	6.5-8.4	5.15

Downstream phase II	4	0.11	6.5-8.4	7.13
Upstream phase III	4	0.25	6.5-8.4	7.02
Downstreamphase III	4	0.22	6.5-8.4	7.29

Chloride at the upstream phase II had a value of 0.9 me/l as presented in Table 1, while at the downstream, there was a drastic reduction to a value of 0.11 me/l, the values at upstream phase III and downstream phase III was acceptable compared to the FAO standards of 4me/l. The value of chloride at the upstream of phase II could be traced to the activities carried out there which includes washing of clothes, plates and passing of waste both by human and animal. High chloride in irrigation water could cause early dropping of leaves and yellowing of leaf.

Table 2: Concentration of Carbonates and Bicarbonates of Oshin River

Sample	[8] mg/l	Current Data (2015) mg/l	[8] mg/l	Current Data (2015) mg/l
	Carbonates		Bicarbonates	
Upstream phase II	2	3	10	2
Downstream phase II	2	1.6	10	1.8
Upstream phase III	2	1.7	10	3
Downstreamphase III	2	2.6	10	2.2

Table 3: Concentration of Copper and Potassium in Oshin River

Sampling Point	[8] mg/l	Current Data (2015)mg/l	[8] mg/l	Current Data (2015) mg/l
	Copper		Potassium	
Upstream Phase II	0.02	0.58	2	2.2
Downstream Phase II	0.02	0.10	2	1.3
Upstream Phase III	0.02	0.06	2	0.9
Downstream Phase III	0.02	0.00	2	1.3

Bicarbonate and Carbonate ions combine with calcium or magnesium to form calcium carbonate or magnesium carbonate, high concentration of carbonate was present in the irrigation water at phase II having a value of 3and 1.6 mg/l at the upstream and downstream respectively as presented in Table 2. While a value of 1.7 and 2.6 mg/l at phase III correspondingly was observed in the river. As stated by FAO standards, carbonate values higher than 2mg/l shows an increasing risk of alkalinity hazard. At the upstream Phase II the value of bicarbonate was 2.0mg/l, while DS showed a value of 1.8mg/l, with 3.0mg/l for the upstream phaseIII and 2.2 mg/l for DS phase III, FAO recommend a value of 1.5 to 7.5mg/l as slightly moderate while any value above7.5mg/l becomes severe and this will cause an alkalizing effect.

There were very high concentration of copper and potassium at upstream phase II each having values of0.58mg/l, 2.2mg/l and0.02mg/l as against2mg/l of the FAO standards(Table 3). These could be due to waste dropped at the site . Pearson correlation coefficient was used to test for relationship between parameters of present study and FAO standard.

Statistical analysis

Table 4: Correlation between present study and FAO standards

	pH	Cl	CO_3^{2-}	HCO3	Na^+	NO_3	P_2O_3	TDS	K	SO_4^{2-}	Cu
Ph	1										
Cl	-.981*	1									
CO_3^{2-}	-0.685	0.789	1								
HCO3	0.255	-0.172	-0.29	1							
Na^+	-0.76	0.74	0.768	-0.776	1						
NO_3	-.998**	.981*	0.716	-0.307	0.8	1					
P_2O_3	-.981*	.976*	0.788	-0.379	0.86	.991**	1				
TDS	-0.695	0.556	-0.042	-0.165	0.345	0.667	0.581	1			
K	-0.903	0.887	0.798	-0.605	.965*	0.929	.963*	0.49	1		
SO_4^{2-}	-.969*	.966*	0.809	-0.42	0.886	.982*	.998**	0.548	.976*	1	
Cu	-.994**	.956*	0.646	-0.345	0.797	.994**	.979*	0.735	0.922	.968*	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

All parameters except pH are in mg/l.
Correlation Rating: > 0.91= very strong; 0.90 - 0.81= Strong; 0.80 – 0.31= moderate; < 0.30= weak
In table 4, copper (Cu) and potassium (K) is significant within the group (P > 0.05) but chlorine (Cl) is not significant within the group (P < 0.05).

IV. Conclusion

There is high level of Carbonate in the irrigation water sources and when taken up by plants through transpiration it causes leaf burns, drying of leaf and even early droppings of leaves and proper leaching is recommended to reduce the presence of carbonates in water used for irrigation

The toxic level of the water which includes the presence of Boron and Chloride ions in the water sample shows that the presence of boron ion in the water is relatively small in quantity compared with the FAO standards and thus does not pose any infiltration problem but at upstream phase 2 the chloride level was on the high side and this will affect the plants by showing symptoms such as yellowing of the leaves and also leaf burns and drying of the leaves and thus attention should be given to the toxic level of the water used for irrigation.

Potassium level at the upstream phase II also shows a high value compared with the FAO standards and care must be taken to address this problem which may be due to the human activities carried out at the upstream. There was also the high presence of suspended solids in the water used for irrigation and suspended solids needs to be removed from the water source to prevent clogging of pipes, valves nozzle and emitters in an irrigation system.

V. Recommendations

The water used for irrigation is moderately saline, low in sodium and boron content, no sodium hazard, with high chloride and carbonate at the upstream phase II and high suspended solids present in the water, under proper management on light soil with good infiltration rate and drainage the water can be used for irrigation purpose and crops that are tolerant to moderate salinity such as vegetables, watermelon, potatoes should be planted.

Human activities such as laundry, waste disposal, human waste carried out at the upstream should also be reduced as much as possible so as to have the water source from been contaminated and hence good for irrigation purposes There is also the need for regularly chemical analysis on the source of water used for irrigation. Proper drainage should be given attention to so as to prevent water logging and accumulation of salts in the root zone.

References

[1]. OurimbahV.B (2011). Irrigation Water Quality. Department of primary industry.Agriculture NSW - Field Vegetables. First edition, Page 1-3.
[2]. James C. (2001). Irrigation Water Quality. Turf grass Programme Clemson University. Update from the 2001 Carolinas GCSA annual meeting. Page 1-13.
[3]. Al-KhaierR. B. (2003). Guidelines for designing and evaluating surface irrigation systems. FAO Irrigation and Drainage Paper 45.
[4]. Kirda E.T, (1997). Salinization of land and water resources. Water Quality Technical Committee of the Irrigation and Drainage, 433.
[5]. Joshi, D.M, Kumar, A., Agrawal, A. (2009). Assessment of the irrigation Water Quality of River Gangy in Harid War district. *RasanyajournalofChemistry*, *12*(2), 285-292
[6]. Oriola, E. (2004). Dynamics of soil Chemical Properties in Oke-Oyi Irrigation Project Site of Lower Niger River Basin Development Aythority, Ilorin, Nigeria. Geo-Studies Forum, volume 2, No 1, page 12-18.
[7]. Abdulkadir, T. B.(1982). Agricultural Salinity Assessment and Management. ASCE Manuals, 237–261.
[8]. FAO. (1994). Water Quality for Agriculture, paper 5.