Short Communication

Irrigation Water quality as Influenced by Sources along Jega Floodplains, Jega, Kebbi State, Nigeria

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Abstract

A laboratory experiment was conducted to evaluate Irrigation water quality of the Jega floodplains as influenced by different sources. Six tubewell spaced 1500m water samples were collected, blended and analyzed, so also equal distance along the surface stream water was also collected and subjected to laboratory analysis. The results indicates that the concentrations of Sodium 14mg/L and 29mg/L for tubewell and surface stream respectively, is the fear in using this water as it falls within the sodicity level, however, other parameters checked were within the tolerable limit for Irrigation purpose.

Keywords: Sodicity, Tubewell, Stream, Turbidity, Floodplain, Electrical conductivity.

INTRODUCTION

Water is the fundamental resources on which agricultural production depends (Safwat, 1999). Water quality is greatly influenced by its sources, this has a great effect on the quality of soils such and water is used for and invariably on the products that were produced from such soils.

Despite the health and safety concerns, planning the use of low quality water such as municipal, industrial and agriculture effluents for irrigation purposes is practically a useful option (FAO, 2002; Tyagi, 1999). Despite the fact that agriculture plays an essential role in Nigeria's food and fiber supplies, aimed at mitigating poverty and produces a major source of income, it is unable to compete economically for scarce water among other competitors (Pereira, 2005). Therefore the expansion of any sector's of water use will require better management to save fresh water, improve water harvesting techniques, desalinization of salty water and recycling of waste water (Spore, 2001).

Jega floodplains and its surrounding catchment serve as a source of water for both domestic and agricultural uses. There is no compromise as to the quality of water for agricultural production as it will have a great impact on whatever produce that is going to be produced. Considering this uses, water at the floodplain is subjected to and the rapid expansion of the town, a study was conducted to evaluate the quality of the water of Jega floodplain as influenced by various sources for agricultural and non-agricultural uses.

MATERIALS AND METHODS

The research was conducted at Jega floodplains which is at latitude 12° 11' N, longitude 4° 16' E in the Sudan savannah agro-ecological zone. The climate is a semi-arid with an average annual rainfall of about 500-650mm, the relative humidity ranges from 21-47% and 51-92% during the dry and rainy seasons respectively, whereas temperature ranges from 20-30°C during the dry cold season, and 27-41°C during the hot rainy season.

The main sources of water for irrigation at the study area are the tubewell and the surface stream water. A total of six (6) tubewell located at an intervals of 1500m apart were selected for water sampling and a six samples (one from each wells) were collected and blended to make a single sample that was used for laboratory analysis, an equal distance was also used for collection of the water samples from the surface stream and also blended to make a single sample which were immediately taken to laboratory for the chemical analysis.
The parameters measured for the water quality were; Electrical conductivity (EC), pH, Ca$^{2+}$, Mg$^{2+}$, Na$^+$, K$^+$, Boron, Sodium adsorption ratio (SAR), NO$_3$ and Turbidity. EC was determined by conductivity meter electrode, pH by the glass electrode method, Ca$^{2+}$ and Mg$^{2+}$ were estimated by EDTA titration method, while K$^+$ and Na$^+$ were determined by flame photometer. Boron was determined by calorimeter indigo-carmine method. SAR was determined by calculation using the formula:

$$SAR = \frac{Na^+}{\sqrt{Ca^{2+} + Mg^{2+}/2}}$$

Nitrate was determined by EDTA titration method with 0.005N sulphuric acid, while turbidity was determined with an electrometric turbidity meter (NTU), Juo, 1979.

RESULTS AND DISCUSSIONS

Irrigation water quality for the Jega floodplains

Water pH

The pH of the water as shown in Table 1 has the value ranges from 6.9 for the tubewell and 7.1 for the surface stream water. These values are considered to be safe for irrigation activities when compared with the standard value given by Vudhivanich 1998, which shows water whose pH values ranges from 6.5-8.5 are safe for both domestic and agricultural purposes. The results is also within the values as determined by Singh and Tsoho (2000) who finds the pH values for both tubewell and surface water of Kebbi State as 7.5 and 7.3 respectively.

EC and SAR of the water

The EC values for both tubewell and surface stream water as shown in Table 1, were below the critical limit to be considered as a potential threat for irrigation activities as they fall below the limit described as hazard by Vudhivanich 1998. However, there is a threat of sodicity as the values of Na is higher than the critical limit.

Nitrate and Chlorides values of the water sample

The Nitrate levels in both tubewell and surface stream water were found to be 0.01 mg/L and 0.016mg/L respectively. These levels when compared with the levels considered safe for both domestic and agricultural uses by the WHO 1998, of 5mg/L, they can be regarded as safe for the same purpose as well. However, due to the mobile nature of N, and considering agricultural activities going on within the study area, addition of nitrogenous fertilizers to the soil can further leads to an increase of the nitrate content in the tubewell water, however, as the area is not an industrial area, less nitrate is expected to go into the surface stream water.

The Chloride levels in both the tubewell and surface stream water as shown in Table 1 are; 0.89mg/L and 1.19mg/L respectively. Accord to WHO 1998, any water with a chloride value above 10mg/L is considered harmful for both domestic and agricultural purposes. Therefore, the water at the study area falls far below those considered harmful by WHO standard. However, considering the mobility of Chlorides also and some domestic activities taking place in the surface stream water, there is every possibilities that its level may increase with time, as it can be noted in the values for both tubewell and surface stream water as analyzed in this work as 0.89mg/L and 1.19mg/L respectively.

Boron concentrations

Boron concentrations of the water for both tubewell and surface stream are 0.509mg/L and 0.374mg/L respectively; these values when compared to the standard value given by Van Roojen et al. 2005 of 1.0mg/L can be considered safe for both domestic and agricultural purposes, but care should be taken in using these water especially the tubewell water, because boron is known to be toxic even at a lower concentration.

Concentrations of Basic cations

Basic cations concentrations for the tubewell water at the study area as shown in Table 1. Were; 1.1mg/L, for Ca, 1.7mg/L for Mg, 29mg/L for Na and 21mg/L for K, were considered slightly lower than the values of the surface stream water which has the values as 1.4mg/L for Ca, 2.6mg/L for Mg, 14mg/L for Na, and 9mg/L for K. This trend shows that in a near future if care is not taken, the use of this tubewell water can possibly results in the danger of sodicity. However, the concentrations of Ca and Mg does not pose any danger in a near future.

Turbidity

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Table 1. Mean values of EC, pH, Basic cations, Nitrate, Chloride, Boron, SAR and Turbidity of Tubewell and surface stream water of the Jega floodplain.

<table>
<thead>
<tr>
<th>Water source</th>
<th>EC</th>
<th>pH</th>
<th>Ca</th>
<th>Mg</th>
<th>Na</th>
<th>K</th>
<th>NO₃</th>
<th>Cl</th>
<th>B</th>
<th>SAR</th>
<th>Turbidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubewell</td>
<td>244</td>
<td>6.9</td>
<td>1.1</td>
<td>1.7</td>
<td>14</td>
<td>21</td>
<td>0.01</td>
<td>0.89</td>
<td>0.509</td>
<td>24</td>
<td>27.8</td>
</tr>
<tr>
<td>Surface stream</td>
<td>136</td>
<td>7.1</td>
<td>1.4</td>
<td>2.6</td>
<td>29</td>
<td>9</td>
<td>0.016</td>
<td>1.19</td>
<td>0.374</td>
<td>10</td>
<td>38.0</td>
</tr>
</tbody>
</table>

The values for EC is = dSm⁻¹, SAR= mSm⁻¹. Other cations are = mg/L for the water values, while for the soil values is = Cmol/kg.

water such as washing of clothes, dishes and plates, swimming, fishing etc.

CONCLUSIONS AND RECOMMENDATIONS:

Use of the water at Jega floodplains from both tubewell and surface stream is considered as safe for irrigation purpose, however, sodium concentrations especially from the surface stream water have to be carefully assess. To maintain the quality of this water, washing of domestic utensils and automobile engines should be avoided or minimize to the bearest level and government should provide an alternative to this.

REFERENCES


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