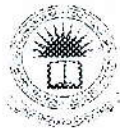


**QUALITY OF IRRIGATION WATER IN PARAKRAMA  
SAMUDRAYA CANAL COMMAND AREA,  
POLONNARUWA DISTRICT**



**By**

**NANAYAKKARA KAPPETIDUWAGE UCHITHA  
WATHSALA**



Library,  
Eastern University, Sri Lanka

**DEPARTMENT OF AGRICULTURAL ENGINEERING  
FACULTY OF AGRICULTURE  
EASTERN UNIVERSITY  
SRI LANKA**

**2019**

## ABSTRACT

Irrigating agriculture plays a vital role in uplifting the livelihoods of farming communities and ensures the national food security. Though there are several sources available to supply water only few are suitable for a specific use based on its quality. Water quality deals with the physical, chemical and biological characteristics of water. Parakrama Samudraya is the main irrigation scheme in Polonnaruwa district and it mainly supply water through the canals for paddy cultivation. Canal water quality may change along the canal distance based on the locations of the discharge outlets of the command area. Poor quality water may affect the crop yield. However, quality of this irrigation water has not yet been assessed. In the above context, the present study was aimed to assess the quality of right bank canal water and the well water of the canal command area for its suitability for irrigation purpose.

In the present study, water samples were collected at 1Km distance along the right bank canal using 1 liter plastic containers. Well water samples also collected at regular distance in both sides of the canal. Collected water samples were analysed for its quality. The pH, Electrical conductivity (EC) and Total Dissolved Solids (TDS) were analysed at the field using portable pH/EC/TDS meter (Model HI 98130). Then the water samples were transferred to the water quality laboratory of the department of Agricultural Engineering, EUSL, where quality parameters such as sodium, potassium, calcium, magnesium, bicarbonate, phosphate and nitrate were analysed using flame photometer, spectrophotometer and titration methods. Derived parameters such as Residual Sodium Carbonate, Sodium Adsorption Ratio, Soluble Sodium Percentage and Calcium/Magnesium ratio were also found out using the analysed data.

Finally, all the results were entered in Excel sheet and results were analysed using descriptive statistics and SPSS package.

It was observed that the quality of right bank canal water and the well water in both sides were varies with the distance. The pH of canal water varied from 8 - 8.4 showing slight alkaline condition. Well water pH also varied from 6.07 - 8.27. The range of EC, TDS, and  $\text{PO}_4^{-3}$  of canal water varied from 0.21 - 0.22 dS/m, 102 - 108 ppm and 0.05-1.99 ppm respectively. Similarly, EC, TDS,  $\text{PO}_4^{-3}$  of the well water from the right side of the canal were 0.21 - 0.58 dS/m, 104 - 289 ppm and 0.06 - 1.93 ppm respectively. In the left side these parameters were varied as 0.21 - 1.02 dS/m, 407 - 105 ppm and 1.83-0.23 ppm respectively. The  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$  and  $\text{HCO}_3^-$  concentration of canal water were recorded as 20.7 - 27.7 ppm, 6.6 - 8.0 ppm, 2.4 - 8.8 ppm, 0.5 - 4.5 ppm and 153.8 - 480.8 ppm respectively. These parameters of the well water from left side were ranged from 24.2-29.4 ppm, 1.1-10.0 ppm, 1.6 ppm - 7.2 ppm, 5.2 - 0.5 ppm and 571.2 - 170.9 ppm respectively. Similarly, in the right side it varied from 27.5 - 30.1 ppm, 0.6-8.5 ppm, 2.4 ppm-5.8 ppm, 5.7 - 0.5 ppm and 122.0 - 461.3 ppm, respectively. As far as the suitability of this water for irrigation based on the individual parameters concerned, the concentrations of these parameters were acceptable for the irrigation purpose. However, suitability of irrigation water based on the SSP, SAR and RSC is concerned; there were some limitations in using these water sources. The SSP, SAR, and RSC of canal water values were varied from 12.4% - 36.9%, 1.82 - 3.47, 2 me/l-7.48 me/l respectively. Well water from right side has SSP, SAR, and RSC values of 16.5% - 40.5%, 1.94 - 4.05, 1.76 me/l-6.8 me/l, and in left side it was 20.9% - 37.6%, 3.92 - 2.13, 2.12 me/l - 8.68 me/l, respectively.

According to the RSC value, most of the canal and well water categorised as unsuitable for irrigation due to the bicarbonate hazards. According to the SSP and SAR, all the

canal and well water samples categorised under suitable class for irrigation. Magnesium hazard in well water in both sides also noticed during the study. Concentration of most of the quality parameters of the canal water are significantly differed from the well water except  $\text{HCO}_3^-$  and phosphate. As far as the right and left side of the well water is concerned, significant difference was found between them for the quality parameters such as EC, TDS, Turbidity, Na, Mg and nitrate. EC and TDS of well water in the left side has shown significant variation than the canal and right side well water samples. It may also noticed that, canal water has lower value of EC and TDS than the well water samples.

Based on these studies, it is concluded that RB canal water of Parakrama Samudraya is suitable for irrigation to crops in dry season. However, appropriate management is needed in some locations of the command area while using ground water for the irrigation purpose. At the same time there should be a control mechanism against the over usage of fertilizer in these command area to avoid the pollution through nutrient accumulation to canal as well as the ground water sources.

## TABLE OF CONTENT

ABSTRACT .....	i
ACKNOWLEDGEMENTS .....	iv
TABLE OF CONTENT .....	v
LISTS OF TABLES .....	viii
LIST OF FIGURES .....	ix
ABBREVIATION .....	x
<b>CHAPTER 01: INTRODUCTION</b> .....	<b>1</b>
1.1 Background .....	1
1.2 Parakrama Samudraya, Polonnaruwa district .....	3
1.3 Problem justification .....	4
1.4 Objectives .....	5
<b>CHAPTER 02: LITERATURE REVIEW</b> .....	<b>6</b>
2.1 Water Resources in Sri Lanka .....	6
2.2 Importance of water resources .....	9
2.3 Necessity for conservation and development of water resources .....	9
2.4 Irrigation Systems in Sri Lanka .....	10
2.5 Parakrama Samudraya Project .....	11
2.6 Quality of Irrigation Water .....	12
2.7 General information on irrigation water quality .....	14
2.8 Water and cultivation in Sri Lanka .....	26

<b>CHAPTER 03: MATERIALS AND METHODS .....</b>	<b>31</b>
3.1 Study area .....	31
3.2 Data collection .....	32
3.3 Site selection and sampling .....	32
3.4 Analysis of samples .....	34
3.5 Data analysis .....	35
<b>CHAPTER 04: RESULTS AND DISCUSSION .....</b>	<b>36</b>
4.1 Variation of canal and well water quality at DI RB canal command area of Parakrama Samudraya .....	36
4.2 Electrical conductivity (EC) .....	38
4.3 Total Dissolved Solid (TDS) .....	40
4.4 Bicarbonate ( $\text{HCO}_3^-$ ) and Carbonate ( $\text{CO}_3^{2-}$ ) .....	42
4.5 Magnesium ( $\text{Mg}^{2+}$ ) .....	43
4.6 Calcium ( $\text{Ca}^{2+}$ ) .....	44
4.7 Phosphate content in water .....	45
4.8 Turbidity in the water .....	46
4.9 $\text{Ca}^{+2}/\text{Mg}^{+2}$ ratio .....	48
4.10 Nitrate ( $\text{NO}_3^{-2}$ ) concentration in water .....	49
4.11 Sodium ( $\text{Na}^+$ ) .....	50
4.12 Potassium ( $\text{K}^+$ ) .....	51
4.13 Sodium Adsorption Ratio (SAR) .....	51
4.14 Residual Sodium Carbonate (RSC) .....	53

4.15 Soluble Sodium Percentage .....	55
4.16 Salinity of water.....	56
4.2 Mean comparison of water quality parameters between canal and well water .....	57
<b>CHAPTER 05: CONCLUSION AND RECOMMENDATIONS .....</b>	<b>58</b>
5.1 CONCLUSIONS .....	58
5.2 SUGGESTIONS AND RECOMMENDATION .....	60
<b>REFERENCES .....</b>	<b>61</b>
<b>APPENDICES .....</b>	<b>71</b>