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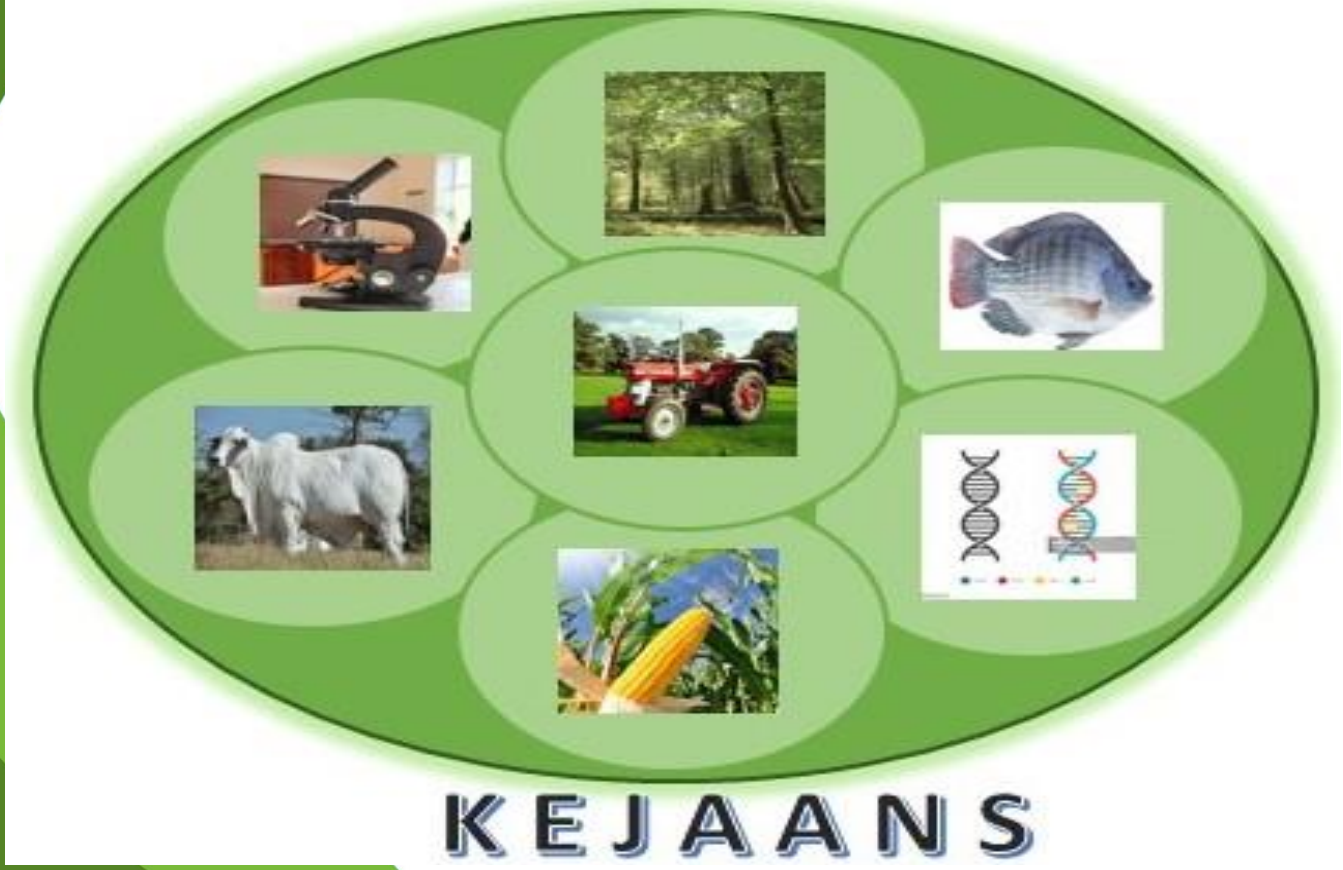

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About the Journal

This official scientific publication of the Faculty of Agriculture, Abdullahi Fodio University of Science and Technology Aliero, is a non-profit, open access, double-blind peer-reviewed Journal publishing four issues (January, April, July and October) per annum. The Journal is a platform open to collaborations with researchers, authors, institutions, research agencies and private companies related to Agriculture. The Mission of the Journal is to disseminate scientific knowledge through the publication of original research articles, research notes, book reviews, letters to the editor and reviews of Literature, representing a contribution to scientific and technological knowledge in respective areas covered by the Journal. The Kebbi Journal of Agriculture and Natural Sciences seeks to validate and disseminate new knowledge, making it public in order to strengthen the human capacity, constitute a link in the scientific community to the society and encouraging the expansion of University and academic researches.

Scope of Kebbi Journal of Agriculture and Natural Sciences (KEJAANS)

The Kebbi Journal of Agriculture and Natural Sciences has the sole aim of providing an intellectual platform and ideas for scholars, by promoting interdisciplinary studies related to agriculture and natural science through publishing the latest scientific research findings that are of direct policy implications and beneficial to the research community. Consequently, the journal covers all aspects of Crop Science, Animal Science, Agricultural Economics, Agricultural Extension and Rural Development, Food Science, Fisheries and Aquaculture, Biotechnology, Soil Science and Agricultural Engineering, Forestry and Environment, Wildlife, Agricultural Education, Agro-allied Industries as well as all Natural Science researches related to Agriculture.

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
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ASSESSMENT OF SEASONAL (WET AND DRY SEASON) IMPACT OF IRRIGATION WATER QUALITY INDICES IN SOME SELECTED LOCAL GOVERNMENT AREAS OF KEBBI STATE, NIGERIA

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ABSTRACT

This study aimed to assess the variation of salinity indices between wet and dry season of some selected local government areas of Kebbi State, Nigeria namely Augie, Bunza, Birnin Kebbi and Yauri in which irrigation water were sampled from the main sources of irrigation water areas like borehole water, stream water and mix of borehole and stream water. The result were analyzed appropriately by using laboratories materials, salinity indices; TDS, SAR, EC, NO_3^-, Cl^-, Mg^{2+}, Na^+ , Ca^{2+} were analyzed, Electrical Conductivity was determined by conductivity meter electrode, pH by the glass electrode method, Ca^{2+} and Mg^{2+} was estimated by EDTA titration method, while K^+ and Na^{2+} were determine by flame photometer. It was observed that the concentrations of some salinity indices in the study areas showed that in both two season are likely to be the same, the mean value of Calcium in Yauri area (1.56), Magnesium (1.53) , Sodium (0.75) , Potassium (0.75), NO_3 (5.87), SAR (0.78) , Cl (0.85) and SO_4 (0.94) of both three samples collected during dry and wet season in Yauri and Augie are the same at all the two seasons, the mean value of Electrical Conductivity (**23.76)** of borehole obtained during dry season is very higher while its least in stream water (**3.03)** at wet season in Yauri, in some cases electrical conductivity (EC) value of wet season are lower than the dry season ranges from slightly moderate and tilting towards severity across all the 3 sources irrespective of the location sampled.

Keywords**:** Seasonal; Wet; Dry; Impact; Irrigation; Water; Quality.

Introdution

The concentration and composition of soluble salt in water determine its quality for irrigation (Mohammad, 2018). Quality of irrigation water is an important consideration in any appraisal of irrigation schemes and especially in the saline or alkaline conditions in irrigated areas (Kahlown *et al.* 2006; Kahlown, 2002). All irrigation water contains some salt but the concentration and nature of salt vary. The quality of irrigation water depend primarily on the total amount of salt present and the proportion of Na^+ to other cations and certain other parameter. There is a growing human population in the world which means there is need for an increase in food production. However, food production to feed this growing population is decreasing due to poor agricultural practices Sanda *et al. (*2014).

To meet the increasing need for food production through irrigation, assessment of water quality is an essential factor of consideration before using it for irrigation

purposes; this is because poor quality irrigation water can adversely affect crop production as well as soil quality. The presence of soluble salts such as Ca, Mg, Na, and K in irrigation water may result to salinity and sodicity hazards. Poor quality irrigation water can also cause water turbidity, heavy metals pollution and presences of chemical constituents that can adversely affect soil quality and crop growing on it. Suitability of water for irrigation is determined by its chemical composition as regards to concentrations and types of soluble salts present. The chemical constituents of irrigation water can affect plant growth directly through toxicity or deficiency, or indirectly by altering plants available nutrients (Ayers and Wescot, 1985). Electrical conductivity (EC) is a good index of salinity hazard while sodium adsorption ratio (SAR) and residual sodium carbonate (RSC) indicate the sodium hazard in irrigation water. Quality of irrigation water varies from place to place and from season to season. The basis used for determining the suitability of water for irrigation includes chemical analysis requiring the determination of concentration of inorganic constituents such as chlorides, sulphate, nitrates, iron, and manganese and dissolved gases. Other indices include Electrical Conductivity (EC), Total Dissolved Solid (TDS), potassium (K), Calcium (Ca), Magnesium (Mg), pH and evaluation of Sodium Adsorption Ratio (SAR). For example the total dissolved solids (TDS) in water are considered to be good indicators of the overall suitability of water for many types of uses. Groundwater for irrigation purposes is classified based on per cent sodium as follows, groundwater with %Na of less than 20 is considered as excellent, if the %Na ranges 20-40, 40-60, 60-80 the groundwater is classified under good, permissible and doubtful, respectively where as a water with %Na value greater than 80 is a kind of unsuitable water for irrigation (Wilcox, 1955), (Ayers & Westcott 1976) as well as (FAO 1985) gave pH range of 6.0 – 8.4 as normal for irrigation water.

All water used for irrigation contain varying amount of salts**.** Salty irrigation water can cause two major problems in crop production; salinity hazard, and sodium hazard. When irrigation water is used by plants or evaporates from the soil surface, salts contained in the water are left behind and can accumulate in the soil. Foliar applications of salty water often cause marginal leaf burn and, in severe cases, can lead to defoliation and significant yield loss.

Materials and Methods

Study Area

The study was conducted in four distinct locations namely Augie (12^0 54’2’’N, 20 $36’2^0$’’E), Birnin Kebbi (12^0 27’14’’N, 4^0 11’51’’E), Bunza (12^0 5’3’’N, 4^0 1’15’’E), and Yauri (10^0 46’55’’N, 4^0 48’28’’E). The climate of the study area is classified as semi-arid equatorial Tropical, consisting of a long dry (October - May) and a short wet (June – September) season. Mean annual rain fall ranges from 860mm at Yauri to 690mm and 591mm at Augie, Birnin Kebbi and Bunza respectively.

Water Sample Collection and Procedure

The water samples were taken from the Bore holes, Streams, and Bore holes + Streams water from irrigation farms in Yauri, Bunza, Augie, and Birnin Kebbi local government areas. The water from River Niger was collected at three different points of 200m intervals and the surface water sample was mixed to have a representative surface water sample. The sub-surface water bore-hole in irrigation farms was also collected at three different point of 200m interval and the sub-

surface water sample were mixed to have a representative sub-surface water sample. The parameters that will be measured as indices for irrigation water quality include (EC) total dissolved solids (TDS), pH, Calcium, (Ca^{2+}), Magnesium (Mg^{2+}), sodium (Na^{+}), Potassium (K^{+}), Boron, sodium adsorption ratio(SAR), nitrate (NO_3), and chloride (Cl^{-}). Standard laboratory techniques were used to evaluate the concentrations of the above mentioned parameters, thereafter guidelines for interpretation of water quality for irrigation (Ayers and Westcot, 1985; 1994) was used to discuss the results of this work.

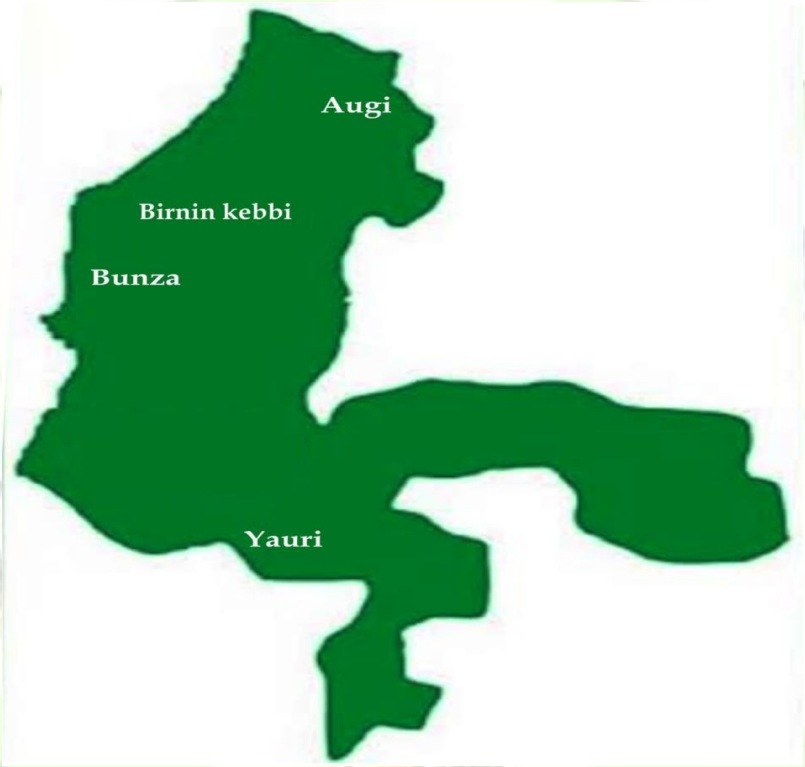

Figure 1: Map of Kebbi State showing the study area.

The parameters measured for the water quality were; Electrical conductivity (EC), pH, Ca^{2+} ,Mg^{2+} , Na^{+} , K^{+} , Sodium adsorption ratio (SAR). Electrical Conductivity was determined by conductivity meter electrode, pH by the glass electrode method, Ca^{2+} and Mg^{2+} was estimated by EDTA titration method, while K^{+} and Na^{2+} was determine by flame photometer. Sodium Adsorption Ratio by calculation using the (USSL, 1954) formula:

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

Nitrate was determined by EDTA titration method with 0.005N sulphuric acid

Data Analysis

The data obtained were subjected to descriptive statistics, using sample statistical tools such as means, ranges, and percentages.

Results and Discussions

The results of this study in both wet and dry season which shows the variation between some selected local government areas of Kebbi State namely; Bunza, Augie, Yauri and Birnin Kebbi were presented on Table 5 to 7 and table 1 as a guideline for the interpretations of the finding and other relevant literature that could also be cited. Tables 2 and 3 shown the amounts of temperature, rainfall and wind speed, while Table 4 mean variation of temperature, rainfall and wind speed of 2019 and 2020 (Wet and Dry Season) of the study areas

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Table 1. Guidelines for interpretation of water quality for irrigation (Ayers and Westcot, 1985; 1994)

Potential Irrigation Problem		Degree of restriction on Use		
		None	Slight to Moderate	Severe
ECw (dS m-1)		<0.7	0.7 – 3.0	>3.0
TDS (mg L-1)		<450	450 – 2000	>2000
Infiltration (Evaluate using EC_w and SAR together)				
SAR meq/L &	=0 –3	>0.7	0.7 – 0.2	<0.2
ECw (dS m-1)	=3 –6	>1.2	1.2 – 0.3	<0.3
together	=6–12	>1.9	1.9 – 0.5	<0.5
	=12– 20	>2.9	2.9 – 1.3	<1.3
	=20– 40	>5.0	5.0 – 2.9	<2.9
Specific ion toxicity (affects sensitive crops)				
Sodium		< 3	> 3	
Chloride		< 4	4 – 10	>10
Nitrogen		< 5	5 – 30	> 30

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
January, 2026: Volume 2, Issue 1: 96-107
p-ISSN: 3122-0584

Table 2. Mean temperature (°c), rainfall (mm) and wind speed (m/s) of the study area for the year 2019

Months	Temperature °c	Rainfall(mm)	Windspeed(m/s)
January	24.6	0	0.4
Febuary	26.2	0	0.5
March	31.9	0	0.3
April	34.1	0	0.3
May	32.1	50	0.6
June	29.5	79	0.4
July	27.1	91.6	0.5
August	26.2	165.6	0.1
September	27.6	77.4	0.1
October	27.2	73.3	0
November	27.5	0	0.1
December	24.5	0	0.3

Table 3. Mean temperature (°c), rainfall (mm) and wind speed (m/s) of the study area for the year 2020

Months	temperature	Rainfall	Windspeed
January	24	0	0.5
February	26.3	0	0.6
March	31.7	0	0.3
April	34.2	11.8	0.2
May	33.5	9.6	0.3
June	30.6	11.2	0.4
July	27.5	86.2	0.2
August	26.3	28.6	0.4
September			
October			
November	37	0	0
December	26	0	0

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
January, 2026: Volume 2, Issue 1: 96-107
p-ISSN: 3122-0584

Tables 4. Variation mean of temperature, rainfall and windspeed between 2019 and 2020 (Wet and Dry Season)

Months	temperature		Rainfall		Windspeed	
	Wet	Dry	Wet	Dry	Wet	Dry
January	24.6	24	0	0	0.4	0.5
February	26.2	26.3	0	0	0.5	0.6
March	31.9	31.7	0	0	0.3	0.3
April	34.1	34.2	0	11.8	0.3	0.2
May	32.1	33.5	50	9.6	0.6	0.3
June	29.5	30.6	79	11.2	0.4	0.4
July	27.1	27.5	91.6	86.2	0.5	0.2
August	26.2	26.3	165.6	28.6	0.1	0.4
September	27.6		77.4		0.1	
October	27.2		73.3		0	
November	27.5	37	0	0	0.1	0
December	24.5	26	0	0	0.3	0

Table 5. Show the main salinity indices concentrations of irrigation water tested in Bunza such as EC, TDS, SAR, Cl, Na, Ca, and Mg. The means value of salinity indices of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Bunza local government areas range from 2.26 to 411.77 (Na and TDS) and 0.69 to 116.73 (Cl and EC) where none to severe and none to moderate respectively when compared to the guideline for interpretation of water quality for irrigation (Ayers and Westcot, 1985; 1994), TDS <450 none, 450-2000 moderate, Cl <4 none and EC < 0.7 none, 0.7-3.0 moderate and >3.0 is severe.

Total Dissolved Solid of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Bunza local government areas. Result obtained shows that TDS obtained during dry season is lower when compared with one of wet season with stream having the highest value of TDS, followed by borehole+stream and the least obtained at bore hole in both seasons. Calcium of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Bunza government areas. Result obtained shows that Ca obtained during dry season is high when compared with one of wet season with borehole+stream having the highest value of Ca, followed by stream and the least obtained at bore hole, Higher number Calcium in both seasons. Magnesium, Sodium, Potassium, NO3, SAR, Cl and SO4 of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Bunza government areas. Result obtained shows that they're the same in both season.

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
January, 2026: Volume 2, Issue 1: 96-107
p-ISSN: 3122-0584

Table 5. Mean Salinity indices concentration in irrigation water (mg/L) of Bunza at 3 different sources

Seasons	Area	EC	TDS	Ca	Mg	Na	K	SAR
Dry season	Bore hole	42.36	27.57	1.47	1.42	0.75	0.75	0.73
	Stream	57.36	36.97	1.67	1.56	0.77	0.77	0.72
	Borehole+stream	51.02	32.90	1.69	1.59	0.77	0.77	0.72
	Total mean value	**116.73**	**75.51**	**3.70**	**1.52**	**0.76**	**0.76**	**0.72**
Wet season	Borehole	3.36	427.57	1.47	1.42	0.75	0.75	0.73
	Stream	2.36	536.97	1.67	1.57	0.77	0.77	0.72
	Borehole & Stream	1.02	332.90	1.69	1.59	0.77	0.77	0.71
	Total Mean value	**2.25**	**432.29**	**1.70**	**1.52**	**0.76**	**0.76**	**0.72**

Electrical conductivity (EC), Calcium (Ca) , magnesium (Mg), Sodium (Na), Potassium (K), Chlorine (Cl). Nitrite (NO_3), Sulphate (SO_4), Sodium adsorption ratio (SAR)

Table 6. shows the salinity indices of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Birnin Kebbi areas. Result obtained shows that EC obtained during wet season is high, when compared with dry season where bore hole having the highest value of EC, followed by stream and the least obtained at borehole+stream. High EC obtained during wet season may be as a result of high level of soluble salt obtained in bore hole which is a result of washing away of salt based fertilizer from soil surface into stream resulting in higher concentration of soluble salt. EC of both wet and dry season obtained range from 2.32 to 3.32 and 18.65 to 22.32 respectively.

Total Dissolved Solid of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Birnin Kebbi government areas. Result obtained shows that TDS obtained during wet season is high when compared with one of dry season with stream having the highest value of TDS, followed by borehole and the least obtained at borehole + Stream in both seasons. Calcium of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Birnin Kebbi government areas. Result obtained shows that Ca obtained during dry season is high when compared with one of wet season with stream having the highest value of Ca, followed by bore hole and the least obtained at bore hole + Stream in both seasons. Magnesium of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in B government areas. Result obtained shows that Ca obtained during wet season is high when compared with dry season with bore hole having the highest value of Mg, followed by stream and the least obtained at bore hole + Stream in both seasons.

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
January, 2026: Volume 2, Issue 1: 96-107
p-ISSN: 3122-0584

Table 6. Mean Salinity indices concentration in irrigation water (mg/L) of Birnin Kebbi at 3 different sources

Seasons	Area	EC	TDS	Ca	Mg	Na	K	SAR
Dry Season	Borehole	22.32	12.08	1.30	1.35	0.85	0.65	0.68
	Stream	18.65	10.09	1.37	1.19	0.66	0.67	0.67
	Borehole&Stream	20.32	13.16	1.05	1.12	0.66	0.66	0.60
	Total mean value	**20.43**	**11.78**	**11.78**	**1.22**	**0.65**	**0.66**	**0.65**
Wet Season	Borehole	3.32	412.08	1.30	1.35	0.64	0.65	0.68
	Stream	2.65	510.09	1.37	1.19	0.66	0.67	0.67
	Borehole & Stream	2.32	313.16	1.05	1.12	0.66	0.66	0.60
	Total mean value	**2.76**	**411.77**	**4.67**	**4.60**	**2.26**	**2.28**	**2.35**

Table 7. shows the salinity indices of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Augie government areas. Result obtained shows that EC obtained during dry season is higher compared with wet season with Bore hole having the highest value of EC, followed by borehole stream and the least obtained at stream. Higher number EC obtained during dry season may be as a result of high level of soluble salt obtained in stream which is a result of washing away of salt based fertilizer from soil surface into stream resulting in higher concentration of soluble salt or may be as a result of warm dry winds causes lots of evaporation, this evaporation removes water when water vapour rises into the atmosphere, it leaves the salt behind as water continues flow from the souses it continuous and salt to the water and soil. Low value obtained during wet season may be as a result of high rate of dilution due to rainfall thereby decreasing soluble salt concentration. EC of both dry and wet season obtained range from 37.78 to 57.11 and 2.45 to 3.78 respectively.

Total Dissolved Solid of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Augie government areas. Result obtained shows that TDS obtained during dry season is lower when compared with one of wet season with stream having the highest value of TDS, followed by borehole+stream and the least obtained at bore hole in both seasons. Calcium of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Augie government areas. Result obtained shows that Ca obtained during wet season is high when compared with one of dry season with borehole+stream having the highest value of Ca, followed by stream and the least obtained at bore hole, Higher number Calcium in both seasons.

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
January, 2026: Volume 2, Issue 1: 96-107
p-ISSN: 3122-0584

Table 7. Mean Salinity indices concentration in irrigation water (mg/L) of Augie at 3 different sources

Season	Area	EC	TDS	Ca	Mg	K	Na	SAR	NO_3	Cl	SO_4
Dry season	Bore hole	57.11	38.83	1.58	1.59	0.85	0.85	0.85	4.78	0.79	0.73
	Stream	37.78	24.46	1.66	1.40	0.86	0.86	0.88	5.68	0.80	0.77
	Borehole & Stream	42.45	27.45	1.65	1.69	0.86	0.87	0.88	6.85	0.84	0.85
	Total mean value	45.78	30.25	1.63	1.56	0.86	0.86	0.87	5.77	0.81	0.78
Wet season	Borehole	3.31	338.83	1.58	1.59	0.85	0.85	0.85	4.78	0.79	0.73
	Stream	3.78	524.46	1.59	0.40	0.86	0.86	0.80	5.68	0.80	0.77
	Borehole & Stream	2.45	427.45	1.65	0.69	0.86	0.87	0.80	6.85	0.84	0.85
	Total mean value	3.18	430.0	91.6	1.56	0.86	0.86	0.87	5.77	0.81	0.78

Table 8. shows the salinity indices of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Yauri government areas. Result obtained shows that EC obtained during dry season is higher compared with wet season with bore hole having the highest value of EC, followed by borehole +stream and the least obtained at stream. Higher number EC obtained during dry season may be as a result of high level of soluble salt obtained in stream which is a result of washing away of salt based fertilizer from soil surface into stream resulting in higher concentration of soluble salt or may be as a result of warm dry winds causes lots of evaporation, this evaporation removes water when water vapour rises into the atmosphere, it leaves the salt behind as water continues flow from the souses it continuous and salt to the water and soil. Low value obtained during wet season may be as a result of high rate of dilution due to rainfall thereby decreasing soluble salt concentration. EC of both dry and wet season obtained range from 21.65 to 26.32 and 2.65 to 3.32 respectively.

Total Dissolved Solid of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Yauri government areas. Result obtained shows that TDS obtained during wet season is high compared with dry season with stream having the highest value of TDS, followed by borehole+stream and the least obtained at bore hole in both seasons Calcium, Magnesium, Sodium, Potassium, NO_3, SAR, Cl and SO_4 of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Yauri government areas. Result obtained shows that they're the same in both Season.

KEBBI JOURNAL OF AGRICULTURE AND NATURAL SCIENCES (KEJAANS)
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Table 8. Mean Salinity indices concentration in irrigation water (mg/L) of Yauri at 3 different sources

Season	Area	EC	TDS	Ca	Mg	K	Na	SAR	NO_3	Cl	SO_4
Dry season	Borehole	26.32	17.08	1.45	1.39	0.74	0.75	0.78	4.54	0.85	0.93
	Stream	21.65	14.09	1.67	1.59	0.76	0.77	0.77	6.48	0.86	0.94
	Borehole & Stream	23.32	15.16	1.55	1.62	0.76	0.76	0.80	6.58	0.85	0.95
	Total mean value	23.76	15.44	1.56	1.53	0.75	0.75	0.78	5.87	0.85	0.94
Wet season	Borehole	3.32	417.1	1.45	1.39	0.74	0.75	0.78	4.54	0.85	0.93
	Steam	2.65	514.1	1.67	1.59	0.76	0.77	0.77	6.48	0.86	0.94
	Borehole & Stream	3.12	315.1	1.55	1.62	0.76	0.76	0.80	6.58	0.85	0.95
	Total mean value	3.03	415.4	1.56	1.53	0.75	0.75	0.78	5.87	0.85	0.94

The means value of salinity indices of both three samples areas; bore hole, stream and bore hole + stream during dry and wet season in Bunza local government areas range from 2.26 to 411.77 (Na and TDS) and 0.69 to 116.73 (Cl and EC) where none to severe and none to moderate respectively when compared to the guideline for interpretation of water quality for irrigation (Ayers and Westcot, 1985; 1994), TDS <450 none, 450-2000 moderate, Cl <4 none and EC < 0.7 none, 0.7-3.0 moderate and >3.0 is severe.

The means of salinity indices of both three samples areas; during dried and wet season in Augie local government areas range from 0.78 to 430.0 (SO_4 and TDS) and 0.78 to 45.78 (SO_4 and EC) where none to severe and none to severe respectively when compared to the guideline for interpretation of water quality for irrigation (Ayers and Westcot, 1985; 1994), EC <0.7 none, 0.7-3.0 moderate and >3.0 is severe.

The means of salinity indices of both three samples areas; bore hole, stream and bore hole + stream during dried and wet season in Yauri local government areas range from 0.75 to 415.44 (Na/K and TDS) and 0.75 to 23.76 (Na/K and EC) where none to severe and none to Severe respectively when compared to the guideline for interpretation of water quality for irrigation (Ayers and Westcot, 1985; 1994), TDS <450 none, 450-2000 moderate, Cl <4 none and EC < 0.7 none, 0.7-3.0 moderate and >3.0 is severe.

The means of salinity indices of both three samples areas; during dried and wet season in Birnin

Kebbi areas range from 0.65to 20.43(Na and EC) and 2.26 to 411.77 (Na and TDS) where none to severe and none to severe respectively when compared to the guideline for interpretation of water quality for irrigation (Ayers and Westcot, 1985; 1994), TDS <450 none, 450-2000 moderate, Cl <4 none and EC < 0.7 none, 0.7-3.0 moderate and >3.0 is severe.

In general, viewed that the two season is indicate salinity differences where by some indices are similar without variation e. g Augie have the same value of SO_4 (0.78) with differences TDS value wet (430.0) and dried season (45.78). And in some cases electrical conductivity(EC) value of wet season are lower than dry once, this may be as the result of warm temperature, heavy winds and high water evaporation and once

the water vapor rises into the atmosphere, it leaves some contents of salt behind, continues adding water may also continuous evaporate and definitively the concentration of salt its increase in water and soil.For the temperature during wet and dry season range from 24.5 (December 2019) to 34.1 (April 2019) and 24.0 (January 2020) to 34.2 (April 2020) which is their high temperature in both season at month of April (34.2), Rainfall value during wet and dry season range from 0.0 (January-April an November - December) to 165.6 (August) and 0.0 (January – March) to 86.2 (July), Wind speed value for season range from 0.0 (October) to 0.6 (May) and 0.0 (November –December) to 0.6 (February) respectively.

Conclusion

The results of the variation under two season shows that wet season has high TDS value in both areas but with high concentration of EC in dry, these shown that there's presented of salinity in all season of years its thus that wet season has less of EC with high TDS value vice versa. salinity water reduces the yield of plant this is because at its stress to absorb moisture and nutrients on the top soil and become unable to produced high amount of plant, very high salinity water it is not suitable for irrigation under normal conditions, but may be used occasionally under very special circumstances with little likelihood that soil salinity will develop.

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