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Evaluation of normal and saline irrigation water on chemical properties of soil in district Kannauj, Uttar Pradesh

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Abstract
The field experiment was conducted during the year 2016 and 2017 at village Jasaura district Kannauj, Uttar Pradesh. Soil samples were collected from 0 -15, 15 – 30 and 30 – 45 cm depth from the field by soil augur. The result was carried out the mean values of pH, (g moles L^{-1}), electrical conductivity (EC) dSm^{-1},carbonate (CO_3^{2-}), bicarbonate (HCO_3), chloride (Cl_2), varied from 7.53 – 7.93, 1.08 – 1.38, 00 – 0.0, 1.23 – 1.70, 1.70 – 2.13, $meql^{-1}$ in pre-sowing maize field whereas; lowest and highest values of above constituents were found (T_1 7.53 – T_2 7.87) and (T_1 7.57 – T_2 7.93), (T_1 1.08 – T_2 1.28) and (T_1 1.08 – T_2 1.38), (T_1 00 – T_2 00) and (T_1 nil – T_2 nil) (T_1 nil – T_2 0.50), (T_1 1.23– T_2 1.57) and (T_1 1.30 – T_2 1.70), (T_1 1.70 – T_2 1.93) and (T_1 1.70 – T_2 2.13) in post harvest maize field respectively.

Keywords: pH, EC, carbonate, bicarbonate, chloride**,** groundwater, geologic formations, aquifers, salinity

Introduction
Groundwater is the most important natural resource to domestic, industrial and agricultural purpose in the world. It has significant role in building the economy of nation. It is the main source for drinking, irrigation and food industry. In general groundwater is a reliable source for agriculture. Globally, groundwater irrigation accounts for more than 70% of total water with draw (both surface and groundwater). Groundwater is found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks are called aquifers. Aquifers are typically made up of gravel, sand, sandstone or fractured rock, like limestone. Water can move through these materials because they have large connected spaces that make them permeable. The speed of groundwater flows depends upon the size of pore spaces in soil or rock. Ground waters in arid and semi-arid regions often contain high concentrations of soluble salts and the continuous use of such waters for irrigation increases salinity and exchangeable Na in the soil. Various standards have been developed to determine the salinity on the basis of their salt concentration and ionic composition U.S. Salinity Laboratory Staff (1954) [20].

Materials and Methods
Study area: The Kannauj district lies between 27^0 07’ latitude and 79^0 92’ longitudes, average height from mean sea level is 456 feet’s and total geographical area is 2093 sq km. The district Kannauj is surrounding by many districts like Kanpur-Nagar, Hardoi, Etawah, Auraiya, Mainpuri, Kanpur Dehat and Farrukhabad. The Ganga River is divided Kannauj & Hardoi district. The study area is lies within the district between 27^0 04’ - 79^0 48’ latitude and longitudes. Maize; paddy, Wheat; potato and Sunflower are most popular agricultural crops grown in village. The soil texture of this site was found sandy loam to loam.

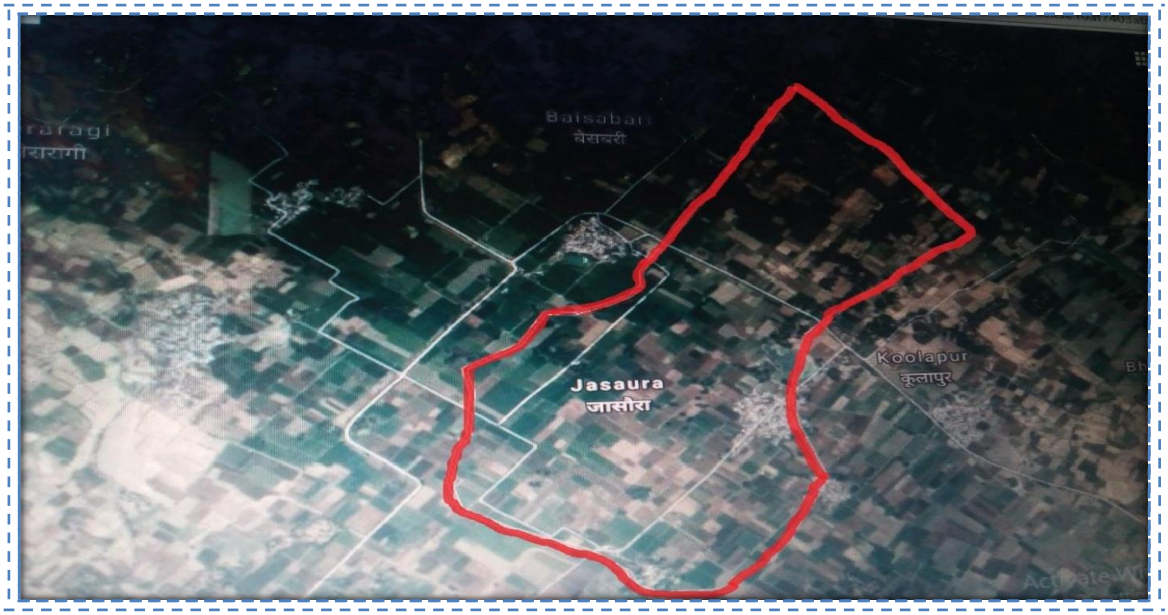

Table 1: Description of experimental layout

Experimental details	
Year of commencement	5 March 2016 and 5 March 2017
Location	Village: Jasaura district Kannauj
Recommended dose of fertilizers	150: 60:40 (N: P: K) Kg ha^{-1} + 20 Kg $ZnSO_4$. $7H_2O$ + 10 tonne FYM
Variety	Hybrid Maize *variety* DeKalb 9108 plus
Spacing	60 x 30cm
No. of irrigations-	6
Design	RBD
Replication:	4
Plot size	2.5 x 2= 5 M^2
Net area	160 M^2

Table 2: Treatment combinations

T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
NW	SW	3NW:3SW	3SW:3NW	4NW:2SW	4SW:2NW	5NW:1SW	5SW:1NW

NW- Normal Water SW- Saline Water

Requirement: Wooden hammer, electronic balance, and oven, sieve, beaker, measuring cylinder, glass rod, shaker, hot plate, water bath, burette, pipette, burette stand, pH and electrical conductivity meter, chemicals and indicators etc.

Result and Discussion

In Table 3.0 the mean values of pH, electrical conductivity, carbonate, bicarbonate and chloride in pre-sowing maize field varied from 7.53 – 7.63, 1.05 – 1.19, 0.0 – 0.0, 1.23 – 1.50 and 1.67 – 1.90 mql^{-1} respectively. The mean values of above chemical constituents were found slightly increased from previous to final year.

Table 3: pH, EC, CO_3, HCO_3 and Cl values pre-sowing of maize field

Year	Mean Values				
	pH	ECe (dSm^{-1})	CO_3	HCO_3	Cl
2016	7.53	1.05	0.0	1.23	1.67
2017	7.63	1.19	0.0	1.50	1.90

Table 4: pH, electrical conductivity, carbonate, bicarbonate and chloride ($meql^1$) concentration in post harvest of maize field in 2016

Treatments	Mean Values				
	pH	EC	CO_3	HCO_3	Cl
T_1	7.53	1.08	0.0	1.27	1.70
T_2	7.87	1.28	0.0	1.57	2.03
T_3	7.63	1.15	0.0	1.37	1.80
T_4	7.70	1.17	0.0	1.40	1.83
T_5	7.60	1.12	0.0	1.33	1.77
T_6	7.63	1.12	0.0	1.30	1.77
T_7	7.57	1.10	0.0	1.30	1.73
T_8	7.83	1.23	0.0	1.23	1.93
C. D at 5%					
Ai.- Aj. (Soil Depth)	0.04724	0.01215		0.01049	0.02681
Bi.- Bj. (Water Quality)	0.07714	0.01985		0.01713	0.04378
AiBi-AiBj	0.13360	0.03437		0.02966	0.07584
AiBi-AjBi	0.13360	0.03437		0.02966	0.07584

In Table 4.0 the mean values of pH, electrical conductivity, carbonate, bicarbonate and chloride in post-harvest maize field in 2016 varied from 7.53 – 7.87, 1.08– 1.28, 0.0 – 0.0, 1.23 – 1.57 and 1.70 – 2.03 mql^{-1} respectively. The lowest and highest values of above constituents were found in treatment T_1 and T_2 but lowest value of bicarbonate were examined in treatment T_8.

Table 5: pH, electrical conductivity, carbonate, bicarbonate and chloride ($meql^1$) concentration in post harvest of maize field in 2017

Treatments	Mean Values				
	pH	EC	CO_3	HCO_3	Cl
T_1	7.57	1.08	0.0	1.30	1.70
T_2	7.93	1.38	0.0	1.70	2.13
T_3	7.67	1.20	0.5	1.47	1.90
T_4	7.70	1.21	0.0	1.50	1.93
T_5	7.70	1.17	0.0	1.43	1.87
T_6	7.63	1.17	0.0	1.53	1.87
T_7	7.60	1.10	0.0	1.40	1.77
T_8	7.83	1.25	0.0	1.57	2.00
C. D at 5%					
Ai.- Aj. (Soil Depth)	0.07874	0.01411		0.01415	0.02038
Bi.- Bj. (Water Quality)	0.12858	0.02304		0.02311	0.03328
AiBi-AiBj	0.22271	0.03991		0.04003	0.05764
AiBi-AjBi	0.22271	0.03991		0.04003	0.05764

In Table 5.0 the mean values of pH, electrical conductivity, carbonate, bicarbonate and chloride in post harvest maize field in 2017 varied from 7.57– 7.93, 1.08– 1.38, 0.0 – 0.5, 1.30 – 1.70 and 1.70 – 2.13 mql^{-1} respectively. The lowest and highest values of these constituents were reported in treatment T_1 and T_2.

Similarly results were reported by Justin and Mark (2016) [11], Hailu *et al.,* (2015) [9], Hossain *et al.,* (2015) [10], Khuhro *et al.,* (2014) [12], Bhuyan *et al.,* (2014) [6], Nath (2014) [16], Aderoju and Festus (2013) [2], Sannappa and Manjunath (2013) [17], Sarmah *et al.,* (2013) [18], Verma and Kumar (2012), Aechra (2017) [3], Arast (2017) [4], Leogrande *et al.,* (2016), Zhang *et al.,* (2016), Chaudhari (2017), Shafiq and Saleem (2013) [19], Leogrande *et al.,* (2012) [14], Bhajwa *et al.,* (1992) [5]. Kumar *et.al* (2016). Adamu (2013) [1], Boxma, R. (1972) [7].

Conclusion

Soil pH were ranged from 7.53 - 7.63, 7.53 - 7.87 and 7.57 - 7.93 g moles L^{-1}. The highest (7.87-7.93) and lowest (7.53-7.57) pH was found in treatment T_2 and T_1 in the both years. Electrical conductivity varied from 1.05 - 1.19, 1.08 - 1.28 and 1.08 -1.38 dSm^{-1}. The maximum (1.28-1.38 dSm^{-1}) and minimum (1.08 dSm^{-1}) EC was investigated in treatment T_2 and T_1. Carbonate concentration not detected in pre-sowing and post-harvest maize field in 2016 whereas, in the final year carbonate was only found in treatment T_2 (1.0 and 0.5 Meq L^{-1}) with respective depth 0 -15 and 15 - 30 cm respectively. Bicarbonate concentration were ranged from 1.23 - 1.50, 1.23 - 1.57 and 1.30- 1.70 Meg L^{-1}. The highest (1.57) and lowest (1.23) bicarbonate concentration was examined in treatment T_2 and T_8 in the previous year whereas, in the second year was found highest and lowest in treatment T_2 (1.70) and (1.30) T_1 Chloride concentration were ranged from 1.67 - 1.90, 1.70 - 2.03 and 1.70 -2.13 Meq L^{-1} The highest and lowest chloride concentration was seen in treatment T_2 and T_1 in the both years respectively. These data were obtained in pre-sowing and post-harvest maize field of 2016 and 2017.

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