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Impact 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 sulphate ($SO4^{2-}$), nitrate-nitrogen (NO_3-N), boron varied from 0.77 – 0.98, 0.30 – 0.63 and 0.19 – 0.23 $meql^{-1}$ whatever; lowest and highest values of above constituents were found in treatments T_1 and T_2 previous to final year respectively.

Keywords: Sulphate, nitrate-nitrogen, boron, salt stress, remobilized, nutritional imbalance, accumulation, photosynthesis, respiration, starch metabolism and nitrogen fixation

Introduction
In Northern India about 70 % of the total rain falls during the monsoon period i.e. in the months of July to September. In this region the underground sources of irrigation waters contain high amounts of carbonates and bicarbonates of sodium Bajwa *et al.* (1974) [3]. The high osmotic stress due to low external water potential, ions toxicity by sodium and chloride, or imbalanced nutrition due to interference with the uptake and transport of essential nutrients are three potential effects of salt stress on crop growth. The latter may not have an immediate effect because plants have some nutrient reserves which can be remobilized Flowers and Flowers (2005) [6]; Munns *et al.*, (2006) [9].
Osmotic stress is linked to ion accumulation in the soil solution, whereas nutritional imbalance and specific ion effects are connected to ion buildup, mainly sodium and chloride, to toxic levels which interferes with the availability of other essential elements such as calcium and potassium El–Bassiouny and Bekheta (2001) [5]; Munns *et al.* (2006) [9]; and Hussain *et al.* (2013) [7]. Toxic levels of sodium in plant organs damage biological membranes and sub cellular organelles, reducing growth and causing abnormal development before plant mortality Davenport *et al.* (2005) [4]; Quintero *et al.* (2007) [10]. Several physiological processes such as photosynthesis, respiration, starch metabolism, and nitrogen fixation are also affected under saline conditions leading to losses in crop productivity.

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 ZnSO4. 7H2O + 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 M2
Net area	160 M2

Table 2: Treatment combinations

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

NW- Normal Water, SW- Saline Water

Constituents	Method
Sulphate	gravimetric method after precipitation as $BaSO_4$ -A.O.A.C. (1950) [1]
Nitrate-nitrogen	Kjeldalh distillation in the presence of Devedra alloy - A.O.A.C. (1950) [1]
Boron	Yoshida and Yoshida (1964) [15]

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

Sulphate, nitrate-nitrogen and boron concentration in soil

In the table 4 mean values of sulphate, nitrate-nitrogen and boron concentrations in soil extract of pre-sowing maize field were ranged from 0.82 – 0.86, 0.30 – 0.40 and 0.18 – 0.21 $meql^{-1}$ respectively. The value of sulphate, nitrate-nitrogen and boron were found increased from previous to final year.

Table 4: Sulphate, nitrate-nitrogen and boron concentration ($meql^{-1}$) pre-sowing of maize field

Year	Sulphate	Nitrate-nitrogen	Boron
2016	0.82	0.30	0.18
2017	0.86	0.40	0.21

Table 5: Sulphate, nitrate-nitrogen and boron ($meql^{1}$) concentration post harvest of maize field in 2016

Treatments	Mean Values		
	Sulphate	Nitrate-nitrogen	Boron
T_1	0.77	0.30	0.19
T_2	0.94	0.53	0.22
T_3	0.82	0.40	0.20
T_4	0.82	0.40	0.21
T_5	0.81	0.37	0.19
T_6	0.85	0.37	0.19
T_7	0.79	0.33	0.19
T_8	0.91	0.47	0.21
CD at 5%			
Ai.- Aj. (Soil Depth)	0.00987	0.00504	0.00184
Bi.- Bj. (Water Quality)	0.01612	0.00823	0.00301
AiBi-AiBj	0.02792	0.01426	0.00521
AiBi-AjBi	0.02792	0.01426	0.00521

In the Table 5 the mean value of sulphate, nitrate-nitrogen and boron in soil extract were from 0.77 – 0.94, 0.30 – 0.53 and 0.19 – 0.22 $meql^{-1}$ respectively. The lowest and highest value of sulphate, nitrate-nitrogen and boron were determined in treatment T_1 and T_2. The value of sulphate, nitrate-nitrogen and boron was observed repeated in treatment T_3, T_4 and T_3, T_4 T_5, T_6 and T_1, T_5, T_6, T_7, T_4, T_8 respectively.

Table 6: Sulphate, nitrate-nitrogen and boron ($meql^{1}$) concentration post harvest of maize field in 2017

Treatments	Mean Values		
	Sulphate	Nitrate-nitrogen	Boron
T_1	0.81	0.33	0.20
T_2	0.98	0.63	0.23
T_3	0.86	0.50	0.21
T_4	0.87	0.43	0.21
T_5	0.82	0.40	0.20
T_6	0.86	0.43	0.21

T_7	0.82	0.33	0.20
T_8	0.95	0.50	0.21
CD at 5%			
Ai.- Aj. (Soil Depth)	0.00668	0.00359	0.00307
Bi.- Bj. (Water Quality)	0.01091	0.00586	0.00502
AiBi-AiBj	0.01890	0.01015	0.00870
AiBi-AjBi	0.01890	0.01015	0.00870

As depicted in Table 6 the mean value of sulphate, nitrate-nitrogen and boron in soil extract were varied from 0.81 – 0.98, 0.33 – 0.63 and 0.20– 0.23 $meql^{-1}$ respectively. The value of sulphate, and boron was observed repeated in treatment T_5, T_7. The value nitrate-nitrogen was found not repeated in treatments in T_2 and T_5. The value boron was found similar in treatments in T_1, T_5, T_7, $T_3T_4T_6$, T_8 except in treatment T_2. Similar trends were reported by Adamu (2013) [2], St. Leuce *et al.* (2013) [13], St. Leuce *et al* (2011) [12], Safi *et al.*, (2018) [11], Walter *et al.*, (2016) [14].

Conclusion

Sulphate, nitrate-nitrogen and boron in soil extract was calculated by gravimetric method after precipitation as $BaSO_4$ -A.O.A.C. (1950) [1], Kjeldalh distillation in the presence of Devedra alloy - A.O.A.C. (1950) [1] and Yoshida and Yoshida (1964) [15] methods. Sulphate ($SO4^{2-}$), nitrate-nitrogen (NO_3-N), boron varied from 0.77 – 0.98, 0.30 – 0.63 and 0.19 – 0.23 $meql^{-1}$ whatever; lowest and highest values of above constituents were found in treatments T_1 and T_2 respectively. Sulphate, nitrate-nitrogen and boron were found increased from previous to final year

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