Analysis On Salt Affected Soil With Special Reference To Water Environment Of Eastern Uttar Pradesh, India

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ABSTRACT:
Exhaustive studies showed that any assessment of saline or alkaline conditions, as well as any wise agricultural planning in an irrigated area, must take water quality into account. The soils under research were also extensively watered by tube wells, canals, wells, rivers, ponds, and hand pumps, which had a detrimental effect on seedling germination and growth. As a result, there should be a significant increase in the investigation of irrigation water quality. It is common knowledge that the kind and quantity of dissolved salts affect the quality of irrigation water. In this article, analysis on salt affected soil with special reference to water environment of eastern Uttar Pradesh, India has been discussed.

Keywords: Salt, Soil, Water, Environment, Eastern Uttar Pradesh

INTRODUCTION:
In dry and semi-arid regions, crop productivity is seriously threatened by salinity, an issue with irrigated agriculture. [1-2] According to estimates, the country's 7 million hectares of land have been negatively impacted by salt and alkali infestations of varying degrees of severity. It is estimated that around 2.5 million hectares of land in the three Indian states of Punjab, Haryana, and the U.P. are affected by salinity and alkalinity. There are around 1.2 million hectares in the U.P. that are affected by salinity and alkalinity. The districts most severely impacted are those found in the Ganga-Yamuna and Ganga-Gomti doabs' extension half, which extend all the way up to Eastern U.P., including Varanasi and Jaunpur. [3-5] Many sections of these "problem soils" are completely desolate in the Gangetic alluvial plain of Uttar Pradesh. Due to improper application techniques, poor irrigation water quality, and restricted drainage, the area of this type of land is continuously expanding. Either very little or very little crop is produced in these regions.
Despite the many research and studies done across the nation, the issue has not even come close to being solved, and millions of acres continue to be uncultivated and barren. Studying the status of critical micronutrients in saline and alkaline soils is especially crucial since some of these soils may have hazardous levels of some micronutrients and insufficient levels of others. [6]
In irrigated agriculture, the ability to predict how irrigation water will affect soil is also crucial because the changes in soil properties that result from irrigation may be advantageous or harmful depending on the concentration and nature of the dissolved constituents of the water and the initial characteristics of the soil. [7] The dissolved salts in irrigation water have a dual impact on the soil, affecting both the cations in the exchange complex as well as the concentration and make-up of the soil solution. [8] It is occasionally necessary to take into account the link that exists between specific ions as well as between their concentrations. [9] It is suggested that the current standards for the classification of irrigation water should be revised in light of varying soil and crop factors because soils vary greatly in regard to their various physicochemical properties and because different crops differ in their sensitivity to different dissolved salts in different climatic zones [10].

MATERIALS, METHODS AND INTERPRETATION:
The present study was carried out in the laboratory. A germination study related to present research work was also conducted on farmer's field of village- Amiliya Block - Dobhi Distt. - Jaunpur.
Diagnostic Studies:
Soil:
Survey:
Sampling sites were carefully chosen taking into consideration the ground water, micro-relief, degree of erosion, surface drainage, proximity of trees and all other factors like to affect the soil in comparison to normal type. The survey of the area under study was undertaken and sampling sites located. Entire experimental area is divided into ten tracts, viz.,
A. Block Dobhi (Distt. Jaunpur): Village -Amiliya-Amrouna-Satmesera
B. Block Jalalpur (Distt. Jaunpur): Village - Trilochan- Sarkoni-Bandipur
C. Block Buxa (Distt. Jaunpur): Village-Sambhuganj-Basalatpur- Nauperava
D. Block Maharajganj (Distt. Jaunpur): Village - Misrolli - Hariharpur - Karanpur
E. Block Karanjakala (Distt. Jaunpur): Village-Jamuhi-Patanaha-Ghrella- Mahgauva
F. Block Cholapur (Distt. Varanasi): Village - Danganj- Dharsouna- Rounabella

G. Block Pindra (Distt. Varanasi): Village - Khalispur-Rajpur- Basani- Odara
H. Block Badagaon (Distt. Varanasi): Village - Rampur- Rasulpur- Chuckchourpur-Auckroha
I. Block Harhuav (Distt. Varanasi): Chadmari- Aiore- Murdha
J. Block Chirayangovan (Distt. Varanasi): Village - Jalhupur- Dinapur- Neveda

Soil sampling:
A few profiles which were not receiving sewage and industrial effluents for cultivation were exposed with the help of spades. At each location composite samples were obtained from different horizons, viz. 0-15cm, and 15-30 cm, 30-45 cm, 45-60 cm and 60-90 cm segments. Collected composite soil sample from each depth, crushed up any lumps into smaller pieces and mixed together and taken the small amount of soil sample about 1 kg which was representative of the original material (quartering method). The samples were placed in numbered calico bag giving details of location and depth of soils detailed notes of the samples were also taken. The samples were transported to laboratory for analysis.

Analysis of soil samples:
In the laboratory all the soil samples were air dried and pass through sieve < 2 mm. Routine analysis of soil like pH, ECe, organic carbon, cations exchange capacity, calcium carbonate, N, P, K, Fe, Zn, Cu, Mn, Mo and mechanical analysis (sand, silt, clay) were performed as per standard methods.

Water sampling:
To success of the water samples survey depends largely upon the planning made prior to sampling. So, a survey of the area under investigation was done and sampling sites located. In order to collect samples from difference water resources such as tube wells, canals, wells, rivers, ponds and hand pumps. Entire experimental area are divided into ten tracts, viz.,
A. Block Dobhi (Distt. Jaunpur): Village -Amiliya-Amrouna-Satmescra
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Water samples were collected for the present work from different water bodies. The selection of locations for the sampling are gradually decided on the basis of the well-defined objectives of the study undertaken. It is also imperative that quality in a dynamic water system of water bodies, varies from place to place and hence any one sampling location can never be representative of the entire system. Sampling stations must be chosen with respect to the factual and desired use of water system. Therefore, keeping the above facts in view sampling sites were selected. The water samples were collected with the help of stainless-steel sampler of about 500 ml capacity to which a nylon cord was tied. The whole assembly was lowered inside the water surface and then withdrawn. The samples were transferred into precleaned sample collection bottles. After rinsing each bottles with the water to be examined. About 400 ml of each sample was collected for analysis and preserved in a refrigerator. For routine physico-chemical analysis, the water samples were stored separately without treatment with acid.

Germination Studies:
A systematic investigation was carried out on representative salt affected soils and irrigation waters in eastern U.P.(village- Amiliya Block- Dobhi Distt.- Jaunpur). Many salt affected soils and adjacent irrigated fields, where salinity and alkalinity are limiting factors for (2-5cm) ground level and brought to the laboratory. Freshly taken samples were dried at 60° C for three days. Samples were protected carefully from all the possible sources of contamination. Rapid drying by forced ventilation over thin layers of tissue contained in mesh trays or bags were provided. Dried samples were ground using stainless steel grinder in order to avoid any contamination.

Chemical analysis of plant samples:
Air dried plant samples were ground in Wiley Mill having stainless steel blades and digested in diacid mixture of H_2SO_4: $HClO_4$ (10:4) and standard procedures (Jackson 1967) were followed for the estimation of phosphorous (colorimetric, yellowed vanadomolybdate), calcium, magnesium (Atomic- Absorption), potassium and Sodium (flame photometrically), Nitrogen was estimated following micro-Kjeldahl procedure.

Statistical analysis:
The observed data were analysed statistically in order to judge the significant of treatments difference at 5 per cent level of significance. Values of correlations of Co-efficient among different factors were also worked out.

RESULTS, FINDINGS AND DISCUSSION:

In this section characteristics of salt- affected soils and waters have been briefly discussed for their important characteristics. From the results reported elsewhere it was found that problems soils of the locality are saline sodic in nature. The problems of salinity and alkalinity of the problem soils have been created with depth of the profile. Sodium was found to be the dominant cation and calcium invariably the second dominant cation, followed by Mg and K. In general, the amount of sodium and Mg increased, but Ca and K decreased with the depth, possibly due to difference in their leaching behaviour. Na and Mg leaching to a greater extent than Ca from upper soil layers. As these soils also contain large amounts of soluble bicarbonate and carbonate especially in the lower horizons, therefore, they are likely to precipitate a considerable amount of soluble Ca as calcium carbonate. As a result, amount of soluble Ca and K decreased but Na and Mg increased in the lower horizons. The high ESP of these soils may be due to the adsorption of Na on the exchange complex from the soil solution containing appreciable amount of soluble carbonate and bicarbonate, because predominance of these anions causes greater adsorption of Na on the exchange complex. It was also enhanced by the presence of relatively higher amount of Ca than Mg in the soil solution. The salt - affected soils under study have very low hydraulic conductivity, possibly due to high ESP and EMP and low ECP and EPP. The decrease in hydraulic conductivity with the depth of the soil profile may be due to the presence of comparatively larger amount of clay, exchangeable Na and Mg but lesser amount of exchangeable Ca and K in the deeper horizons. The soils contained Boron in toxic Further, in the presence of a lower amount of soluble neutral salts, the hydrolysis of dissociating Na-ions must have been increased, causing an increase in soil pH.

A comparative study of irrigated vs non- irrigated soils revealed that the irrigated soils had higher pH than the adjacent non-irrigated soils, which was possibly due to the leaching of soluble neutral electrolytes. The lower layers of irrigated soils had comparatively more ESP & SAR than the non- irrigated soils, possibly due to the accumulation of Na along with the dispersed clay. Due to high ESP in the lower horizons the amount of exchangeable Ca was also low. The higher hydraulic conductivity of the non-irrigated soils than that of the adjacent irrigated soils was possibly due to the presence of more soluble neutral electrolytes in them, which coagulate the finer soil particles and cause better physical condition. The increase in salt concentration of these soils irrigated by irrigation water may be attributed to the bad internal drainage and poor-quality irrigation waters.

On the basis of U.S.S.L classification based on soil salinity there are four groups of EC: C1 (< 0.25 dSm-1) for low salinity, C2 (0. 25 to 0.075 dSm_1) for moderate salinity, C3 (0.075 to 2.25 dSm-1) for moderate to high salinity and C4 (> 2.25 dSm-1) for high salinity of water. Q is used for irrigation of crops. On moist soil, C2 can be used if a moderate amount of leaching occurs, C3 cannot be used on soils with restricted drainage. Even with adequate drainage special management for salinity control may be required and plants with good salt tolerance should be selected in C3. But under ordinary condition Q is not suitable for irrigation. It may be used only under very special circumstances.

CONCLUSION:

It has been estimated that out of 329 million hectare of geographical area of India, about 167 million hectares have been suffering from different kind of degradation, such as water erosion (90 m ha) wind erosion (50 m ha) salinity and alkalinity (7 m ha) and flooding (20 m ha). Another 20 m ha in the canal irrigation areas are under risk of becoming degraded (Bali and Kanwar, 1977). Salinity and alkalinity is one of the main problem in different states of India, including U.P., Haryana and Punjab.

In the three states of India, namely, U.P., Haryana and Punjab, it is estimated that about 2.5 million hectares of land are infested by salinity and alkalinity. The area affected by salinity and alkalinity in U.P. is about 1.2 million hectares. The worst affected districts are those located in the extension halves of the Ganga- Yamuna and Ganga- Gomti doabs with extension right upto Eastern U.P. including Varanasi & Jaunpur. The area of such type of land is increasing due to continuous use of poor quality of irrigation waters, its faulty method of application and impeded drainage. These lands either hardly produce any crop or produce a very poor crop.

Diagnosis and demarcation of salt affected soils of Jaunpur and Varanasi and studying the causes of sodicity development in the area under study. Summary and conclusion of the research observation are dealt herewith.

The samples taken from soil surface and different depths were found to be saline alkali in nature. These soils contained large amount of Na. The physical condition of these soils was very bad. It was found that in all soil profiles, Na is the dominant cation, Ca as the second dominant cation followed by Mg and K. Chloride is the dominant anion and bicarbonate is second dominant anion followed by carbonate and sulphate. Similarly, amongst exchangeable cations Na is the dominant cation followed by Ca, Mg, and K in almost all the soil profiles. The clay and cation exchange capacity increased with the profile depth. Gypsum requirement, ESP and ECe proved to be better indices for the diagnosis of these soils. The texture of the soil varied from sandy clay loam to clay. Hydraulic conductivity was very low and it decreased with the depth of the soil profile. Gypsum requirement increased with the depth of the soils. Organic matter, Nitrogen, phosphorus, potash and micronutrient such as Fe, Zn, Mn, Cu and Mo decreased with the depth of the soil profile. The soils of area under study were also found to be deficient in phosphorus status, whereas nitrogen and potassium status was found to be in medium range. They were also rich in water soluble B. On the other hand, these soils were deficient in available Mn.

Finer soil fractions and ESP were found to be the important soil factors in governing the distribution of Mn in these profiles.

Composition and quality of a number of water samples were also determined. On the basis of EC and SAR, it was found that must of the samples of irrigation water fall under bad quality and were rich in Na and poor in Ca. They also contained large amount of Mg. These water samples contained large amount of RSC and considered unsafe for irrigation purposes. Na was found to be a dominant cation. Ca was second dominant cation followed by Mg and K. They also contained other constituents like $C0_3$, $HC0_3$ and B in toxic concentration. The irrigation water samples taken in May were of bad quality, but their quality improved after monsoon.

Like the quality of irrigation water, the salt affected soils improved after rains so far as their soluble salts were concerned, but permeability after rains. Soil irrigated by irrigation water showed almost the same trend of cation distribution as irrigation waters. They were also rich in CO_3, $HC0_3$ and B. Some characteristics of irrigation waters were significantly related to the characteristics of these soils.

The effect of tube well water on germination of wheat has been examined under field condition. The characteristics of tube well water like EC, SAR, SSP and RSC were found to be significantly correlated (negatively) with germination percentage. The correlation between soluble calcium percentage (SCP) and germination percentage was positively correlated. According by these characteristics were considered as better indices for predicting the germination under field condition in the area concerned. pH, ECe and SAR of the soil adversely affected the N, P, K, Ca and Mg content of paddy, whereas favorable effect of these parameters was observed and context of Na content of the crop.

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