IMPACT OF SEASONAL VARIATIONS ON MACRONUTRIENTS IN SALINE TRACTS OF BIKANER DIVISION, RAJASTHAN, INDIA

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ABSTRACT *In this research soil samples of Saline tracts from Bikaner division investigated in different seasons for pH, EC, Percent Organic Carbon, Phosphorus, Potassium, Sulfur and Nitrogen. Water samples were also analyzed for chemical parameters such as pH, Total Dissolve Solides, Floride, Nitrate, Chloride, Total Alkanity and Total Hardness. Result show that in summer season EC was very high while the value for Percent Organic Carbon was reported high in rainy season. It was interesting to note that Potassium level in soils of selected sites were significantly high for samples collected during spring and summer seasons, while it was reported lower in rainy season. Results of water samples showed that pH and floride in normal range in all season but nitrogen, chloride, Total Alkanity and Total Hardness are very high (out of range).*

Keywords: *Macronutrients, water logging, saline tracts, Bikaner Division*

INTRODUCTION:

Soil and water are important factor for plants growth and development. Soil is the combination of minerals, organic matter, gases, liquids and countless organisms that, survive with plant life. Soil is a complex natural medium and properties of soil determined by physico- chemical parameters, these parameter depends on topography, climate, physical weathering processes, vegetation cover, microbial activities and several other biotic and abiotic variables (Paudel and Sah, 2003). Soil is not only essential for agriculture but also have more valuable for living being.

Soil and water are the basic natural resources for agricultural and economic development of the nation. Canal irrigation was introduced in the north-west part of Rajasthan state, after advent of Gang canal, Bakhara canal and Indira Gandhi Nahar Pariyojna (IGNP). These canal systems ment to irrigate nearly 2.2 million hectares of arid land. It has raise the food production but it also introduced water logging and secondary salinization problems (Arora and Goyal, 2012, Mandal and Sharma, 2008). Change in soil chemistry in one of the effects of it on the soil. As an example, denitrification of soil nitrogen as a result of water logging may affected the amount of nitrogen (Mascagni and Sabbe, 1991). Soil organic carbon has an important role in improving soil quality and sustainable production (Seul, *et al.,*1990). Actually Nitrogen is an important part in structure of chlorophyll and amount of it in the leaf strongly influenced by environmental and nutritional factors (Wagatsuma, *et al.,* 1990). It also brought problems viz. waterlogging, salinization, canal seepage, sandy texture, indiscriminate use of irrigation water, absence of natural surface drainage etc. (Shankarnarayan and Gupta 1991).

About 70% of fresh water used in agriculture (Baroni, *et al.,* 2007). Water logging is said to a condition that all small and large soil pores are packed with water and creates anaerobic conditions in the soil (Luxmoore, *et al.,* 1973). In effect, water is preventive gas distribution in the soil under water logging conditions (Setter and Waters, 2003, Belford,1985, Brisson, *et al.,* 2002).

Enhancement of water logging is expected cause of introduction of irrigation without providing for enough drainage. Stalinization of the soil depends on the quality of soil. As such water logging and soil salinity have emerged as main problems in the irrigation commands affecting the agricultural productivity and sometime becomes imperative to take the land out from crop production (Anonymous, 2002).

Waterlogging and salinity have a range of effects. Firstly, they quickly reduce the primary growth of roots and shoots (Barrett-Lennard, 1986a and Drew *et al*., 1988). Secondly, affect the processes connected with solute movement across membranes such as nutrients uptake eg. Ponnamperuma, 1977; Trought and Drew,1980 and Buwalda *et al.,* 1988a, Greenway and Gibbes, 2003, Bradford and Hsiao,1982; Huage *et al.,* 1995a and Else *et al*.,2001 studied impact of salinity on soil properties and yields of different crops.

The salt affected soils were primarily located in the irrigated areas, zones of low rainfall, shallow water table depth and hot and dry moisture regions (Mandal and Sharma 2005). The visual interpretation of Indian Remote Sensing data (IRS LISS II) on 1:50000 scale followed by ground survey identified waterlogged and salt infestation in IGNP, Rajasthan. Such data also indicated seasonal dynamics of

waterlogging soil salinization in irrigated areas (Mandal and Sharma 2011). Soil degradation by various organic and inorganic contaminants is an ecological risk with socio-economic issues. Degraded soil becomes poor in physicochemical properties, loss of productivity, sustainability and diminished food chain quality. The industrial effluents are directly used for irrigation in the areas near Sanganer adjoining to AmanishahNallah. Soil samples were collected from five different sites within the Sanganer. Soil samples were analyzed for pH, EC, water holding capacity, exchangeable ions (Ca++ and Mg++) and presence of heavy metals. Results of soil samples indicate its slight alkaline nature. Water holding capacity was decreased, exchangeable cations also showed wide variation in contaminated soil as compared to the values of standard soil of the area under consideration (Bansal *et al.*, 2016).

STUDY AREA: - Present study conducted in north-western parts of Thar Desert (Bikaner Division). There are some important saline tracts, like- Loonkaransar, Badopal and Rawatsar. These areas are permanent waterlogged areas. The climate of this area is arid and semi arid nature. The annual rainfall of study area is 325.28mm. 80% of annual rainfall received during monsoon season. This area irrigated by Indira Gandhi Nahar Pariyojana. Due to excessive flood irrigation and poor soil quality the problem of water logging occurs here. Saline tracts Bikaner division viz. Rawatsar, Badopal and Loonkaransar were studied for macronutrients in soil and water. Rawatsar lies between 29^{0}15'53.68"N latitudes and 74^{0}24'10.20"E longitudes elevation 180.137m, Badopal 29^{0}21'57.76"N latitudes and 74^{0}02'32.99"E longitudes elevation 169.164m and Loonkaransar 28^{0}29'36.61"N latitudes and 73^{0}44'17.52"E longitudes elevation 189.89m from mean sea level **(Figure-1**). The soil of the study area is very poor in nutrient load. The colour of the soil is pale yellow with very low humus content. The texture of the soil is loamy clay.

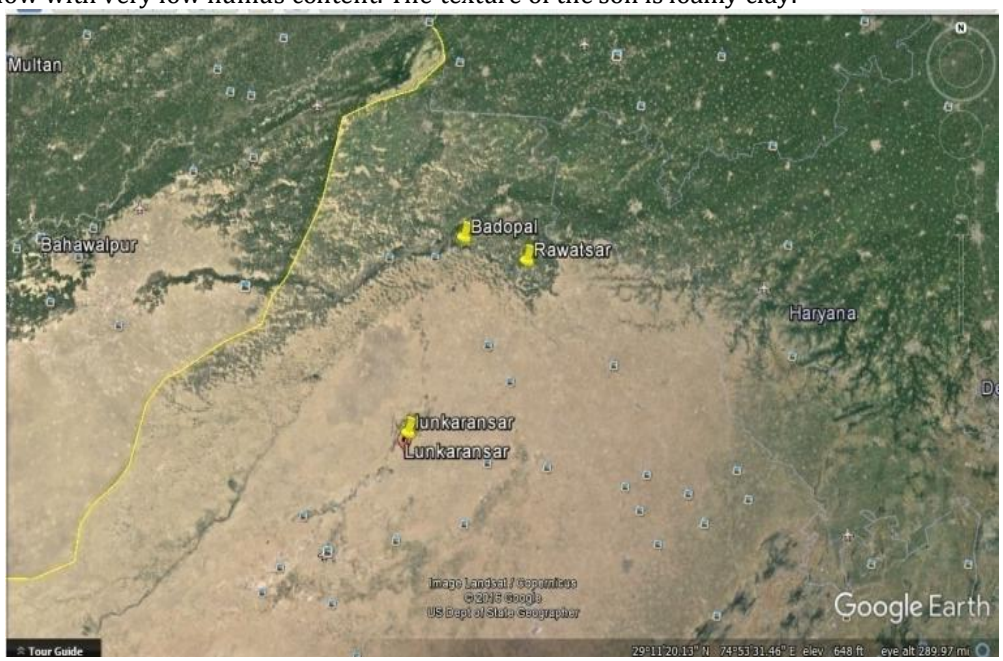

Figure 1: Map of the study area

MATERIAL AND METHODS: - The soil and water samples were collected from three different sites of waterlogged areas during different seasons viz. Spring, Summer, Rainy and Winter (2015-2016) of the year. The collected soil and water samples have been analyzed for physico-chemial characteristics. Soil samples are collected from surface as well as from the depth of 10 inches and 20 inches. Samples were collected in sterilized plastic bottles and plastic bags. A durable label is placed outside the bag and bottle giving details of the location and depth of sampling. Soil sampling bag and bottle tied or sealed properly. The selection of sites for soil samples collection were done in such a way that it represents the diversity of samples as well the impacts of saline tracts on soil. Therefore, the samples taken from bank of water bodies, from distance of 100meter from water bodies and from agricultural fields, which were considered as control site.

The soil samples have been analyzed for various parameters as pH, electrical conductivity (EC), percent organic carbon, available phosphorus, available potassium, available sulfur, available nitrogen. Water sample have been analyzed for various parameter as pH, TDS, floride, nitrate, chloride, total alkanity

and total hardness. Physico-chemical parameters of soil and water were done by standard methods (APHA,1998).

RESULTS AND DISCUSSION: - The soil and water samples collected from waterlogged and non-waterlogged areas showed great variation in the physico-chemical properties. The soil samples were analyzed for pH, EC, Percentage organic carbon, nitrogen, sulphur, potassium and phosphorus. The water samples were analyzed for pH, TDS, floride, nitrate, chloride, total alkanity and total hardness. In all season water pH (6.8 to 8.3) and floride (0.1 to 1ppm) in normal range but TDS, nitrate, chloride, total alkanity and total hardness were very high in range **(Table 1- 4).**

Table-1 Comparative assessment of physico-chemical parameters of water samples in rainy season (August 2015)

S.No.	Location	pH	TDS (mg/l)	Floride (ppm)	Nitrate (ppm)	Chloride (mg/l)	TA (mg/l)	TH (mg/l)
1	Rawatsar	7.03	1218	0.1	74	12500	11550	18080
2	Badopal	7.83	1078	0.6	115	15080	9430	950
3	Loonkaransar	7.9	680	0.2	25	850	540	400

Table-2 Comparative assessment of physico-chemical parameters of water samples in winter season (December 2015)

S.No.	Location	pH	TDS (mg/l)	Floride (ppm)	Nitrate (ppm)	Chloride (mg/l)	TA (mg/l)	TH (mg/l)
1	Rawatsar	7.43	34000	0.2	14	18000	550	11300
2	Badopal	8.25	26400	0.6	123	12000	3600	2600
3	Loonkaransar	7.37	1640	1	22	180	320	520

Table-3 Comparative assessment of physico-chemical parameters of water samples in spring season (March 2016)

S.No.	Location	pH	TDS (mg/l)	Floride (ppm)	Nitrate (ppm)	Chloride (mg/l)	TA (mg/l)	TH (mg/l)
1	Rawatsar	6.8	52000	0.1	169	32500	17500	33000
2	Badopal	8.35	40000	0.4	185	800	5300	900
3	Loonkaransar	7.63	76000	0.7	15	20400	2600	6900

Table-4 Comparative assessment of physico-chemical parameters of water samples in summer season (June 2016)

S.No.	Location	pH	TDS (mg/l)	Floride (ppm)	Nitrate (ppm)	Chloride (mg/l)	TA (mg/l)	TH (mg/l)
1	Rawatsar	7.5	52500	0.1	74	15050	22050	14050
2	Badopal	7.3	52500	0.2	15	15100	21000	14060
3	Loonkaransar	7.4	32400	0.1	25	850	740	630

The pH of soil samples ranged from 7.5 to 9.6 alkaline in nature and higher than standard values **(Figure-2).**

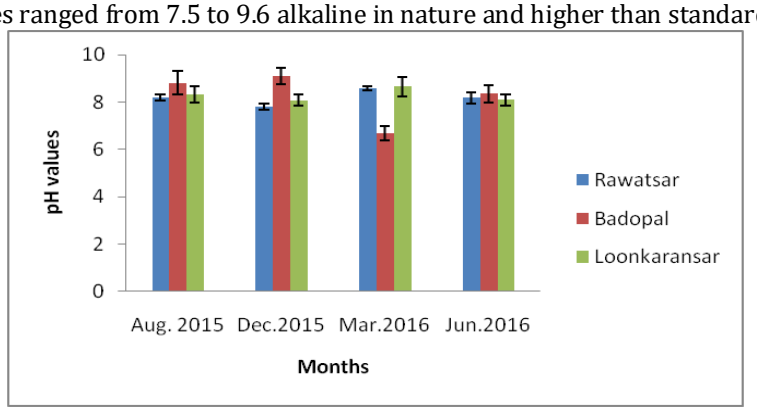

Figure 2: pH of soil

The value of electrical conductivity ranged from 0.15 to 7.48mho/cm very high **(Figure-3)**.

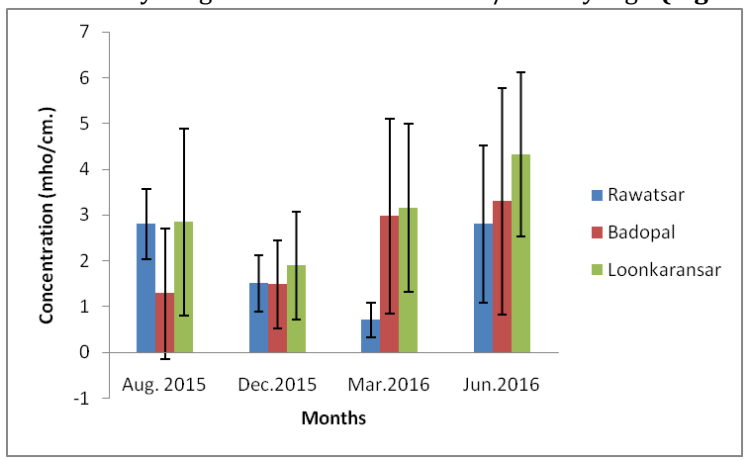

Figure 3: Electrical Conductivity of soil

The high value of electrical conductivity might be due to the presence of high concentration of ions. The amount of percent organic carbon ranged from 0.293 to 4.007 was very high **(Figure-4).**

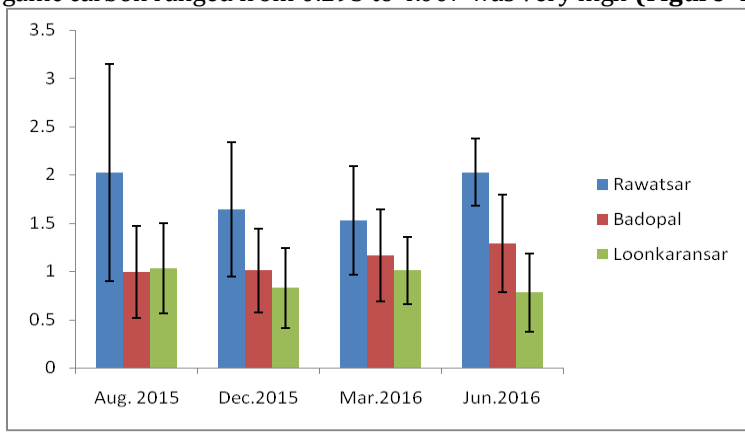

Figure 4: Percentage Organic Carbon of soil

The value of nitrogen ranged from 67.73 to 163.365 Kg/ha **(Figure 5)**. The value of sulphur ranged from 0.1 to 47NTU **(Figure 6)**. The value of phosphorus ranged from 12 to 300Kg/ha and were in rainy season all sites soil samples range normal, in winter season Badopal waterlogged areas soil range high, in spring season normal range and in summer season Badopal and Loonkaransar soil samples range were very high **(Figure 7)**. The value of potassium ranged from 100 to 2120Kg/ha and approximately all site soil samples range very high in all season **(Figure-8).** Study show similarly with Luxmoore, *et al*. (1973) that anaerobic condition describe due to waterlooging. Present study show soil degradation and decrease in crop production by Anonymous (2002). Result are similar to observed by Mandal and Sharma (2011) and show variations in different season.

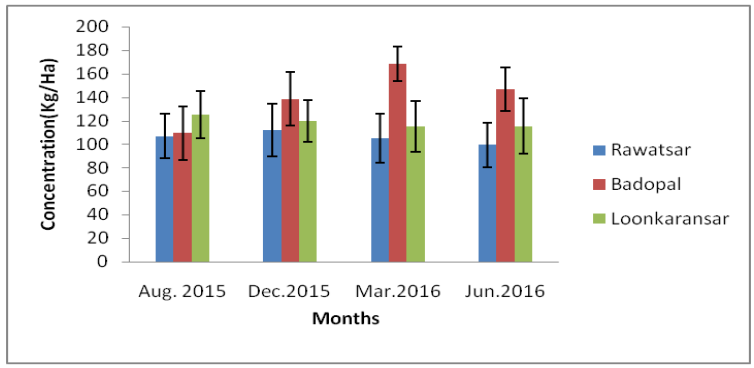

Figure 5: Available Nitrogen of soil

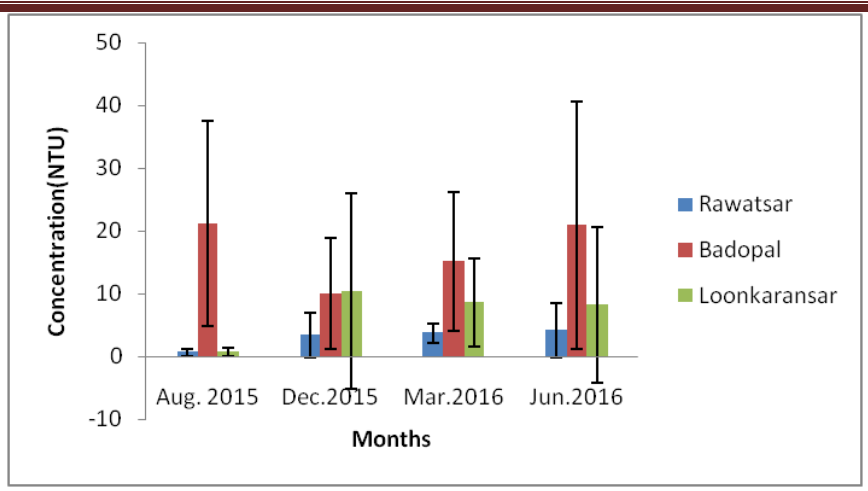

Figure 6: Available Sulphur of soil

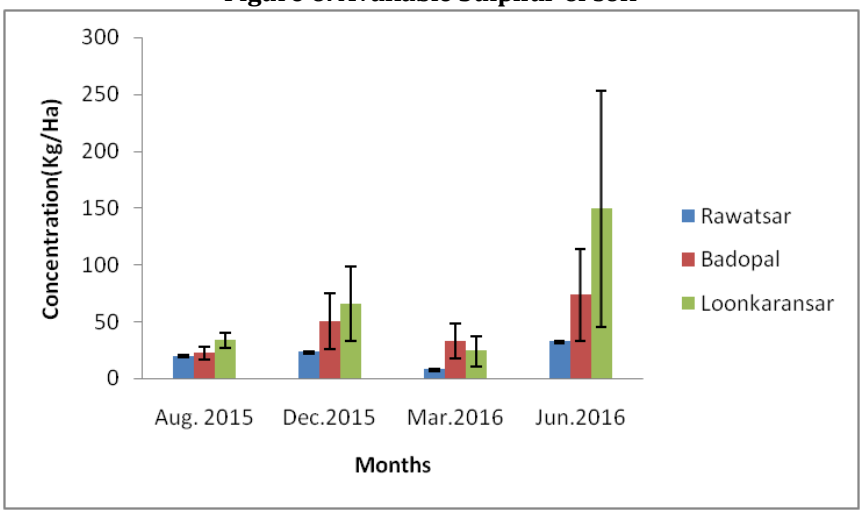

Figure 7: Available Phosphorus of soil

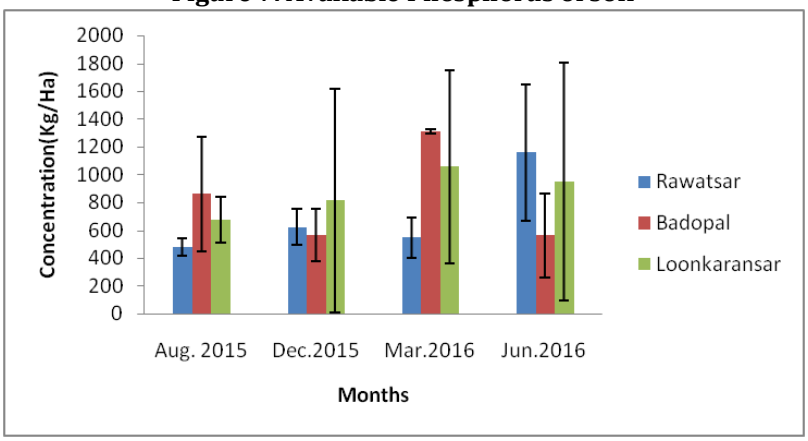

Figure 8: Available Potassium of soil

CONCLUSION:- The main goal of present study is to assess the some chemical parameters such as pH, EC, Sulphur, nitrate, percent organic carbon, phosphorus and potassium of soil samples and pH, TDS, fioride, nitrate, chloride, total alkanity and total hardness of water samples collected from selected sites of saline tracts in Bikaner division. The results show that the study sites around water logging area's soil are highly saline. These problematic soil and water require special attention to maintain proper soil-water relationship by providing sufficient drainage system. The results of the study may help local administration to mitigate the effects of such problems. Therefore the present study may help to improve the soil and water quality and enhance the sustainable agro-economic growth of the region.

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