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STUDY OF SALINITY EFFECTS AND ITS MANAGEMENT IN CHOPRA BARI AREA OF BIKANER CITY (RAJASTHAN)

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ABSTRACT

Natural water contains water soluble chemicals known as salts. The total salt contents of water is its salinity. Irrigation with saline water produces large physiological deformities *viz*. reduction in plant height or in the number of leaves or shoots. As the plant become more affected, it may appear wilted despite a moist soil and the leaves may show leaf burn. Under these circumstances, the plant may die. To evaluate salinity in irrigation water (waste water) of investigated area, twenty samples were collected in wide mouth plastic bottles and were analyzed according to standard methods. Study reveals that investigated area have salinity level above permissible limits.

Key words: Salinity, Plant growth, Electrical conductivity

INTRODUCTION

Chopra bari area of Bikaner city is a vast irrigating land, which irrigates the field with industrial effluent of dyeing and printing units. As these industries release very toxic chemicals and hence, there is strong possibility of their presence in effluents.

Salinity is the total concentration of water-soluble salts in water and soil. It is measured in the form of electrical conductivity.[1] Irrigating with water of higher salinity than a crop can tolerate will result in loss in yield and decrease in quality of crop. Plant varies greatly in their tolerance to irrigation with saline water[2].

Salinity limits plant growth by three factors. These are – (i) a water imbalance in the plant (physiological drought), (ii) ion imbalances that results in the increased energy consumption (carbohydrate respiration) to maintain metabolic processes and (iii) toxicity from $Na^+$and Cl^-.

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The high osmotic pressure in soil solution causes a correspondingly low saline water potential and when in contact with plant cell, the solute moves towards the soil solution and the cell collapses. Salt affected plants may exhibit stunted growth and have darkened green leaf colour[3,4].

Generally a reduction in plant growth is evident by a reduction in height of plant or in the number of leaves or shoots is the first plant response to salinity. As the plant becomes more affected, it may appear wilted, despite a moist soil, and the leaves may show leaf burn. Under these circumstances, the plant may die, shoots are generally more inhibited in growth than roots and at low salinity levels, root growth may not decrease at all.

Above all, physiological disorders are present in plants /crops of investigated area, so it was thought interesting to carry out analysis of salinity level of irrigation water (industrial effluent).

EXPERIMENTAL

To analyze salinity, whole area was divided into twenty zones and water samples from these area were collected in wide mouth plastic bottles. Prior to analysis, the samples were filtered using Whatman No. 42 filter paper and then the electrical conductivity Ec was determined using conductometer[5].

RESULTS AND DISSCUSSION

The salinity level of irrigation field is illustrated in Table 1.

Table 1. Salinity level in irrigation water of Chopra bari area of Bikaner city

S. No.	Zones	Electrical conductivity in mmhos/cm
1	Zone 1	2.56
2	Zone 2	2.58
3	Zone 3	2.65
4	Zone 4	2.60
5	Zone 5	2.62

Cont…

S. No.	Zones	Electrical conductivity in mmhos/cm
6	Zone 6	2.63
7	Zone 7	2.70
8	Zone 8	2.75
9	Zone 9	2.74
10	Zone 10	2.51
11	Zone 11	2.58
12	Zone 12	2.62
13	Zone 13	2.67
14	Zone 14	2.72
15	Zone 15	2.81
16	Zone 16	2.84
17	Zone 17	2.90
18	Zone 18	2.91
19	Zone 19	2.83
20	Zone 20	2.87

The acceptable range of electrical conductivity (salinity) for irrigation is 1.5 mmhos/cm[4]; but perusal of Table 1 shows that irrigation water of Chopra bari area have Ec (salinity) levels above permissible limits.

Crops yields are usually markedly reduced before visual symptoms of salinity damage become apparent. The first sign of salinity damage is usually stunted growth with plant leaves often having bluish green color. As salt levels in the soil increases towards more toxic levels, scaling or burning on the tip and the edges of the older leaves occurs. The leaf dies and falls off and finally the plants die. In other cases, the youngest leaves may appear yellow or the crop may show signs of wilting even though the soil appears moist. Excessive concentration of sodium and chloride ions in irrigation water can cause toxicities in plants. These ions can be taken either by the roots or by direct contact on the leaves. Typical sodium toxicity symptoms are leaf burn, scorch and dead tissue along the outside edges of leaves, in contrast to the symptoms of chloride toxicity, which normally

occurs initially at the extreme leaf tip. High concentration of sodium in irrigation water can induce calcium and potassium deficiency in soils low in these nutrients. Another effect of sodium is that if it is high in relation to calcium and magnesium, it may result in water logging due to degradation of well structured soils. The chloride ion can be taken up by the plant roots and ore accumulated in the leaves. Excessive accumulation may cause burning of leaf tip or margins, bronzing and premature yellowing of the leaves.

Later the signs become more obvious, but by that time, it may too late for that particular crop or Pasteur. The visible signs of more advanced salinity are (when Ec level is greater than 2.2 mmhos/cm), new patches or boggy areas in paddocks, whole plant become yellow and bronzed, crops haying off early, legumes dying out, increase in number and size of bare areas, Greasy black patches and salt crust on the soil surface, trees dying in low areas and along drainage lines[6-9].

From the above study, it is concluded that irrigation with saline water will ultimately results into plant death and changes the structure of soil. In order to manage the problem of salinity, growers are advised to adopt following suggestions –

(i) **Soil reclamation** - The process of true reclamation involves replacing sodium ions in the soil with calcium. The released sodium ions are then leached deep beyond the roots zone by using excess water and finally carried out of the field in the drainage water. The most commonly used method for replacing the sodium ions is by applying large quantities of gypsum (calcium sulphate) to the soil and followed by water releasing calcium ions, which replaces sodium ions from the soil into the downward moving water. Lime ($CaCO_3$) is not used as saline soils are sometimes already high in carbonate salts and therefore, alkaline.

(ii) **Presowing irrigation with good quality water** – Where irrigation is available with good quality water prior to sowing, it helps in leaching salts from the top soil. It help in promoting better seed germination and seedling establishment.

(iii) **Appropriate use of ridges or beds for planting –** The impact of salinity may be minimized by placing seeds (or plants) appropriately on ridges, where exactly the seeds should be planted on the ridges would be irrigated via furrows on both sides of the ridge. It is better to place plants on the ridge shoulders rather than ridges top because water evaporation will concentrate more salts on the ridge top or centre of the bed. If the crop is irrigated via alternate furrows, then it is better to plant only on one shoulder of the ridge closer to the furrows that will have water. Sprinklers irrigation also helps in reducing salt concentration.

(iv) **Mulching** – Mulching with crops residue, such as straw reduces evaporation from the soil surface, which in turn reduces the upward movement of salts. Reduced evaporation also reduces the need to irrigate.

(v) **Deeptillage** – Accumulation of salts closer to the surface is a typical feature of saline soils. Deep tillage would mix the salt present in the surface zone into a much large volume of soil and hence, reduces its concentration and impact.

(vi) **Incorporation of organic matter** – Incorporating crop residues or green manure crops improve soil tilt structure and water infiltration, which provides safeguard against adverse effects of salinity[10].

From the above analysis, it is concluded that by applying the above suggestions, growers of Chopra bari area can get rid off salinity problems and can increase crop yield.

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