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RECLAMATION OF SALINE SOIL BY USING LOCALLY AVAILABLE ADMIXTURES: MARALGOE NIFAD

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Abstract
Salinization is measure problem in agricultural soil. Salinization of soil is caused due to the use of chemical pesticides, fertilizers and climatic conditions such as high temperature and low rainfall. Climatic conditions and use of chemical pesticides are affected on the environment. In this paper saline soil samples was collected from Mralgoe, Nifad. Pot experiment was conducted to reclaim saline soil. Individual and combination of admixtures are used in this study. Locally and cheaply available admixtures were added at 2cm depth layer in each pot. Seven treatments were given, such as T1(control), T2(soil + cow dung), T3(soil + kitchen waste), T4(soil + garden trimming) T5(soil + fly ash), T6(soil + coal powder), T7(soil + cow dung + kitchen waste + garden trimming + fly ash + coal powder). Leaching treatment were provided after 8,16,24,32 days of leaching. pH, electrical conductivity, sodium adsorption ratio, bulk density of the soil were calculated after 8,16,24,32 days of interval. After adding admixtures, combination of admixture gives better result than the single one. Cow dung is helpful for changing the pH and electrical conductivity of soil. Cow dung playing the important role for decreasing the value of total petroleum hydrocarbons. Fly ash changing the bulk density of soil. Coal powder is helpful for decreasing the electrical conductivity.

Keywords: Salinization, pH, Electrical Conductivity, Sodium Adsorption Ratio, Bulk Density, Leaching Treatment,

I. INTRODUCTION

Saline soil reclamation is one of the main problems in the future for humans. Land is polluted with some pollutants like pesticides than it is further consume by plants which in turn consumed by animal and human being thus entering the ecosystem which will further introduce problem of decrease in resistance power of human being. Hence due to decrease immunity chances of people being affected by diseases increases. If we living in peace and harmony with nature the nature will give us optimistic result. For example with the carbon-based manures soil fertility is increases but also various other properties of soil like water holding capacity, porosity, softness, etc. increases for longer period but with chemical manure efficiency is high but quality of food grains, fruits, etc. is less as compared to organic manures applied soil.

Salt occurs due to naturally or for human activities within soil or water. Salinization caused due to the use of chemical pesticides, fertilizers and climatic conditions such as high temperature and low rainfall. Capillary action from the saline water table and higher concentration of salt water in the soil are the causes of increases in soil salinity. It is reported that approximately 932 million ha of land available for agriculture worldwide are affected by salinity and sodicity of this area, 23% of arable land is affected by salinity, while 10% is affected by saline-sodic conditions.

Waste minimization is also important for living and non-living things. Utilization of waste is a good option to convert these waste energy. In this present study the waste generated from kitchen waste, garden, thermal power plant were used for reclaiming the salinity of land. These is helpful for public health, environment.

The present study undertaken to investigate the physicochemical parameters such as pH, electrical conductivity, sodium adsorption ratio, bulk density. In this study the cost effective and locally available admixtures were used to remove the salinity of land for increasing the crop productivity, crop growth.

The selection of reclamation agents should take into account not only their influence on the soil itself, but also their prize and environmental hazard (T. Raycher , S. Popandra 2000). If we live in peace and harmony with nature the nature, nature will give us positive results. Between all additions of admixture is best suitable and less expensive technique to remove the salinity of soil. Locally available admixture such as cow dung, coal powder, rice husk, wheat straw, etc. can be used. This addition of admixture improves the soil properties varies with economic, environmental and technical points.

Soil salinity can be tested easily and inexpensively. County Allowance Agents can give advice on how to sample the soil and where to have the samples analyzed. Salinity can significantly hamper plant growth, and because it is often willingly treatable, soils should be analyzed before planting time, whether in lawns, landscapes, or gardens. Soil salinity levels below 1 dS/m (deci-Seimens per meter) are normal. Salinity values greater than 2 dS/m will cause difficulties for salt-sensitive plants, such as beans, carrots, corn, lettuce, sugar maples, and Scotch pine. Soil salinity levels greater than 4 dS/m are knotty for a large variety of landscape and garden plants. There are some plants which can tolerate soil salinity; these plants include tall fescue, buffalo grass, bermuda grass, asparagus and beets, among others. Salt tolerant plants can be grown in instead of treating moderately-saline soils if those particular plants meet the needs of the cultivator. Soils

with an electrical conductivity of the saturation soil extract of more than 4 dS/m^{-1} are called saline soil. Salt generally found in saline soil include chloride and sulfates of N_a, C_a, M_g,. The pH of saline soil is generally below 8.5. The normal range of pH is 6.5-7.5.

II. MATERIAL AND METHODS

A. Collection of saline soil

Soil samples are collected randomly from 0-30 cm depth from identified saline site in Maralgoe in Nashik District. Collected samples was examine in laboratory. Salinity and Sodicity parameters such as Electrical Conductivity (EC) and pH of the initial soil values were measure to reveal that the selected soil is saline.

B. Materials

Materials are the main constituents which are required to perform experiment. The material which used in this study are water, low cost locally available admixture such as cow dung, kitchen waste, garden trimming, fly ash, coal powder etc.

Fig.1 kitchen waste Fig.2 coal powder Fig.3 cow dung Fig.4 garden trimming Fig.5 fly ash

C. Preparation of sample

All the admixtures were used in this research are organic and easily available with low cost. Pot experiment was conducted. Soil was passed through the 2 mm sieve for removing the larger particles and obtain a homogeneous soil size. Cow dung is air dried then screen in 2 mm sieve. Kitchen waste also air dried and then chop with knife. Then coal powder and fly ash is also screen through 2 mm sieve. Five kg soil sample are filled in each plastic plant bags which are made from ubiquitous polymer substance known as polyethylene. Then 2 cm depth layer of admixture were added in each plastic plant bag. And then samples was mixed.

D. Experimental design

Pot experiment was conducted in completely randomized design with three replicates of each treatment to examine the saline soil samples. The pot containing 5 kg of soil with different combinations of the admixtures were prepare is as follows:

T1: control (soil only)
T2: soil + cow dung
T3: soil + kitchen waste
T4: soil + garden trimming
T5: soil + fly ash
T6: soil + coal powder
T7: soil + cow dung +kitchen waste + garden trimming + fly ash + coal powder

To calculate the initial values of T1 of collected sample. After calculating initial values of sample 32 days leaching was provided at the rate of 2 lit/ plastic bag. Each combination of bag containing 3 bags i.e. 3 bag for T2, 3 bag for T3, 3 bag for T4……3 bag of T7. And then after 8, 16, 24, 32 days interval soil quality parameters such as pH, electrical conductivity, bulk density and sodium adsorption ratio was calculated.

E. Soil analysis

Prepared sample were pass through the 2 mm sieve and then calculate the physicochemical parameter such as pH, EC, SAR, BD. The experiment were carried out at Green Diamond Hightech Lab, Nifad. pH and Electrical conductivity is measured by pH and EC meter. The soil bulk density were determined by using core method. Sodium adsorption ratio is the amount of sodium (Na) comparative to calcium (Ca) and magnesium (Mg). Sodium were measured with the MAARK II Flame Photometer. Calcium and magnesium were measured with the AA303 Atomic Absorption Spectrometer.

III. RESULT AND DISCUSSION

It is very important to reclaim the soil salinity for increasing the crop growth. In this study the physicochemical parameters (pH, electrical conductivity, sodium adsorption ratio and bulk density) of salt affected soil before and after the treatment were calculated. The following table shows the initial values of salt affected area before treatment:

TABLE 1
Initial values of saline soil sample before treatment at depth 0 to 30 cm

Sr.No.	Properties	Values	Permissible Limit
01	pH	8.40	< 8.50
02	Electrical conductivity	4.15 ds/m^-1	> 4 ds/m^-1
03	Sodium Adsorption Ratio	29.50	> 13
04	Bulk Density	1.58 g/cm^3	> 1.48 g/ cm^3

From above table, pH were found to be below permissible limit. SAR and EC was also found to be above permissible limit. These observations are compared with the early research papers of E.S.Hoseini et al. (2015), JADHAV P. N. et al. (2016), Y. Sakai et al. (2010). The results of chemical analysis of the water used in the leaching experiments indicate that the water has a low amount of EC and SAR.

TABLE 2
Relevant chemical properties of water used for leaching experiments

Sr.No.	Properties	Values
01	pH	8.98
02	Electrical Conductivity	0.67 ds/m^-1
03	Sodium Adsorption Ratio	5.43

A. Effect on Ph after treatment

Chemical properties of the soil were taken 0 to 30 cm depth, In this study 7 treatments were given to saline soil for improving their stability, crop growth and also utilizing the waste material. Following table shows the values of pH (8, 16, 24, 32 days) for different treatments

TABLE 3
pH of 8, 16, 24, 32 days of leaching process after treatment

	pH after treatment			
Treatment	8 days	16 days	24 days	32 days
T1	8.45	8.32	7.99	7.76
T2	8.11	7.87	7.46	7.19
T3	8.32	7.67	7.55	7.25
T4	8.27	8.07	7.57	7.51
T5	8.35	8.20	7.62	7.57
T6	8.21	7.65	7.63	7.13
T7	8.20	7.76	7.37	7.25

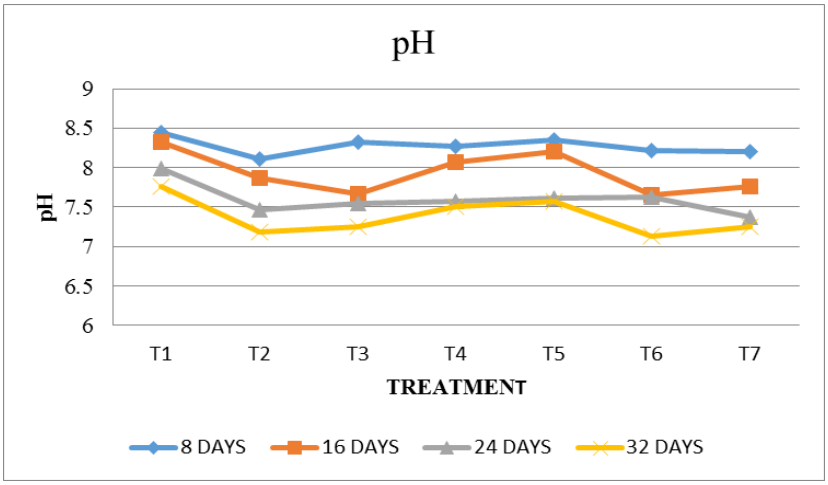

Figure:6 comparative results of pH at 8,16,24,32 days of leaching treatment

Above fig. shows the great variation in the pH levels in the soil. No significant results were obtain at 8 and 16 days. The best results were obtain at 32 days of leaching process. The best treatment for pH was T2 and T6 than T3 and T4. pH was decrease for T2. The combinations of all admixtures gives better result than the fly ash ie. T5.

It is observed that the application of various organic material decreased the pH value due to organic and inorganic acids formed when organic matter decomposition take place. Cow dung helps for decreasing the pH than fly ash. Similar results was reported by Saeed A. Abro et al. (2007) and Jadhav P. N. et al. (2016).

B. Effect on Electrical Conductivity

Electrical conductivity of the soil samples should be less than 4 ds/m^-1, then it is safe for the plant growth. Table 4.2.2 shows the values of the EC of different treatments at 8, 16, 24, 32 days of leaching.

TABLE 4
EC of 8, 16, 24, 32 days of leaching process after treatment

Treatment	EC (ds/m^-1)after treatment			
	8 days	16 days	24 days	32 days
T1	4.15	3.98	3.95	3.50
T2	3.45	2.99	2.01	1.35
T3	3.83	3.50	2.95	1.85
T4	3.78	3.11	2.66	1.92
T5	3.90	3.73	2.68	1.84
T6	3.59	3.08	2.71	1.22
T7	3.57	3.21	2.50	1.10

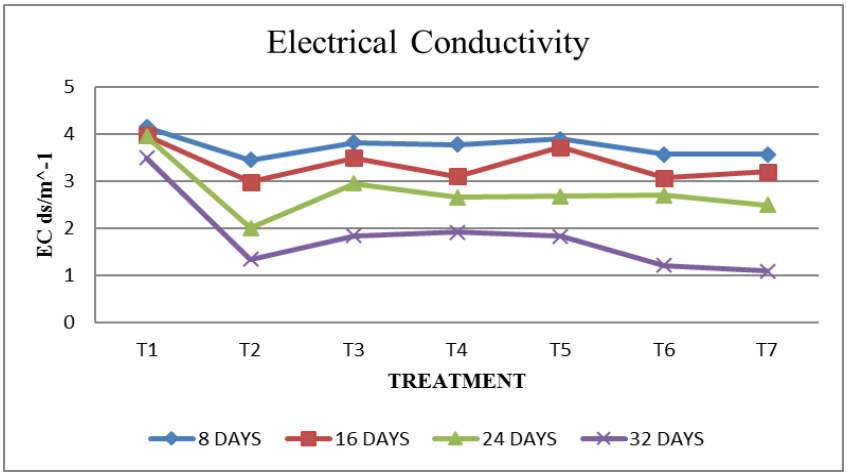

Figure:7 comparative results of EC at 8,16,24,32 days of leaching

Fig., shows the changes in the EC of different treatment at different days of interval. The maximum EC were observed for the first 8 and 16 days. The best treatment for decreasing the EC were found to be T7. Combination of all admixtures gives the more accurate reading than the other treatments. Coal powder is also best suitable for decreasing the EC of the soil. Garden trimming and fly ash (T4 and T5) were observed the maximum EC value at 32 days. The possible reason of decreasing EC may be the improvement in porosity and hydraulic conductivity, which resulted in enhancing the leaching of salts. Similar results were recorded in E.S. Hoseini et al. (2015), Zouheir Elouear et al. (2016).

C. Effect on Sodium Adsorption Ratio

In this study, the high percentage of sodium were observed. Therefore, sodium adsorption ratio was higher in this study. The presence of calcium as a competing ion in the leaching water may repel sodium in soil exchange complex, resulting to the highest initial concentrations of sodium in the leachate solution. After the first 8 days interval sodium concentration gradually decreased for all the treatments. Following table shows decreasing SAR of different treatments at 8,16,24,32 days of interval.

TABLE 5
SAR of 8,16,24,32 days of leaching process after treatment

Treatment	SAR after treatment			
	8 days	16 days	24 days	32 days
T1	31.85	25.30	20.12	15.22
T2	28.29	20.93	15.90	10.75
T3	28.96	21.98	16.97	12.55
T4	29.08	22.15	18.10	12.20
T5	28.78	23.27	18.24	13.13
T6	28.56	20.25	16.88	10.49
T7	25.96	17.13	11.68	8.81

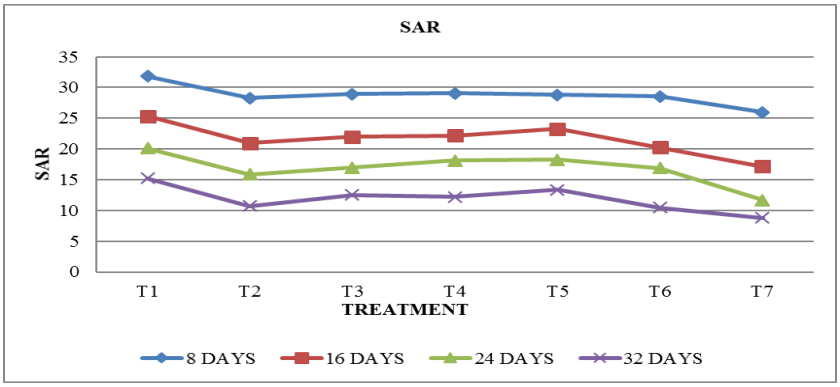

Figure:8 comparative results of SAR at 8,16,24,32 days of leaching

From fig.4.4.5, a decrease in SAR with simple leaching in control was likely due to mineral weathering and leaching out from the soil. The relatively high mobility and leachability of Na+ from soil due to the applied admixtures as compared with Ca2+ resulted lower value in SAR. The significant result were obtain after 32 days of leaching process. Treatment T2,T6 and T7 gives better result than the T1, T3. Similar results were reported by Jadhav P.N. et al. (2016), Saeed A. Abro et. al.(2007). The initial high amount of sodium concentrations in the leachate solution was also observed in a study by Jalali et al.(2008).

D. Effect on Bulk Density

The basic physical properties of soils used in this study are shown in below table 4.5.1. The bulk density for different treatments at 8,16,24,32 days of leaching ranges from 1.58 g/cm^3 to 1.07 g/cm^3.

TABLE 6
BD of 8,16,24,32 days of leaching process after treatment

Treatment	BD (g/cm^3)after treatment			
	8 days	16 days	24 days	32 days
T1	1.58	1.37	1.29	1.20
T2	1.33	1.26	1.12	1.07
T3	1.37	1.32	1.26	1.13
T4	1.41	1.33	1.21	1.16
T5	1.40	1.31	1.26	1.16
T6	1.30	1.27	1.19	1.10
T7	1.32	1.28	1.17	1.10

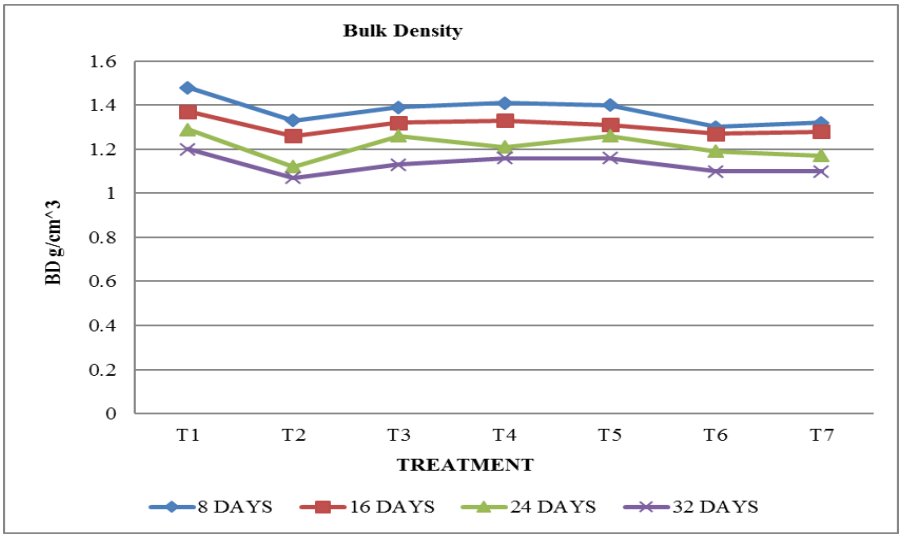

Figure:9 comparative results of bulk density at 8,16,24,32 days of leaching

Fig., shows that soil bulk density generally decreased after the 24 and 32 days of leaching. Cow dung gives better result than the other treatments.

IV. CONCLUSIONS

The present investigation shows that addition of locally available admixtures were significantly reclaiming the soil salinity. Leaching process is also suitable for removing salinity. Crop growth and productivity of crop can be increasing

due to removing salinity into land. The study shows that the combination of admixture gives better result than the individual admixture. In present study the combination of admixture removing 90% salinity from soil. Cow dung is more effective in changing EC and SAR values. Cow dung is more suitable for removing the sodium concentration into land. Kitchen waste and garden trimming also helpful for removing the 80% soil salinity of land. Kitchen waste decreases the value of pH, bulk density. Fly ash is not more efficient for decreasing the pH and SAR. In this present study 32 days of leaching gives maximum decreasing results of pH, EC, SAR and BD. The present investigation shows the best utilization of waste material. Kitchen waste, garden trimming, coal powder, fly ash all are the waste material were used for removing the salinity into the land. Admixtures which are used in this study is easily and cheaply available.

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