International Journal of Advanced Technology in Engineering and Science
Vol. No.4, Issue No. 05, May 2016
www.ijates.com
ijates
ISSN 2348 - 7550

RECLAMATION OF SALINE SOIL BY USING BIOLOGICAL METHOD

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ABSRACT

The aim of this project was to reclaim the saline soil by using biological amendments. The reason of salinity of selected soil sample was monocropping. To reduce the salt concentration in soil sample vermicompost and vermiwash was used. Which improves sustainability of land. An experiment was conducted to explore the effects of these amendments on soil properties. The vermicompost dose was varies between 2500gm m^2 to 5000g/m^2 ,vermiwash was applied in equal proportion to vermicompost. The post implementation analysis include analysis of soil pH, electrical conductivity, organic carbon, water holding capacity, potassium, calcium magnesium, sodium and SAR. The dosing was continued for 75 days with an interval of 15 days. Decrease in electrical conductivity is 25.85%.Increase in organic carbon is about 55.77%.There is also decrease in water holding capacity of soil by 10% which improves the drainage property of soil. Application of various amendments shows the promising results and improves the soil texture and structure.

Keyword: Saline Soil, Reclamation, Vermicompost, Vermiwash, Gypsum.

I.INTRODUCTION

In India, agriculture is backbone of its economy from food production and employment point of view. India's agriculture contributes significantly to other sectors and is the main source of growth of the economy. About 60 to 70% of the total population is dependent on agriculture for livelihood. In recent years the soil quality is adversely affected by desertification, water logging, soil salinity and erosion leading to loss of top soil and fertility. The spread of alkaline soil in the world is around 952 million hector and India shares 7.421 million hector (0.78%). Saline soils are largely addressed by the researcher's governmental and nongovernmental organisations for their reclamation and remediation. Excessive salt rate can adversely influence the physical, chemical, and biological properties of soils, mainly in arid and semi-arid world regions. Therefore, salt-affected soils must be reclaimed to maintain satisfactory fertility levels for increasing food production. Different approaches have been suggested to solve these issues. Organic materials for example farmyard manures, different agro-industrial by-products, Vermiwash and Vermicompost as effective tools to improve different soil properties such as structural stability and permeability in salt-affected soils. Organic fertilization is highly sustainable when compared to other options to date when taken into consideration as a solution to the highlighted issues.

II.MATERIAL AND METHGODS

Vermicompost : Compost can be rich in nutrients. It is used in gardens, landscaping, and agriculture. The effectiveness of the composting process is dependent upon the environmental conditions present within the composting system i.e oxygen, temperature, moisture, material disturbance, substrate conditions. Approximately a 5% minimum concentration of oxygen is required with in the pore spaces in the media. . Biological activity ceases below 15% moisture content and in theory activity is optimal when materials are saturated. Generally moisture content of between 40% to 60% should be maintained. Accordingly, the ideal ratio of carbon to nitrogen (C:N) is 30 to 1.

Vermiwash: It is a liquid fertilizer collected after the passage of water through a column of worm activation is very useful as a foliar spray. It contains plant growth hormones like auxins and cytokinin apart from nitrogen, phosphours, potash & other micronutrient. It acts as a plant tonic and helps to reduce many plant diseases.

Gypsum: is chemically $CaSO_4.2H_2O$ and is a white mineral that occurs extensively in natural deposits. It must be ground before it is applied to the soil. Gypsum is soluble in water to the extent of about one-fourth of 1 percent and is, therefore, a direct source of soluble calcium. Gypsum has several possible agricultural uses as a soil amendment. It can be used to reclaim sodic soils (dispersed soils high in sodium), improve soil aggregation, which in turn can decrease bulk density and increase water percolation,to reduce soil costing and reduce runoff and decrease soil pH in high-pH soils (greater than pH 8.2).

III.METHODOLOGY

Various methods are adopted for remediation of saline soil. The methods adopted in the project work include are biological and chemical method. In biological method biological amendments such as vermicompost and vermiwash are used whereas gypsum is used in chemical method. Six earthen pots of size 0.40 X 0.30 X 0.15 m having volume 0.018 cubic meter were used for experimental work. Each pot contains 6 kg of soil sample with selected dose of amendments. In this the test were conducted in pre-implementation, same tests are to be taken in post implementation and then compare the results of pre- implementation and post-implementation**.** It gives the information on the basis of result reduction in salinity of soil is calculated. Dose is applied after at an interval pof 15 days for the duration of 75 days.

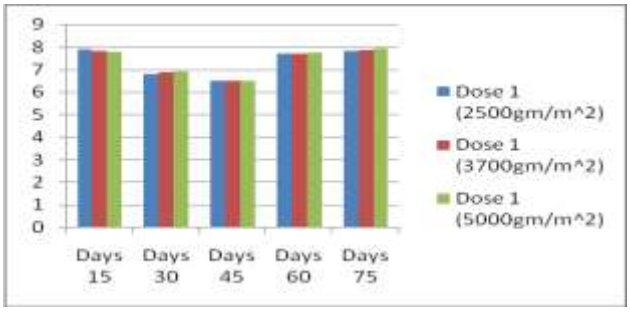
3.1 Initial Soil Quality

Sr. No.	Parameters	Initial Soil Quality
1.	pH	7.9
2.	EC	4.5 ds/cm
3.	Organic Carbon	1.8%
4.	WHC	69.44%
5.	Potassium	409.79 Kg/ha

6.	Calcium	81.54 %
7.	Magnesium	8.62 %
8.	Sodium	2.02 %
9.	SAR	0.28%

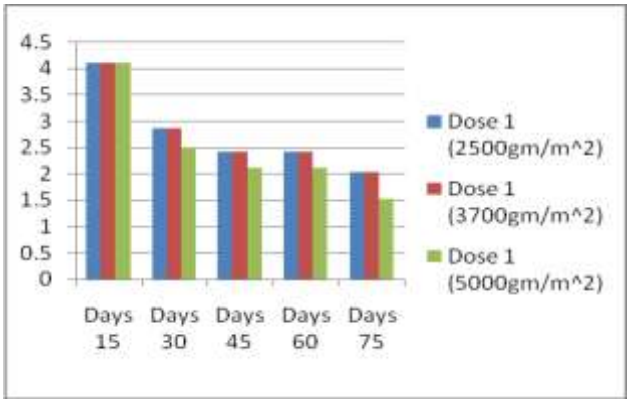
Variation in soil properties for different doses of biological amendments were observed at an interval of 15 days. The results of analysis of soil for post implementation are summerised in table. **1. pH**

pH	**Dose 1 (2500gm/m^2)**	**Dose 2 (3700gm/m^2)**	**Dose 3 (5000gm/m^2)**
Days			
15	7.90	7.82	7.79
30	6.92	6.97	6.97
45	6.60	6.60	6.60
60	7.70	7.74	7.79
75	7.83	7.91	7.99



3.2 EC

EC (ds/m)	**Dose 1 (2500gm/m^2)**	**Dose 2 (3700gm/m^2)**	**Dose 3 (5000gm/m^2)**
Days			
15	4.10	4.10	4.10
30	2.86	2.86	2.50
45	2.41	2.41	2.11
60	2.41	2.41	2.11
75	2.02	2.02	1.52



3.3 Organic Carbon

Organic Carbon(%)	Dose 1 (2500gm/m^2)	Dose 2 (3700gm/m^2)	Dose 3 (5000gm/m^2)
Days			
15	1.80	2.05	2.35
30	2.87	2.91	2.96
45	3.60	3.62	3.63
60	2.40	2.47	2.59
75	3.16	3.72	3.95

3.4 Water Holding Capacity

WHC (%)	Dose 1 (2500gm/m^2)	Dose 2 (3700gm/m^2)	Dose 3 (5000gm/m^2)
Days			
15	69.44	69.51	69.63
30	68.79	68.70	67.77
45	68.34	68.17	67.82
60	68.24	68.13	68.01
75	67.31	67.18	66.98

3.5. Potassium

Potassium (kg/hact)	Dose 1 (2500gm/m^2)	Dose 2 (3700gm/m^2)	Dose 3 (5000gm/m^2)
Days			

15	409.79	409.93	410.18
30	687.15	687.33	687.56
45	923.08	923.10	924.02
60	724.53	724.32	724.05
75	513.97	502.68	497.12

3.6. Calcium

Calcium (%)	**Dose 1 (2500gm/m^2)**	**Dose 2 (3700gm/m^2)**	**Dose 3 (5000gm/m^2)**
Days			
15	81.54	81.22	81.04
30	72.61	72.43	72.22
45	61.54	61.02	60.76
60	50.77	50.59	50.18
75	41.87	41.59	41.43

3.7. Magnesium

Magnesium (%)	**Dose 1 (2500gm/m^2)**	**Dose 2 (3700gm/m^2)**	**Dose 3 (5000gm/m^2)**
Days			
15	8.62	8.62	9.78
30	7.26	7.28	7.18
45	7.30	7.30	7.48
60	3.52	3.52	3.22
75	3.19	3.19	3.03

3.8 Sodium

Sodium (%)	**Dose 1 (2500gm/m^2)**	**Dose 2 (3700gm/m^2)**	**Dose 3 (5000gm/m^2)**
Days			
15	2.02	2.02	2.64
30	5.75	5.75	5.36
45	8.13	8.13	7.44
60	3.53	3.53	3.28
75	3.22	3.22	3.04

3.9 Sodium Adsorption Ratio (SAR)

SAR	Dose 1 (2500gm/m^2)	Dose 2 (3700gm/m^2)	Dose 3 (5000gm/m^2)
Days			
15	0.03	0.032	0.039
30	0.054	0.072	0.086
45	0.097	0.094	0.089
60	0.067	0.065	0.074
75	0.067	0.067	0.064

IV COMPARISON OF BIOLOGICAL METHOD FOR THIRD DOSING AT 15 DAYS INTERVAL

Sr. No	Parameters	15 Days	30 Days	45 Days	60 Days	75 Days
	Dose	**3**	**3**	**3**	**3**	**3**
1.	pH	7.79	6.97	6.60	7.79	7.99
2.	EC	4.10	3.03	2.50	2.11	1.52
3.	Organic Carbon	2.35	2.96	3.63	2.59	3.95
4.	WHC	69.63	67.77	67.82	68.01	66.98
5.	Potassium	410.18	687.56	924.02	724.05	497.12
6.	Calcium	81.04	72.22	60.76	50.18	41.43
7.	Magnesium	9.78	47.08	77.98	3.22	3.03
8.	Sodium	2.64	5.36	7.44	3.28	3.04
9.	SAR	0.039	0.086	0.089	0.074	0.064

V RESULT AND DISCUSSION

pH- pH of the soil sample goes decreasing which indicates reduction in salinity. But it goes on increasing after the particular period of time, as per our result pH decreases upto 45 days but after this it goes on increasing. Initial value of pH is 7.90 after 45 days it reaches upto 6.60 and 75 days is 7.83.Hence dosing upto 45 days is sufficient.

EC- Graph shows that Electrical Conductivity goes on decreasing gradually. Initial value of EC is 4.10 and after 75 days it decreases upto 2.02. It is good and shows the reduction in salinity. Further addition of gypsum will also reduce the salinity.

Organic Carbon-As per the test results organic carbon increases on addition of compost. Carbon content goes on increasing upto 45 days. After this it goes on decreasing. Initial value of organic carbon is 1.80 and after 45 days it reaches upto 3.60 and after 75 days 3.16.Further addition of dosage decreases the organic carbon in soil sample. It improves the quality of soil.

WHC-WHC goes on increasing upto 45 days its initial reading is 69.44 and after 75 days it decrease upto 67.31.But after 45 days its value goes on decreasing which is good as it shows improvements in drainage property of soil. Hence further increase in dosing and duration will shows the improves the texture of soil and its quality.

Potassium-As per result potassium goes on increasing till 45 days. Its initial value is 409.79 and after 45 days it reaches upto 923.03 but after 75 days it starts to decrease upto 513.97.

Calcium-Calcium goes on decreasing gradually its initial reading is 81.54 after 75 days its value is 41.87 Result for calcium is good. As there is reduction in calcium it indicates reduction in salinity and improves soil quality.

Magnesium- Magnesium goes on increasing for particular period of time it goes on increasing upto 45 days and after this it decreases. Its initial value is 8.62 for 45 days its value is 7.3 but after this there is sudden drastic change and its value becomes 3.19.Further increase in dosing may decrease the magnesium in soil.

Sodium- Initial value of sodium is 2.02 and at 45 days its value is 8.13. it indicates the increase in sodium in soil sample. But after 45days it goes on decreasing and at 75 days it becomes 3.22 which shows reduction in salinity.

SAR- Increase in SAR upto 45days and after this it goes on decreasing. Initial reading is 0.03 at 45days it reaches upto 0.097 and as after 45days it decreases and at 75 days its value becomes 0.067.

VI CONCLUSION

Use of amendments can benefit the farm soil, agriculture and the environment in every way. Compost is a sustainable alternative to the costly chemical fertilizers for farmers in both developed and the developing countries while also producing 'safe organic foods' for the society. It also improves 'moisture holding capacity' of the soil by 30-40 % and thus reducing water for irrigation by the same amount. Vermicompost and vermiwash helps to restore the 'degenerated and chemically contaminated soils' resulting from the heavy use of agrochemicals in the wake of green revolution. All composts are of biological origin i.e. a 'renewable resource' and is readily available to mankind. Chemical fertilizers are made from 'non-renewable' and 'depleting' resources apart from being highly destructive to farm soils. There is decrease in water holding capacity of soil by 10% which improves the drainage property of soil. Application of various amendments shows the promising results and improves the soil texture and structure

The monitory gain per hector for biological method is 80000 where for chemical method it is also 80000. But cost of single bunch in biological method is Rs.20 means cost of 80000 bunches is Rs.1600000 Also biological method gives more profit than chemical method.

According to the test result and observation we concluded that application of vermicompost, varmiwash and gypsum are the strong and helpful strategy for reclamation of salt affected soils and consequently increases in crop yield. Both these amendments are more likely to be beneficial to improve the soil properties of salt affected soil and sustaining crop yields.

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