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Effects of Salinity on Land Fertility in Coastal Areas of Palghar, Maharashtra

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Abstract

The present research project conducted for the soil health of different locations from coastal areas of Palghar district, which covered various physico-chemical, biological parameters and the effect of salinity and heavy metals in soil fertility. Due to various industrial activities and human interface on Palghar coastal areas it is likely to be disturbed and it is not good indicator socio-economic health of affected areas along Palghar coast. Fishery is the main occupation in this coastal belt of Palghar district alternatively many people from this coastal belt of Palghar depend on chikoo and vegetable farming, therefore it is very necessary to investigate soil fertility from different locations along coastal areas of Palghar district. Continuous removal of nutrients from the soil via different means requires continuous replacement to maintain productivity. This replacement (fertilization) requires specific knowledge in order to truly maximize yield, minimize cost and to reduce adverse effect on soil/crops in Palghar district. soil test seems to be the easiest to predict fertilizer requirement for Palghar farmers. At a certain level, the complex tissue analysis may be used as a tool for future soil quality in Palghar district.

Keywords: Salinity, Soil, Palghar , Maharashtra

Introduction

The Maharashtra state has 720 km of coastal length with 54 creeks. It comprises the districts of Palghar, Thane, Raigad, Ratnagiri and Sindhudurg. The coastal saline soils occur in these districts due to periodical inundation of cultivable land by creek/sea water during high tides. Such periodical inundation renders the otherwise fertile soils progressively saline and in time makes it completely unfit for growing any crop. These coastal saline soils are locally called as khar or khajan soils. Even when encroachment of saline creek water is checked by putting an embankment, the brackish water from shallow water table rises through the capillaries due to evaporation, enriching the upper crust of the soil with salts and thus the salinity problem persists.

Soil analysis is a valuable tool for farmyard as it determines the inputs required for efficient and economic production. A proper soil test will help ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrients already present in the soil. It will also allow one to determine time requirements and can be used to diagnose problem areas. It is very important that our sampling technique is correct as the results are only as good as the sample we take. Soil testing is also a requirement for farms that must complete a nutrient management plan.

Rationale/Research Hypothesis

The present research project conducted for the soil health of different locations from coastal areas of Palg-

har district, which covered various physico-chemical, biological parameters and the effect of salinity and heavy metals in soil fertility. Due to various industrial activities and human interface on Palghar coastal areas it is likely to be disturbed and it is not good indicator socio-economic health of affected areas along Palghar coast. Fishery is the main occupation in this coastal belt of Palghar district alternatively many people from this coastal belt of Palghar depend on chikoo and vegetable farming, therefore it is very necessary to investigate soil fertility from different locations along coastal areas of Palghar district.

Area of the study

Palghar is the new progressive district of the Maharashtra state. It is the northern district of Konkn region. Palghar district is very important agriculture district as being nearer to Mumbai. Topographically it has much diverse condition.ie. hilly zone, saline zone, plateau zone and characterised by high iritic rainfall. 55% of the area of the district is covered by forest. Total 6 talukas of the district are tribal. Land fragmentation, taxonomic backwardness, traditional farming, poor knowledge level about agri-business and marketing are weakness of agriculture. Monoculture, low productivity, rain fed farming, traditional mentality, stray cattle are the hurdles in the progress of the district. Salinity has caused significant negative effects on agricultural production. This research is focused on the vulnerabilities of soil and water salinities on crop, fish, and livestock production across the Palghar coastal area. Salinity intrusion is one of the major environmental issues throughout the world . Salinity causes a hostile environment for the normal crop production throughout the year in the coastal belts of Maharashtra. The organic matter content of the coastal soils is pretty low, nutrient deficiencies of N and P are quite common in saline soils, saline water has been increasing across the coastal belt due to the intensity of cyclones in India. This saline water has many connections with fresh water bodies across the coastal belt. It leads to changes in the trophic structure and diversity of shallow fresh water bodies such as increased strength of trophic interactions. As a result, saline water fish are mixed with fresh water species. Because of this, the intrusion of saline water in different fresh water bodies has played a significant role in the disappearance of some fish species.

Materials and Methods

The saline water intrusion plays a harmful role for agricultural land, the micro-organisms cannot leads their life because of high saline with high content of N, P. Though the fertility of lands is low, the salinity ingression leads more vulnerable condition to the land (Md. Azizur Rahman et al 2014). Due to the climate change, the monsoon comes fast and a regular flooding occurs at the coastal region. Though most of the lands are on the floodplain, so it is easy to intrude saline water and water logging in parts of the basin areas in the dry season (Mohammad Zahangeer Alam et. al 2017).

Total 10 stations were selected for soil sample collection along coastal areas of Palghar district. Soil analysis for various physicochemical and biological parameters was carried out by standard methods.

1. pH: the pH soil sample measured by universal pH indicator.
2. Temperature: Temperature of soil measured by a good quality thermometer.
3. Conductivity: Electric conductivity of soil measured by calibrated digital conductivity meter.
4. Moisture: 100 gm of sediment sample will be taken in a petridish of known weight and will be kept in an oven at 110 ^{0}C for 24 hrs. Thereafter the sample will be cooled in desiccator and weight, loss of weight indicates moisture content of sediment.
5. Soil texture will be analyzed by Buchanan and Kain(1971).
6. Organic Carbon: The organic carbon in the sediment determined by Walkley and Black(1934) method.

7. Sulphur: Total sulphate content of soil samples was determined by turbidimetric method.
8. Total Phosphorus: The sediment will be digested with conc. HNO_3 and $HClO_4$ and further process will be carried out by standard methods.
9. Nitrogen: Nitrate contents in the water samples estimated by standard method.
10. Potassium analysed by Flame emission spectrophotometer method.
11. Heavy metals including Hg, Pb, As, Cd and Cr were analysed by ICP, PES and AAS methods.
12. Microorganisms in soil sample were investigated by standard methods
13. Micronutrients (Zn, Cu, Fe, etc.) were analysed by standard methods.

Results

Soil is the loose surface material that covers most land. It consists of inorganic particles and organic matter. Soil provides the structural support to plants used in agriculture and is also their source of water and nutrients. Soils vary greatly in their chemical and physical properties. Soil quality is the capacity of a soil to function for specific land uses or within ecosystem boundaries. Such indicators as organic-matter content, salinity, tilth, compaction, available nutrients, and rooting depth help measure the health or condition of the soil-its quality-in any given place. Soil infertility implies lack of the qualities which enable it to provide nutrient elements and compounds in adequate amounts and in proper balance for the growth of specified plants. Infertile soils lacking in decomposing organic matter such as manure, will lack nutrients and binding qualities as well. Salinity affects almost all aspects of plant development including: germination, vegetative growth and reproductive development. Soil salinity imposes ion toxicity, osmotic stress, nutrient (N, Ca, K, P, Fe, Zn) deficiency and oxidative stress on plants, and thus limits water uptake from soil. The range of soil pH of Palghar district is from 5.86 to 7.08 indicating acidic to neutral reaction. Most of the soils were acidic to neutral in Konkan region of Maharashtra, Gajanan et al.2012.

Table:1 Physical and Chemical properties of soil

I. Physical properties				
Sr.No.	**Soil Property**	**Minimum**	**Maximum**	**Average**
1	Sand (%)	19.20	48.64	23.87
2	Silt (%)	21.30	36.40	27.48
3	Clay (%)	24.83	44.60	37.51
4	Bulk density (g cc^{-1})	0.96	1.56	1.02
5	Hydraulic conductivity (cm day^{-1})	0.62	1.65	1.04
6	Total porosity (%)	38.45	51.83	43.25
7	Available moisture (%)	12.36	16.82	14.26
II. Chemical properties				
1	pHs	5.50	6.70	5.98
2	ECe (dS m^{-1})	10.30	24.90	14.90
3	Salinity (dSm-1)	12.84	22.30	14.91
3	Soluble Ca++ + Mg++(me l^{-1})	58.54	138.20	96.83
4	Soluble Na+ (me l^{-1})	115.60	240.69	123.94
5	Soluble K+ (me l^{-1})	1.96	2.45	1.07
8	Soluble Cl-- (me l^{-1})	126.89	297.30	183.13

9	Soluble SO4 -- (me l^{-1})	29.64	70.64	56.24
10	Soluble HCO3 - (me l^{-1})	11.65	14.93	13.25
11	Organic carbon (g kg^{-1})	3.97	7.02	5.23
12	Available P2O5 (kg ha_{-1})	52.12	74.23	61.20
13	Available K2O (kg ha^{-1})	992.36	2145.36	1562.39
14	CaCO3 (%)	2.03	6.32	4.92
15	Zn (ppm)	1.92	2.40	3.01
16	Fe (ppm)	41.20	47.13	43.50
17	Cu (ppm)	5.97	6.90	5.94
18	Mn (ppm)	48.12	53.28	50.33
19	B (ppm)	0.63	2.10	0.96
Biological Parameters				
1	**Bacteria** *Bacillus, Arthrobacter, Pseudomonas, Agrobacterium, Alcaligenes, Clostridium, Flavobacterium, Corynebacterium, Micrococcus, Xanthomonas,* and *Mycobacterium*.	10^8 to 10^9 bacteria in a gram of soil		
2	**Actinomycetes** *Microbispora, Microtetraspora, Amycolaptosis, Actinomadura*, and *Saccharothrix.*	10^4 to 10^8 per gram of soil.		
3	**Fungi** *Amanita, Tricholoma, Torrendia, Descomyces, Thelephora, Verticillium, Phytophthora, Rhizoctonia,* and *Pythium*.	500 to 5000 kg/ha.		
4	**Protozoa** amebae, testate amebae, flagellates, ciliates, microsporidia, and sporozoans.	200 to 350 kg/ha		
5	**Nematodes** hookworm, lungworm, pinworm, threadworm, whipworm, and eelworm.	20 to 50 kg/ha		

Conclusion

Continuous removal of nutrients from the soil via different means requires continuous replacement to maintain productivity. This replacement (fertilization) requires specific knowledge in order to truly maximize yield, minimize cost and to reduce adverse effect on soil/crops in Palghar district. soil test seems

to be the easiest to predict fertilizer requirement for Palghar farmers. At a certain level, the complex tissue analysis may be used as a tool for future soil quality in Palghar district.

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