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Seasonal Variations in Soil Heavy Metals and Micronutrients near Roha Industrial Sector in Raigad, Maharashtra

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ABSTRACT

For optimum crop productivity and eco system preservation across a range of agricultural science disciplines, a detailed understanding of the soil temporal variability of micronutrients and how this variation effects the environment is essential. The Roha industrial area's soil temporal variability of micronutrients such cadmium, cobalt, chromium, copper, mercury, nickel, lead, zinc, and SAR was attempted to be studied from March to September of that year. Several micronutrients have high concentrations during the post-monsoon season. The rate at which fertilizer is applied and the ongoing discharge of industrial waste water onto the soil surface both contribute to nutrient imbalance.

Keywords: Soil micronutrients, Roha industrial area, Seasonal variation, SAR.

INTRODUCTION

A full understanding of the temporal variability of soil fertility features and their effects on the environment is becoming increasingly crucial in agricultural research and production. Increase crop productivity while minimizing detrimental environmental effects is the aim of detailed nutrition recommendations and extensive environmental monitoring. Inadequate recommendations for applying fertilizer and manure lead to excess shortages of the nutrients nitrogen (N), phosphorus (P), and potassium (K) in soil. Yet, it is still unclear how fertilizers and management practices in traditional agricultural systems across vast regions affect long-term soil fertility. [1]. While residual water is essentially hierarchically immobile in fine-textured soil, it appears in intragranular pores in coarse-textured soil and makes for around 10% of the total soil porosity [2]. Plant growth requires sixteen components. Both macronutrients and micronutrients are categorized as these substances. Iron, zinc, and copper are examples of micronutrients with synergistic and antagonistic effects on plants [3]. Dynamic soil quality indicators refer to soil characteristics that can be swiftly changed as a result of land use [4]. The presence of heavy metals and toxic material from commercial and municipal waste has been related to soil contamination. The formation of soil is a result of natural processes acting on natural materials. It commonly separates into mineral and organic horizons at different depths. They differ from the parent materials in terms of composition, morphology, physical, component chemical properties, and biological characteristics. Industries damage the air, water, and soil because they exploit natural resources voraciously. Factories, fertilizers, sewage, sludge, municipal compost, other industrial waste, industrial effluents, and water drainage are frequently the culprits behind soil contamination. Pollutants become detrimental to all forms of life, including plants, microbes, and people, once they permeate and are integrated into the soil [5,6]. Throughout the pre- and post-monsoon seasons, the current study seeks to determine the relationship between various soil micronutrients in the Roha industrial zone.

EXPERIMENTAL SECTION

In the Raigad district Roha MIDC is where the study area is situated. We collected soil samples from eight different locations. To determine the depth of the soil horizons and to carry out discrete depth sampling by natural horizons, a soil pit was dug at each sample location. The soil samples were air dried, broken if they were in bulk, and sieved using a 2 mm screen. Every sample was stored in polythene containers [7]. The following was determined about the soil sample's analytical characteristics. Copper and nickel were assessed using an atomic absorption spectrophotometer, whereas cadmium, cobalt, chromium, mercury, lead, and zinc were measured using spectrophotometer. . The chemicals that were used were the AR grade. The analysis was conducted according to industry standards [8, 9]. The following equation was used to calculate the sodium adsorption ratio (SAR).

$$SAR = Na+ / [(Ca++ + Mg++) / 2]0.5$$

Where, Na+, Ca++ and Mg++ in (mg/kg)

RESULTS AND DISCUSSION

The results of the analysis are summarized in Table 1. The temperature in the entire region fluctuated from 37.5°C to 32.6°C from March 2018 to September 2018 for pre monsoon and post monsoon. The range of cadmium concentration in soil was 5.90 mg/kg to 73.5 mg/kg. Pre-monsoon and post-monsoon seasons saw the lowest and highest cadmium amounts, respectively. Industrial waste water discharge on the soil surface resulted in excessive amounts above the limit. The post-monsoon season had the highest cobalt concentration, whereas the pre-monsoon season had the lowest, ranging from 0.40 mg/kg to 168.5 mg/kg. The findings were over the critical thresholds established by higher plants. Microorganisms that fix nitrogen only need trace amounts. As a result, it appears that the soil's cobalt content is entirely sufficient for nitrogen fixation [10].

Chromium levels during the research period ranged from 0.60 mg/kg to 25.7 mg/kg. The pre-monsoon season had the highest concentration, while the post-monsoon season had the lowest. The pre- and post-monsoon seasons saw significant variations in copper and mercury levels. Nickel levels varied from 68.30 mg/kg to 168.5 mg/kg in the samples. The pre-monsoon season saw the lowest concentration of nickel and the post-monsoon season saw the highest. During the pre-monsoon season, the lead concentration ranged from 28.0 mg/kg to 88.5 mg/kg, with the post-monsoon season having the greatest concentration. Percolation of industrial effluent is to blame. Due to farmers' heavy use of inorganic fertilizer and ongoing discharge of industrial waste, effluents, and which was percolated in soil, which creates an imbalance in micronutrient content, copper, mercury, nickel, lead, and zinc seasonal fluctuations were observed in the pre-monsoon and post-monsoon seasons [11]. The range of the SAR, or sodium adsorption ratio, is 0.67 mg/kg to 83.59 mg/kg. The pre-monsoon season had the lowest SAR, while the post-monsoon season had the highest. A higher SAR value denotes clay soil, clay loam, or loamy sand.

Table 1 Shows the concentrations of several elements in soil samples from the Roha Industrial Area.

Location	Season	SAR	Pb	Zn	Cd	Co	Cr	Cu	Hg	Ni
S-1	**Pre. M.**	3.49	28	101.9	9.2	54.7	24	140.6	BDL	119.2
	Post.M.	16.94	81.2	85.6	24.1	104.5	23.9	119.7	BDL	158.5
S-2	**Pre. M.**	2.71	40.3	92.2	7.2	52.8	21.7	135.4	752	92
	Post.M.	9.78	88.5	758.5	23.4	106	21.1	144.4	189	144.8
S-3	**Pre. M.**	0.79	42.3	127.8	7.5	78.1	25	172.5	1174	114.7
	Post.M.	16.94	87.5	103.5	19.5	112.3	19.5	158.2	100	143.3
S-4	**Pre. M.**	13.6	33.1	109.1	7.9	50.1	0.6	95.9	BDL	77.2
	Post.M.	14.34	78.5	328.5	8.8	93.6	20.3	25.9	269	151.2
S-5	**Pre. M.**	2.99	37.2	89.2	9.9	62.7	23.3	119.3	1313	91.1
	Post.M.	5.62	82.3	578.5	20.8	8	23.4	140.8	BDL	156.4
S-6	**Pre. M.**	18.92	42.9	106.4	10.2	0.4	25.7	123	199	80.7
	Post.M.	52.06	81	88.5	5.9	116	17.3	13	69	158.5
S-7	**Pre. M.**	12.75	33.7	91.1	7.9	51.1	11.4	144.2	345	68.3
	Post.M.	83.59	80.5	68	28.6	98.5	10.1	82.1	19	117.3
S-8	**Pre. M.**	0.67	43.8	8.5	13.5	51.5	25.5	143.5	BDL	91
	Post.M.	7.44	88.13	73.5	73.5	168.5	10.4	72	BDL	168.5
Max		**83.59**	**88.5**	**758.5**	**73.5**	**168.5**	**25.7**	**172.5**	**1313**	**168.5**
Min		**0.67**	**28.00**	**8.50**	**5.90**	**0.40**	**0.60**	**13.00**	**19.00**	**68.30**
Average		**17.28**	**62.73**	**180.59**	**17.91**	**76.94**	**18.6**	**112.66**	**442.90**	**120.90**
St.dev.		**21.73**	**24.11**	**205.71**	**16.63**	**42.74**	**7.19**	**45.59**	**469.99**	**33.97**

CONCLUSION

Soil quality suffers as a result of industrial pollution. The overuse of fertilizer and irrigation water has the biggest effect on biomass. Good management is necessary for agricultural success over the long run.

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