Theme 3
Impacts of soil nutrient management on the environment and climate change

Assessment of heavy metal contamination in soils from selected agricultural areas in tropical Southwest India

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INTRODUCTION

High incidence of crop pests has always been a matter of concern in developing countries leading to intensive usage of agrochemicals for crop protection and improved yield. Although the chemicals are quite effective against pests, their influence on soil composition is a matter of serious concern. The study investigates the levels of heavy metals in agricultural soils from Udupi region, southwestern India which has a strong traditional agricultural background.

METHODOLOGY

Sample locations

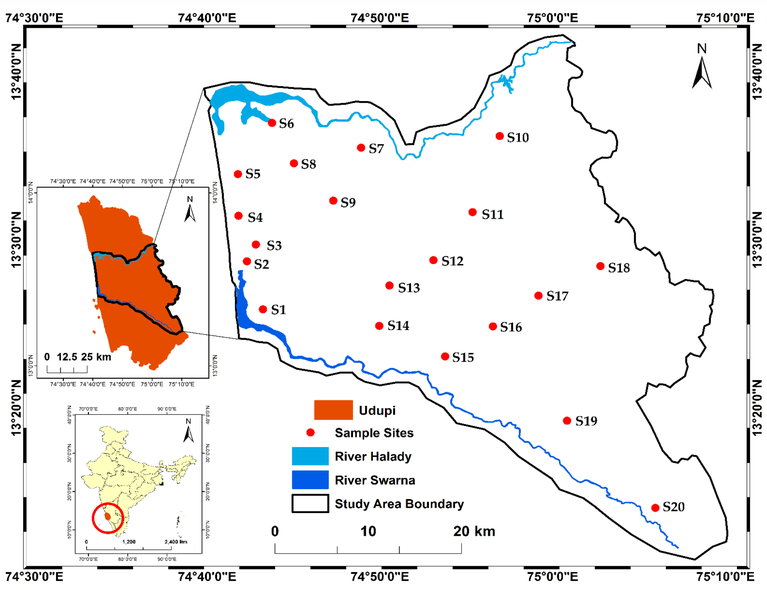

Fig 1: Geospatial location of the research area

Fig 2: Paddy fields used for sample collection

Heavy metal analysis

Twenty soil samples - Upper 10 cm layer was collected.

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Oven-dried at 50 °C, ground, and sieved through 2 mm mesh

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100 mg sample – digested on a hot plate using 2 mL HF (40%), 5 mL HNO_3 (65%), 2 mL HCl (35%).

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Mixture was filtered and diluted to a volume of 50 mL

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Heavy metals were analysed using ICP-OES (Thermofisher ICAP 7000 series).

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Triplicate measurements were carried out and check standards were analyzed as samples to maintain accuracy and precision [1, 2, 3]

Levels of heavy metals varied in the ranges 22 - 190, 11 - 68, 9 - 57, 26 - 75, 35 -130 mg/kg for Cr, Cu, Ni, Pb, and Zn, respectively. The highest concentration was that of Cr with an average value of 190.18 mg/kg. Heavy metals concentration decreased in the order Cr > Zn > Pb > Cu > Ni. Based on contamination factor (CF), heavy metals can be ranked in the order Pb > Cr > Ni > Zn > Cu. The average pollution load index (PLI) revealed unpolluted to polluted soil samples. Potential ecological risk index (PERI) values ranged from 19 to 203 indicative of a low to moderate potential ecological risk.

Table 1: Summary of heavy metals and pollution indices

Metal	Mean mg/kg	Min	Max	I_{geo}	PLI	PERI
Cr	92	22	190	0.59	1.32	1.54
Cu	25	11	68	-0.68	0.60	0.65
Ni	31	9	57	3.34	0.94	1.07
Pb	54	26	75	0.78	1.91	2.03
Zn	66	35	130	1.08	0.90	0.95

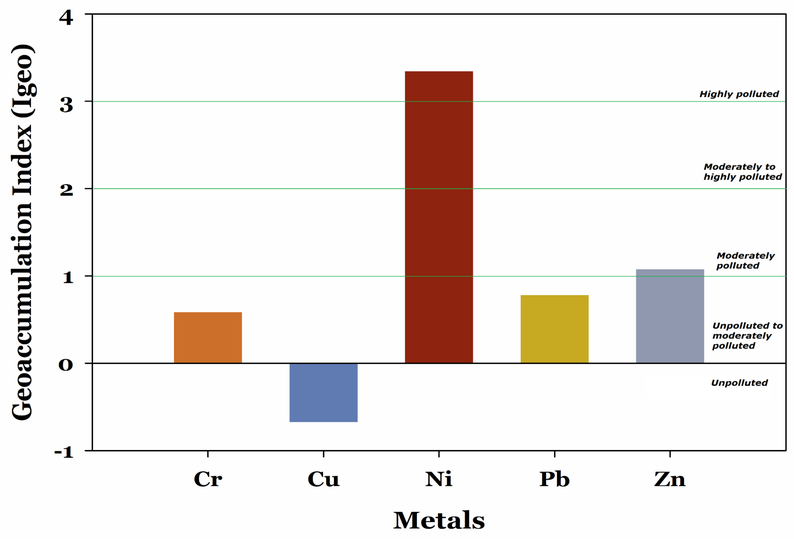

Fig 3: Geoaccumulation index

CONCLUSIONS

The study found that traditional farming practices and low consumption of synthetic fertilizers have aided in the preservation of soil health despite the long-term agricultural practices undertaken in the region. These findings could aid in the development of practical economic methods for sustainable management of heavy metals in soil to protect environmental and human health.

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