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ANALYSIS OF PHYSICO-CHEMICAL AND HEAVY METAL CONCENTRATION IN SOIL OF BIJAPUR TALUKA, KARNATAKA

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ABSTRACT

Assessment of heavy metal content in soil samples from various localities of Bijapur taluka, Karnataka was undertaken. Top soil samples (0-10 cm) were taken at various locations. The soil characterization was carried out for parameters like pH, electrical conductivity, nitrogen, phosphorous, potassium and heavy metals like copper, iron, manganese, zinc etc. During study period, fluctuation in various parameters were recorded. This effect may be due to different uptake tendency of growing plants in the fields. The higher values are indicative of anthropogenic inputs, either due to excess application of fertilizers or to industrial or mining activities. The conclusion is that massive chemical analysis of farmland soil samples could serve as a database for indicating potential micronutrient deficiency and excess or heavy metal build-up in croplands, allowing preventive actions to be taken.

Key words: Heavy metals, Soil analysis, Soil pH.

INTRODUCTION

Soil formation is a constructive as well as destructive process. Destructive process predominates the physical and chemical breaking down of materials, plants and animal structures, which result in the partial loss of more soluble and volatile products. Constructive forces develop new chemical compounds, both mineral and organic and provide new distribution or association characteristics, structural properties as well as chemical compositions. These factors influence the plant growth in the soil[1]. Bijapur taluka is one of the important taluka of Karnataka because of horticulture farming. The main crops cultivated in taluka area are grapes, pomegranate, lime, sapota, bajara, wheat, sugarcane etc. The yield of crop depends on fertility and presence of micronutrients and heavy metals in the soil. The soil condition is of great importance, because it is an universal medium for plant growth, which supplies essential nutrients to the plants. Some agricultural regions in Bijapur taluka present large areas deficient in micronutrients. On the other hand, there is also a risk of contamination of soils with excess metals because of atmospheric deposition or the use of pesticides or fertilizers that contain considerable amounts of metals. There is a growing concern about the possibility of soil contamination resulting in uptake by plants and the introduction of the elements in vital food chains

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affecting food safety. Thus knowledge of buildup of metals in the soils of cultivated areas is important to recognize potential ecological problems.

To monitor contamination of soils by heavy metals, the Environmental Protection Agency of the United States (USEPA)[2] recommends the determination of total contents in soils, extracted with concentrated nitric acid[3], even if the results often do not represent a good indication of bioavailability to plants. The availability of elements for plants in an agronomic sense can be estimated with reasonable precession by soil analysis, which allows the determination of the degree of deficiency, sufficiency or excess of plant nutrients and other elements. In principle, it can also be used for environmental monitoring, but the diagnosis of toxic levels of nutrients and other elements is seldom a concern in routine soil testing.

Survey showing the status of elements in the soils might be helpful in recognizing and understanding the nature and extent of deficiencies as well as excesses. Several alternatives have been used for the survey and mapping of the availability of micronutrients in soils for several parts of the world[4-8].

Metals are persistent pollutants that can be biomagnified in the food chains becoming increasingly dangerous to human and wildlife. Assessing pollutants in different components of the ecosystem has become an important task in preventing risk to natural life and public health. Heavy metals enter into the environment mainly via three routes; (i) Deposition of atmospheric particulate (ii) Disposal of metal enriched sewage sledges and sewage effluents and (iii) By-products from metal mining process. Trace heavy metal concentration in the soils is a major concern because of their toxicity and threat to human life and the environment[9]. Heavy metal studies are necessary to evaluate both soil/sediment and ground water contamination. Urban food security in India is a matter of growing concern. Heavy metals and other trace elements are important for proper functioning of biological systems and their deficiency or excess could lead to a number of disorders. Food chain contamination by heavy metals has become a burning issue in recent years because of their potential accumulation in biosystems through contaminated water, soil and air[10]. The purpose of the present study is to provide information regarding accumulation of heavy metals in the soil of Bijapur taluka. Furthermore, information about micronutrient and heavy metal contents in Bijapur farmland soils are scarce.

Materials and methods

Data collection and analysis- 10 soil samples (three replicates) were collected at surface level (0-10 cm in depth) were collected from various locations. The collected samples were air dried and sieved into course and fine fractions. Well mixed samples of 2 g each were taken in 250 mL glass beakers and digested with 8 mL of aqua regia on a sand bath for 2 hours[11]. After evaporation to near dryness the samples were dissolved with 10 mL of 2% nitric acid, filtered and then diluted to 50 mL with distilled water. The available nitrogen was determined by the method described by Subbaiah and Asija[12]. The available phosphorus and potassium in the soil were determined by the method described by Jackson[13]. Heavy metal concentrations (Cu, Fe, Mn, Zn) of each fraction was analysed by Atomic Absorption Spectrophotometer using GBC Avanta version 1.31 by flame Automization[14]. Quality assurance was guaranteed through double determinations and use of blanks for correction of background and other sources of error. Ec of soil samples were determined from saturation extract by conductivity meter. Measurement of pH of the soil samples were done (soil and water ratio 1 : 25) were done with the help of glass electrode pH meter[11-14]. Nickel and cadmium were analysed according to USEPA method (3050).

RESULTS AND DISCUSSION

The analytical data of soil samples are presented in Table 1. The soil pH of samples ranged from 7.9 to 8.4, slightly above the optimum range (5.5-8.00) considered to be satisfactory for horticulture crops. The

electrical conductivity values varied from 0.22 to 0.30 dS/m, well bellow the critical concentration. The available nitrogen was in lower range 135 to 160 Kg/ha. This might be due to higher range of mineralization due to high temperature (dry zone) and loss of nitrogen in the form of ammonia as the soils are calcareous. The available phosphorus content ranged from 8.0 to 10.1 Kg/ha which was low in range. The available potassium ranged from 295 to 355 Kg/ha which was in high range.

Table 1: Physico-chemical characteristics and heavy metals in soil of Bijapur taluka

S. No.	pH	EC ds/m (1.2)	N Kg/ha	P Kg/ha	K Kg/ha	Cu ppm	Fe ppm	Mn ppm	Zn ppm	Ni ppm	Cd ppm
1	8.2	0.25	135	8.0	300	3.6	1.27	3.5	1.33	BDL	BDL
2	8.4	0.23	144	9.5	325	3.5	1.20	3.9	1.40	0.18	0.02
3	8.1	0.26	151	8.5	336	3.2	1.25	2.8	1.25	BDL	BDL
4	8.1	0.25	137	10.1	350	3.1	1.27	3.2	1.37	BDL	BDL
5	7.9	0.27	145	8.3	355	3.5	1.20	3.4	1.30	BDL	BDL
6	8.0	0.30	160	8.5	340	3.8	1.13	2.9	1.27	BDL	BDL
7	8.4	0.28	157	9.1	320	3.7	1.07	3.2	1.25	BDL	BDL
8	8.2	0.29	148	9.5	310	3.6	1.10	3.4	1.15	BDL	BDL
9	8.1	0.22	150	9.5	340	3.2	1.22	3.3	1.22	BDL	BDL
10	7.9	0.24	158	8.4	295	4.0	1.25	2.8	1.45	0.22	0.054

Below detection limit (BDL)

The plant assimilates essential micronutrients as well as heavy metals from the soil for healthy growth, flowering, fruiting etc. The very low concentration as well as very high concentration shows deficiency and toxicity to the plants. Copper content was found from 3.1 to 4.0 ppm. Lower and higher values were recorded for samples 4 and 10 respectively, indicating a rather low range for most of the samples. The iron content was found to from 1.07 to 1.27 ppm which was in medium range[15]. Manganese content was in the range of 2.8 to 3.5 ppm indicating low range of manganese. Zinc content varied from 1.15 to 1.45 ppm for samples 8 and 10, respectively[16]. Nickel content was 0.18-0.22 ppm and cadmium content was 0.02-0.054 ppm in samples 2 and 10, respectively.

CONCLUSION

Monitoring of micronutrients in the soil provides efficient way to assess the qualitative and quantitative differences in metal concentrations at distinct locations. It can be concluded that the physico-chemical analysis of soil samples under study showed variable concentrations of various parameters. Irregular distributions of micronutrients were recorded during the present investigation which may be attributed to the added fertilizers during the crop formation.

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