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Analysis of different agriculture crop field's soil samples for various physico-chemical parameters from northern dry zone Karnataka

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Abstract
Soil is the one of the most important abiotic factor of the earth crust, it is natural resource and formed by various process like physical, Chemical and Biologically. Soil plays vital role in the life of plants for their growth and development hence acts as a medium. The Bajra and Pigeon Pea agricultural crop field's Rhizosphere and Rhizoplane soil samples from different localities were analyzed to determine the physic-chemical parameters which are basic activity of agricultural practices. Overall Fourteen soil samples of depth about 0-15cm from 7 District of Northern Dry Zone Karnataka, India. The Physico-chemical Parameters such as Soil pH, Color, Temperature, EC, OC, N, P, K. Sulphur, Zinc, Copper, Iron, Magnesium and Moisture Content. The Color and Temperature are measured during the time of samples collection, the strength of the different soil samples were Analyzed.

Keywords: physico-chemical parameters, rhizosphere, rhizoplane

Introduction

Soil rich in nutrients is essential for producing a healthy and nutritious crop. Soil characteristics can be measured using chemical, physical and biological methods (Shukla *et al*., 2006) [19]. These characteristics are often linked to the parent material, atmosphere, relief, living organism, and time (Esu, 1999) [3]. Nutrient compositions in the ecosystem are gradually gathered through the bioresorbable organisms, atmosphere, litter fall, chemical, physical and biological (Glumphabutr *et al*., 2007) [4]. The crop structure and agricultural management systems being used by local people have a big impact on the physico-chemical properties of agroecosystem soils. Soil organic matter (SOM) affects the soil physical characteristics and productivity of the agricultural fields (Campbell *et al*., 1996) [2]. However, continuous cultivation practices cause considerable losses of SOM and other nutrients (Polyakov and Lal, 2004).Cultivation practice reduces soil permeability by destroying soil structure, and these changes have an effect on soil quality and agricultural productivity. However, characteristics of agricultural soil are the utmost important association between farming practices and sustainable agriculture, since agricultural production mainly rely on the soil quality (Law-Ogbomo *et al*., 2010) [11]. Soil nutrients (Nitrogen, Phosphorous, and Potassium) are removed through the soil through agricultural products (food, fibre) and crop residues. As a result, comprehensive studies of soil properties are prerequisite in agro-ecosystems in order to handle soil properties in a way that maximizes yield and efficiency. Keeping above in the deliberation, the aim of this study was to learn about the physical and chemical properties of soil in various agro-ecosystems that were maintained by indigenous people in traditional ways. The conservation of the diversity of mycoflora in farming fields becomes very essential for the development of sustainable agriculture. The studies on fungal diversity and percentile contribution and the periodic occurrence of soil mycoflora are useful for farmers, agronomists, researchers and microbiologists for future activities in the view of conservation of soil ecosystem, conservation of soil microbial variety and sustainable agriculture. (Ratna Kumar P.K *et al*., 2015) [5]. Soil textural characteristics, including such depth, temperature, consistency, moisture content, nutrient content, porosity, permeability, and so on, may have a significant impact on the type of vegetation that grows there (Boyle and Powers, 2013). Soil is a complex zone made up of inorganic (rocks) and organic (animal and plant remains), gaseous substances, liquid (chemicals and water) that are maintained by chemical, physical and biological processes (Isah *et al*.. 2014). Soil is among the most vital resources of nature. All living things depend on plants, and plants grow in soil for day to day need. Soils serve as a growing medium for crops such as food and cloth. Soil is important not only for agriculture, but it is also beneficial to living organisms. Soil is essential not only for agriculture, but it is also beneficial to living organisms. Soil is an element of the terrestrial environment that performs a variety of functions, including all those needed for plant growth and development (Nwachokor *et al* 2009) [16].The moisture and nutrients are the important reservoir of soil for the production of plant species and forage that has been predictable since from the beginning of management of forest as a science (Schlesinger *et al*., 1999) [18]. Every portion of the earth's surface that supports vegetation receives a layer of soil on top of it. The soil condition has a significant impact on the distribution and growth of vegetation (Kardol *et al*., 2009) [6]. The life surface of plants is formed by soil, which is a medium of unconsolidated nutrients and materials. It is one of the biosphere's most vital life-supporting elements. Agricultural chemists use physicochemical studies parameters to help with plant growth and soil management (Jaishree *et al*., 2008;

Kanimozhi *et al.,* 2011) [13, 7].The fertility of the soil relies on the concentration of nitrogen, phosphorous, potassium, organic and inorganic materials, and conductivity. Moisture material, basic gravity, and other physico-chemical properties, nitrogen is a fertilizer that is necessary for plant growth. Potassium utilized for the purpose of flowering, as well as for protein synthesis, fruit quality, photosynthesis, and diseases reduction and further used in the plant root growth. Calcium is a necessary component of a plant's cell wall, since it allows for natural transport and retention of other substances (Gupta *et al.,* 1994, Garba; *et al.,* 2013, Kordlaghari *et al.,* 2013, Borah *et.al.,* 2009) [1, 15, 9, 10].

II. Study site and location: **Northern Dry Zone**

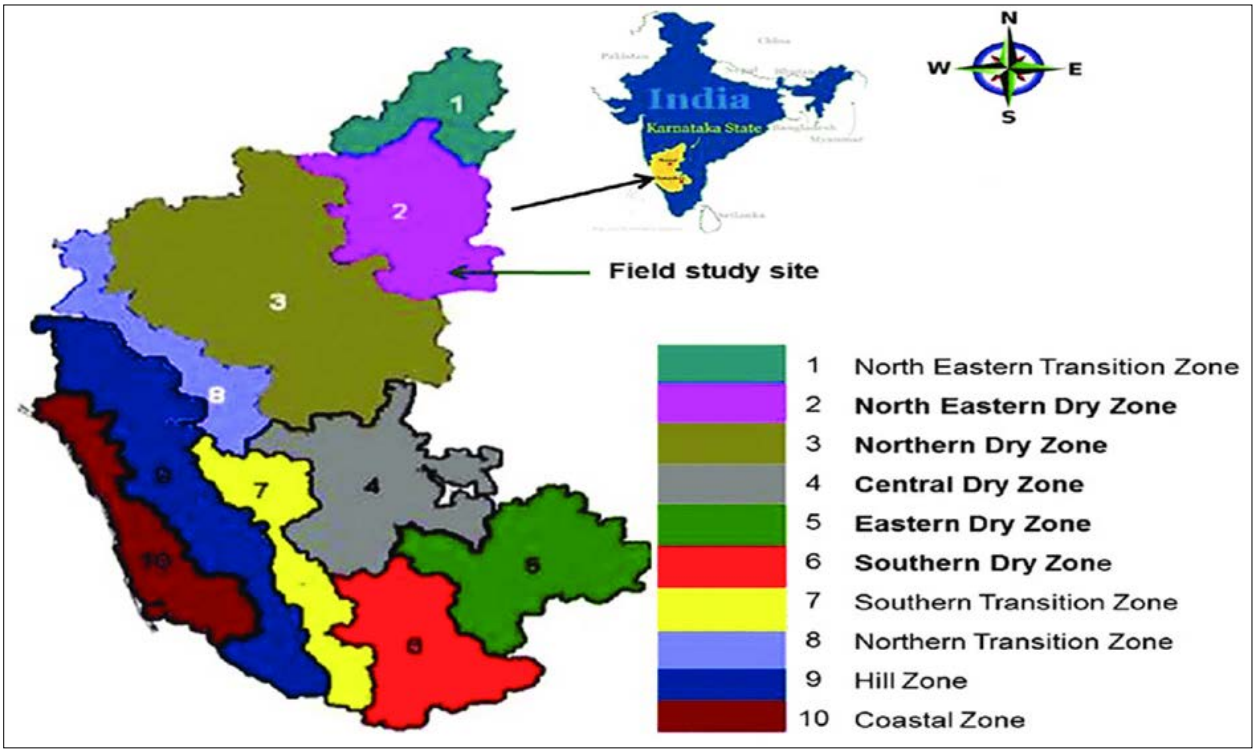

Fig 1: Agro climatic regions of Karnataka state.

Geography

At an altitude of 300m-460m above the mean sea level, 76065' E longitude, and 17025N latitude situated at the Northern Dry Zone. On the north, it is bordered by the North Eastern dry zone; on the south, it is bordered by the Central zone; on the west, it is bordered by the Northern transition zone; and on the east, it is bordered by Andrapradesh. The climate is dryness and the Annual rainfall ranges from 500mm to 625mm and about 420mm or about 52%of yearly rainfall is received during Kharif season (Jun-Sep) and an average normal rainfall of 91mm in the pre-monsoon (Jan-May) and 149mm in the northeast monsoon (Oct-Dec). It is essential to understand the basic rhizosphere and rhizoplane microbial ecology in cultivated Agricultural crop fields.

Materials and Method

Study area: Northern dry zone

The zone is the highest in the state, with a Geographical area of about 5.04 million ha. This zone encompasses 35 taluksof **7** districts (Koppala, Bagalakote, Vijayapura, Davanagere, Ballary, Belagavi and Gadag) with a mean elevation of 800 m to 900 m above the MSL. This zone has basaltic landscape, sedimentary landscape, metamorphic, granite and gneissic landscapes of the plateau region (Ramachandran 2012).

Soil sampling, collection and preparation

Both rhizosphere and rhizoplane Fourteen soil samples were collected randomly from Bajra and pigeon pea crop fields in different localities of the Karnataka Northern dry zone at depth (up to 15cm) Bulk soil samples are taken into small sterilized polythene bags with tags date, place and time are mentioned accordingly and further physico-chemical analysis were conducted in the laboratory.

Physico-chemical analysis of soil samples

The different collected soil samples were estimated for major Physico-chemical parameters of the soil like soil pH, temperature, electric conductivity (Salinity) Percentage of organic Carbon, atmospheric Nitrogen, Phosphorous, Potassium, Sulphur, Iron, Zinc, Copper and Magnesium.

Table 1: Methods used for estimation of Physico-chemical Parameters

Sl.No	Parameter	Method
1.	Soil colour	By visual method (viewing the soil sample)
2.	% of moisture content	By weighing method
3.	pH	By Potentiometric method
4.	EC (dsm-1)	By Electrical conductivity meter
5.	% of organic carbon	By Titration method

6.	Nitrogen (kg/hectare)	By alkaline $KMnO_4$ (potassium permanganate-Titration Method)
7.	Phosphorous (kg/hectare)	By Spectrophotometer method
8.	Potassium (kg/hectare)	By Flame photometer
9.	Sulphur (mg/hectare)	By Turbidometeric method
10.	Iron (mg/hectare)	By Atomic Absorption Spectrophotometer (AAS) Diethyl Triamine Penta Acetic acid (DTPA)
11.	Zinc (mg/hectare)	
12.	Copper (mg/hectare)	
13.	Magnesium (mg/hectare)	

Results and Discussion

The physico-chemical parameters of the soil samples are represented in Table 1. The soil samples colour was observed visually as black and red respectively.

Table 2. Physico-chemical investigation of soil samples from Bajra and pigeon pea crop fields at different locations of the Study area.

Table 2: Bajra crop fields soil samples

Analysis of Soil Quality Parameters									
Sl. No	**Soil Quality parameters**	**Sample-1 (Bijapur)**	**Sample-2 (Baglkot)**	**Sample-3 (Belagavi)**	**Sample-4 (Gadag)**	**Sample-5 (Koppala)**	**Samp-6 (Bellary)**	**Sample-7 (Davangere)**	**Range suitable for cropping IAS for soil Analysis**
1.	Soil colour	Black cotton	Gryesh	Black cotton	Black cotton	Red sandy	Red sandy	Red sandy	-
2.	% of moisture content	3.15 %	3.335%	3.21%	3.44%	1.88%	1.54%	1.61%	1 to 7%
3.	pH	8.42	8.35	8.13	8.27	7.65	8.55	8.32	6.5 to 7.5
4.	EC (dsm-1)	0.55	0.50	0.80	0.60	0.35	0.45	0.57	1 to 2
5.	% of organic carbon	0.41	0.43	0.43	0.52	0.59	0.53	0.52	0.50 to 0.75
6.	Nitrogen (kg/hectare)	217.6	226.13	211.64	297.10	243.92	243.16	283.11	280 to 560
7.	Phosphorous (kg/hectare)	28.76	24.11	27.29	28.55	26.16	21.19	26.64	22 to 56
8.	Potassium (kg/hectare)	412.68	34.56	371.36	306.60	332.68	1044.03	309.70	144 to 336
9.	Sulphur (mg/hectare)	13.11	21.10	16.1	11.17	15.24	13.00	12.67	10 to 20
10.	Iron (mg/hectare)	0.84	2.68	0.88	1.46	3.28	0.72	0.84	2.5 to 4.5
11.	Zinc (mg/hectare)	0.36	0.56	0.62	0.92	0.31	0.54	.51	0.6 to 1.5
12.	Copper (mg/hectare)	0.80	0.86	0.86	0.44	0.40	0.40	0.44	0.8 to 1.6
13.	Magnesium (mg/hectare)	1.20	3.84	1.70	2.16	5.96	1.50	1.20	2 to 4

* Samples collected from crop fields at different locations of the Northern dry zones of Karnataka

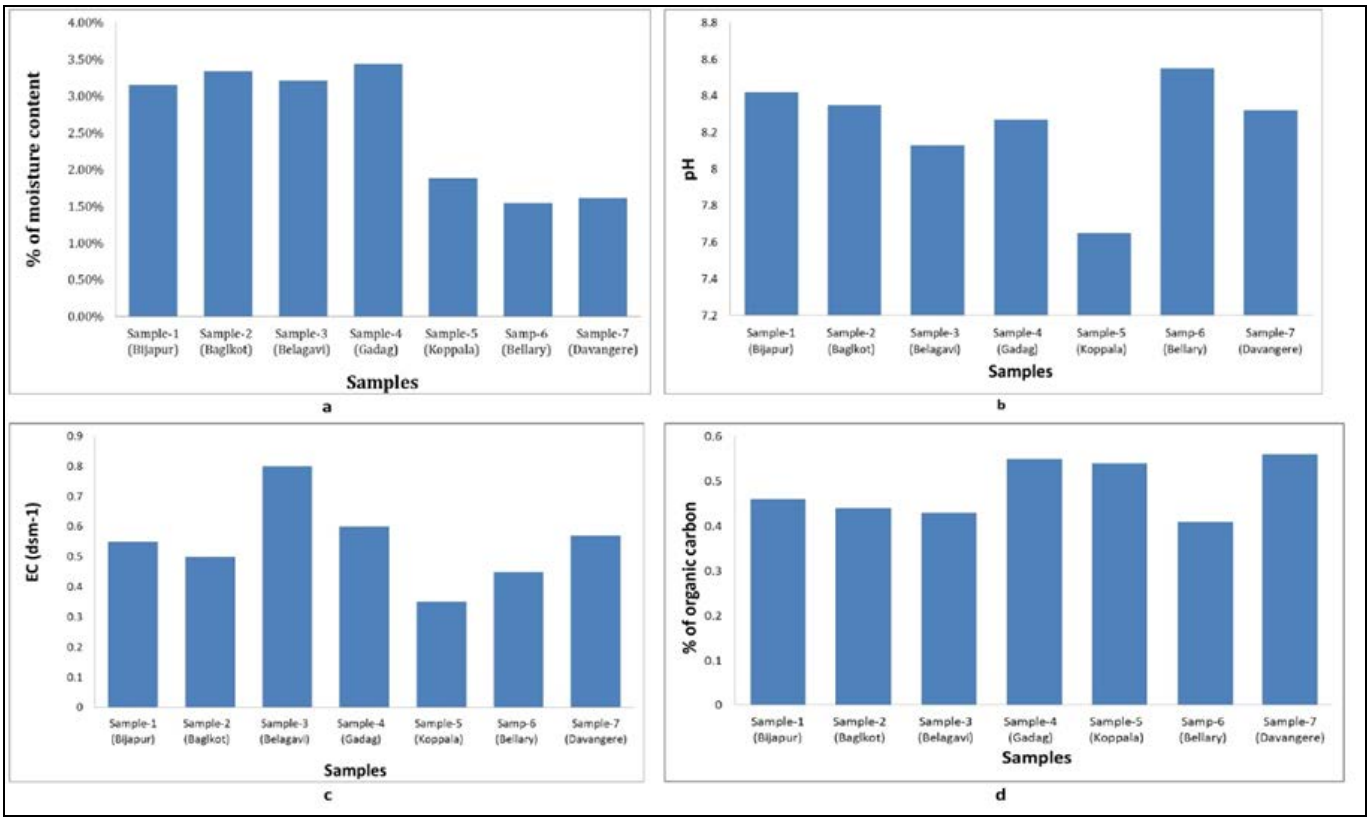

Fig 2: (a) Moisture Content, (b) - pH, (2c) - Electric conductivity and (2d) - Percentage of organic carbon respectively.

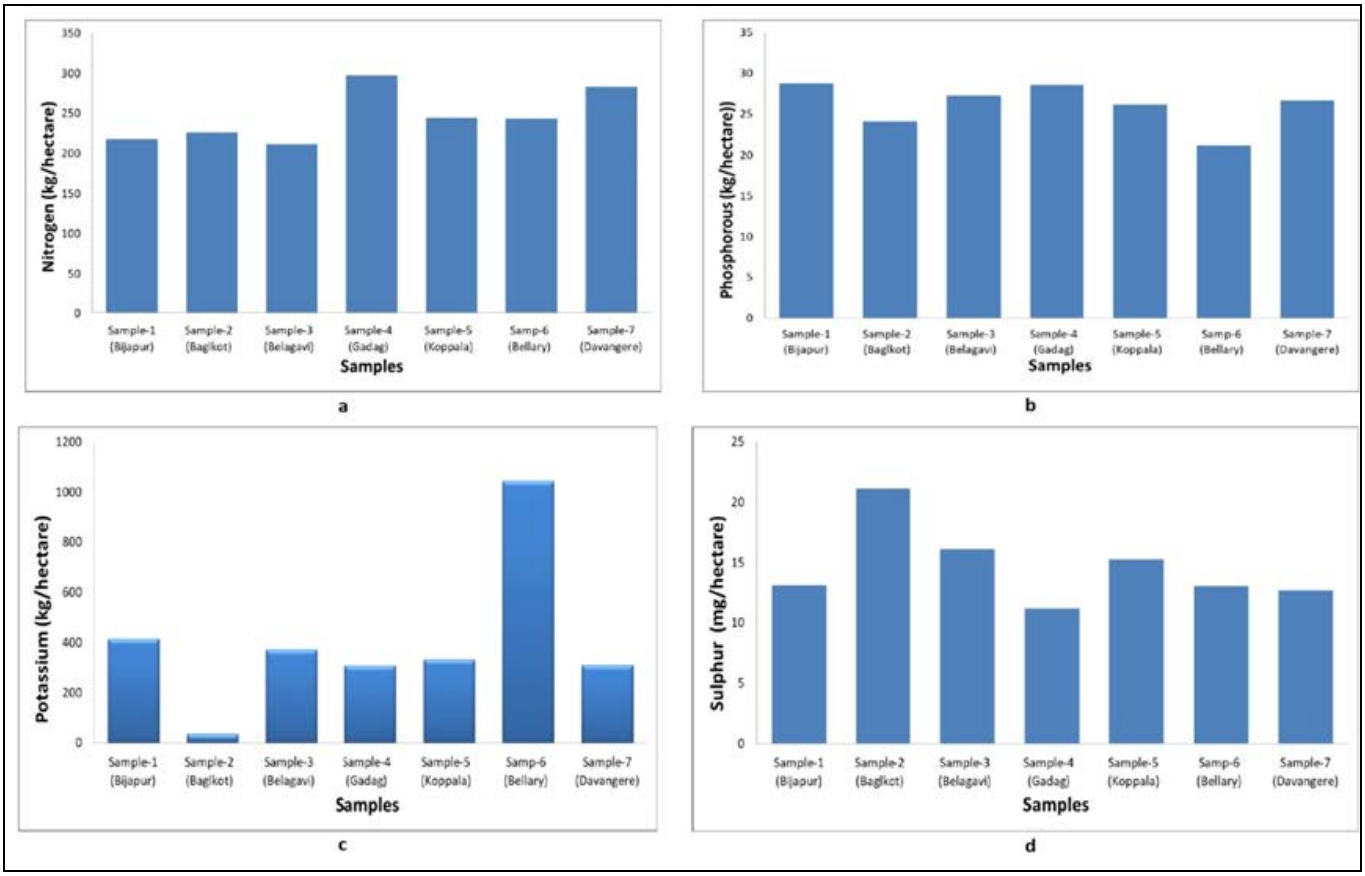

Fig 3: (a) - Nitrogen, (b) - Phosphorous, (c) - Potassium and (d) - Sulphur respectively.

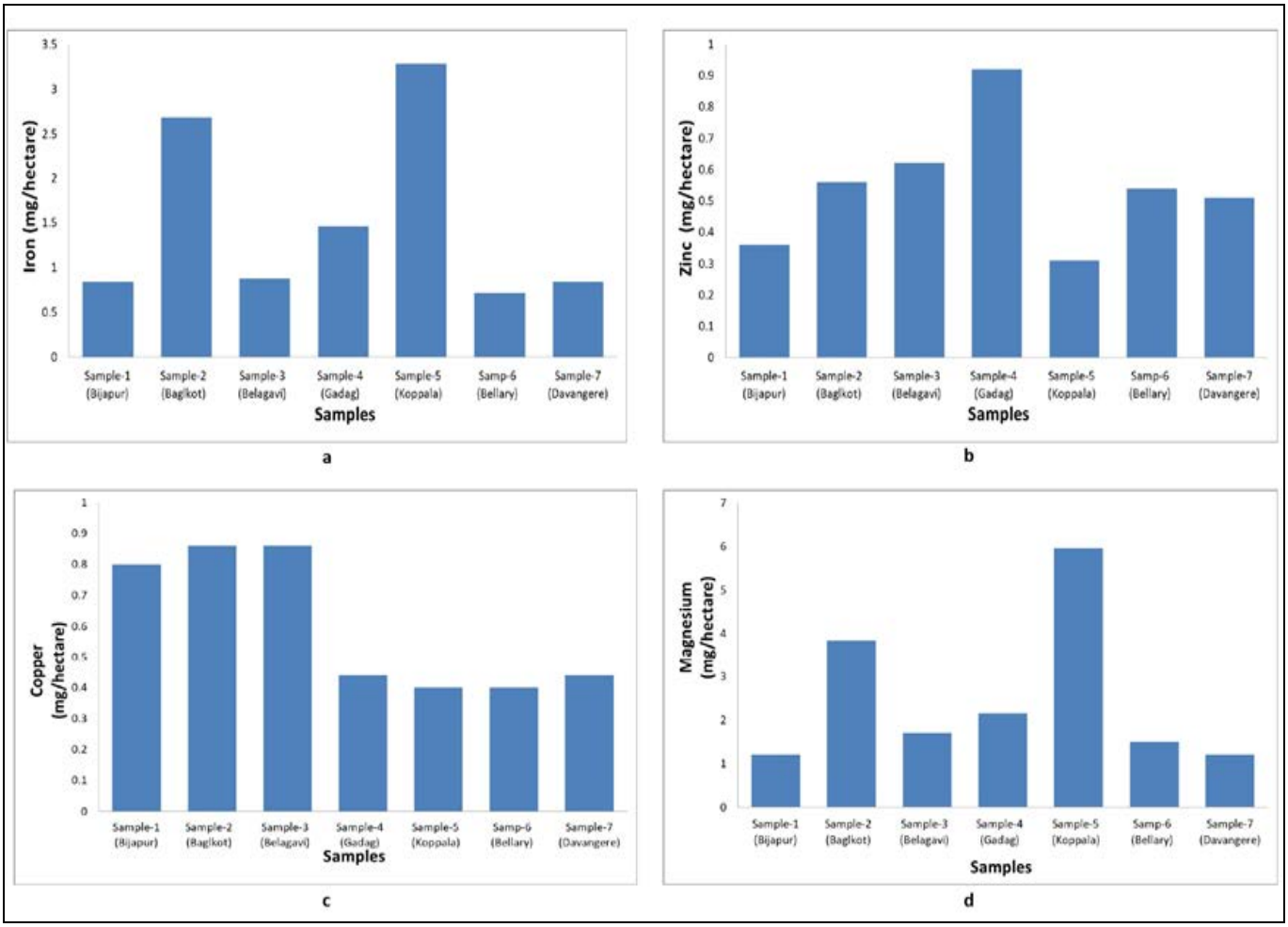

Fig 4: (a) - Iron, (b) - Zinc, (c) – Copper and (d) - Magnesium respectively.

Figure (2a) Percentage of moisture content against samples. Represents the bajra crop field percentage of moisture content in the sample through weighing technique, in which the gadag and bellary district has showed highest and lowest moisture content respectively.

Figure (2b) pH indicators against samples depict the bajra crop field pH of the sample i.e., the relative hydrogen ion concentration in the solution through potentiometric analysis. The pH of the sample usually greater than the pH 7 represents the alkalinity nature of the soil. If the pH value less than 6 indicates acidic nature, and pH range lies in 6.0-8.0 it is normal nature, if the pH greater than 8.0 then it should be alkaline nature of soil.

Figure (2c) Electrical conductivity against samples. Indicates the bajra crop field electrical conductivity studies using conductometry method. The electrical conductivity obtained greater and lower for belagavi and koppala district soil sample respectively.

Figure (2d) Percentage of organic carbon against samples. Represents the bajra crop field organic carbon percent in the soil sample collected from the different region by wet oxidation. In which the davangere district obtained more organic carbon percent compare to other district sample.

Figure (3a) Nitrogen against samples. Depicts the bajra crop field nitrogen available in the soil sample through alkaline per magnate method. The highest available nitrogen content obtained from the gadag district region soil sample.

Figure (3b) Phosphorous against samples. Determines the bajra crop field phosphorous content present in the soil sample collected from the different regions of the district through colorimetry. The bijapur and gadag district soil sample obtained have the more phosphorous weight in the soil.

Figure (3c) Potassium against samples. Represents the bajra crop field available potassium in the different regions of the soil sample. The highest available potassium content obtained from the bellary district soil sample.

Figure (3d) Sulphur against samples. Depicts the bajra crop field sulphur present in the different regions of the soil sample. The greater and lesser content of the sulphur present in baglkot and gadag respectively.

Figure (4a) Iron against samples. Determines the bajra crop field iron present in the different soil regions by atomic absorption spectrophotometer. The highest iron content determined from the baglkot and koppala district regions respectively.

Figure (4b) Zinc against samples. Represents the bajra crop field zinc component present in the various regions of soil sample by atomic absorption spectrophotometer. The highest zinc content obtained in the gadag district soil sample.

Figure (4c) copper against samples. Determines the bajra crop field copper present in the various district soil samples by Diethyl Triamine Penta Acetic acid (DTPA). Three districts regions have more copper content in the soil sample i.e., bijapur, bagalkot, and belagavi respectively.

Figure (4d) Magnesium against samples. Represents the bajra crop field magnesium component obtained from different soil samples. The koppala and baglkot district obtain the larger content of magnesium from the soil sample.

Table 3: Pigeon Pea crop fields soil samples

Analysis of Soil Quality Parameters									
Sl.no	**Soil Quality parameters**	**Sample-1 (Bijapur)**	**Sample-2 (Baglkot)**	**Sample-3 (Belagavi)**	**Sample-4 (Gadag)**	**Sample-5 (Koppala)**	**Samp-6 (Bellary)**	**Sample-7 (Davangere)**	**Range suitable for cropping IAS for soil Analysis**
1.	Soil colour	Black cotton	Grayish	Black cotton	Black cotton	Red loamy	Red sandy	Red sandy	
2.	% of moisture content	4.15 %	2.35%	4.21%	4.44%	2.18%	2.54%	1.81%	1 to 7%
3.	pH	8.35	8.43	8.01	8.59	8.15	8.35	8.12	6.5 to 7.5
4.	EC (dsm-1)	0.58	0.39	0.96	0.59	0.68	0.37	0.53	1 to 2
5.	% of organic carbon	0.46	0.44	0.43	0.55	0.54	0.41	0.56	0.5 to 0.75
6.	Nitrogen (kg/hectare)	223.16	219.00	209.08	210.6	244.11	211.13	291	280 to 560
7.	Phosphorous (kg/hectare)	29.24	26.11	28.40	27.11	22.16	19.16	24.44	22 to 56
8.	Potassium (kg/hectare)	338.88	416.00	413.76	391.00	408	455.16	311.4	144 to 336
9.	Sulphur (mg/hectare)	14.31	19.36	17.16	11.05	10.71	15.11	11.87	10 to 20
10.	Iron (mg/hectare)	0.56	2.60	0.52	4.28	1.26	1.72	0.74	2.5 to 4.5
11.	Zinc (mg/hectare)	0.28	0.56	0.41	0.56	0.66	0.28	0.54	0.6 to 1.5
12.	Copper (mg/hectare)	0.61	0.74	0.86	0.52	0.41	0.48	0.48	0.8 to 1.6
13.	Magnesium (mg/hectare)	0.98	4.50	1.72	2.20	1.66	2.72	1.86	2 to 4

* Samples collected from crop fields at different locations of the Northern dry zones of Karnataka

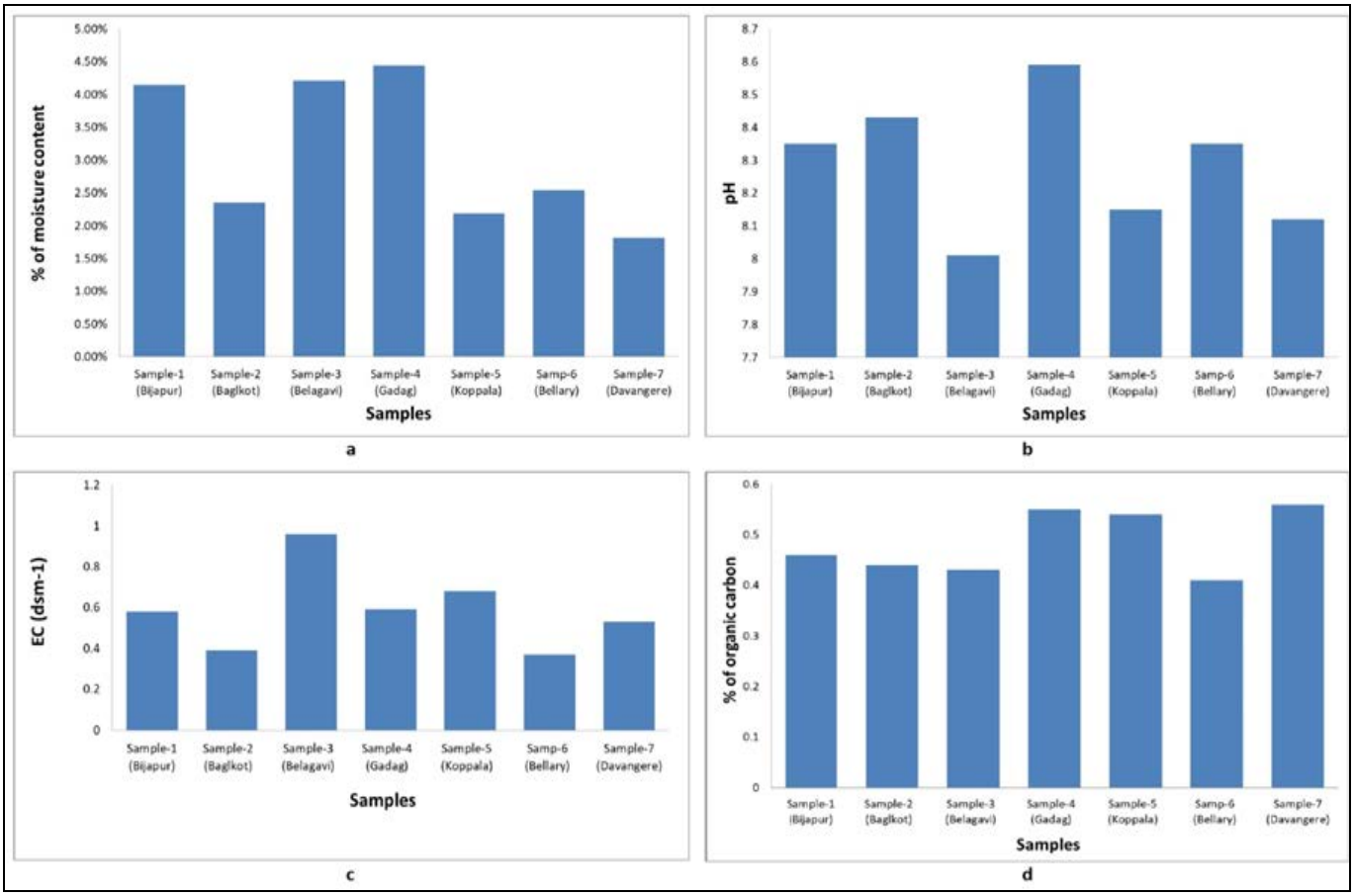

Fig 5: (a)-Moisture Content, (b) - pH, (c) - Electric conductivity and (d) - Percentage of organic carbon respectively.

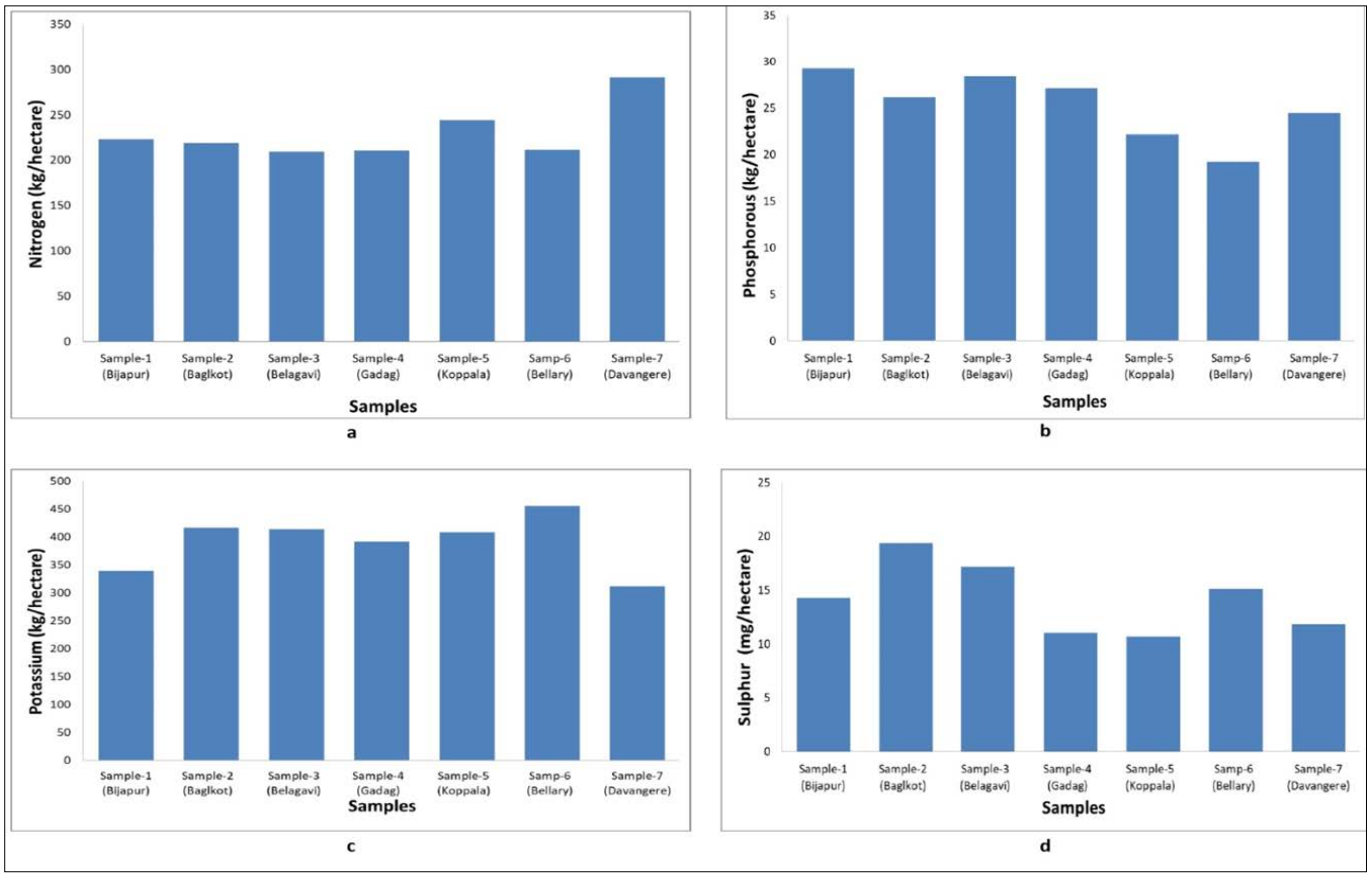

Fig 6: (a)-Nitrogen, (b)-Phosphorous, (c)-Potassium and (d)-Sulphur respectively.

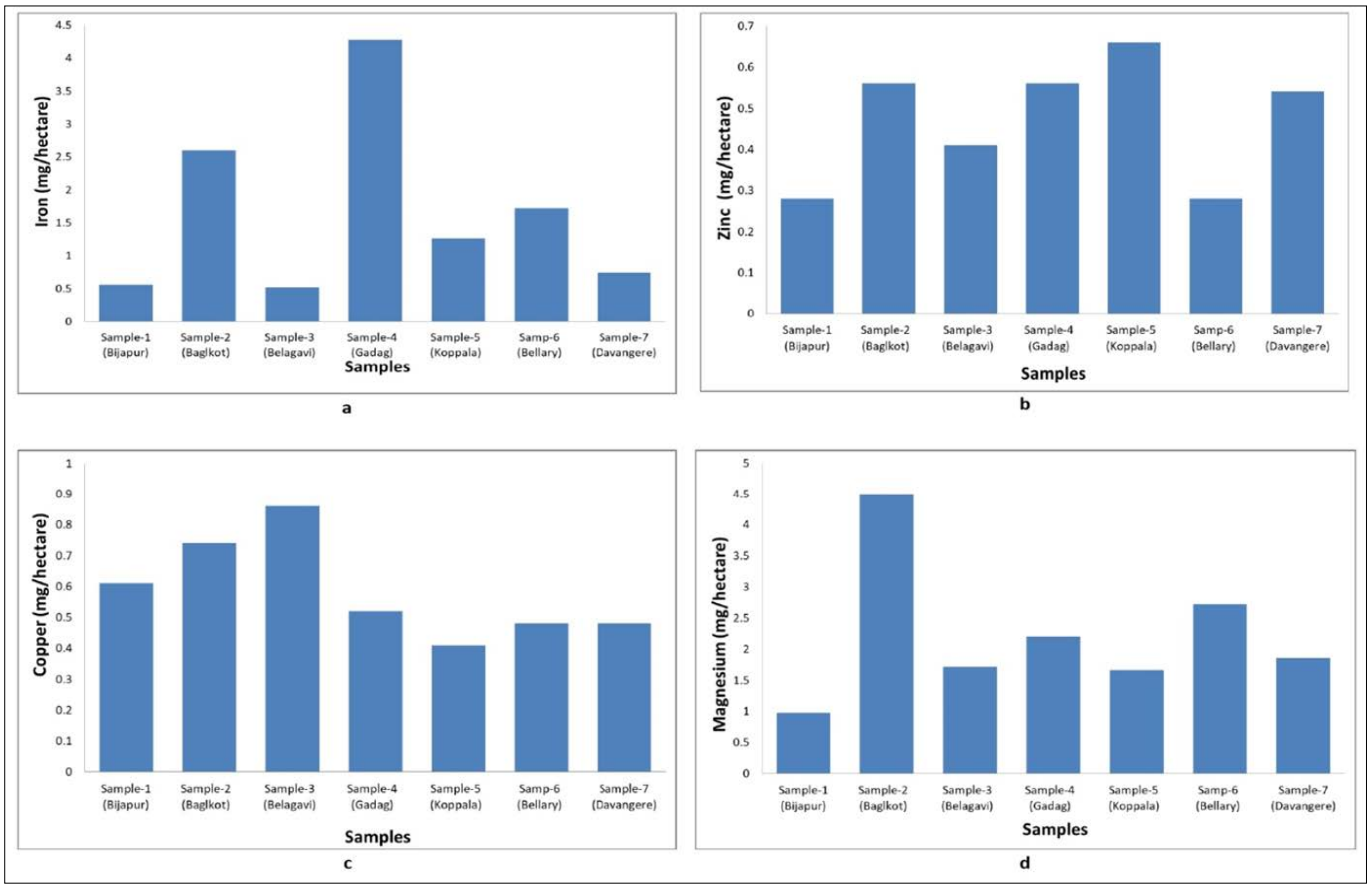

Fig 7: (a)-Iron, (b)-Zinc, (c)–Copper and (d)-Magnesium respectively.

Figure (5a) Percentage of moisture content against samples. Represents the pigeon pea crop field percentage of moisture content in the sample through weighing technique, in which the gadag and davangere district has showed highest and lowest moisture content respectively.

Figure (5b) pH indicators against samples. Depicts the pigeon pea crop field pH of the sample i.e., the relative hydrogen ion concentration in the solution through potentiometric analysis. The pH of the sample usually greater than the pH 7 represents the alkalinity nature of the soil.
If the pH value less than 6 indicates acidic nature, and pH range lies in 6.0-8.0 it is normal nature, if the pH greater than 8.0 then it should be alkaline nature of soil. The gadag district determines the most alkalinity nature of the soil.

Figure (5c) Electrical conductivity against samples. Indicates the pigeon pea crop field electrical conductivity studies using conductometry method. The electrical conductivity obtained greater and lower for belagavi and bellary district soil sample respectively.

Figure (5d) Percentage of organic carbon against samples.represents the pigeon pea crop field organic carbon percent in the soil sample collected from the different region by wet oxidation. In which the davangere district obtained more organic carbon percent compare to other district sample.

Figure (6a) Nitrogen against samples. Depicts the pigeon pea crop field nitrogen available in the soil sample through alkaline per magnate method. The highest available nitrogen content obtained from the davangere district region soil sample.

Figure (6b) Phosphorous against samples. Determines the pigeon pea crop field phosphorous content present in the soil sample collected from the different regions of the district through colorimetry. The bijapur and belagavi district soil sample obtained have the more phosphorous weight in the soil.
Figure (6c) Potassium against samples. Represents the pigeon pea crop field available potassium in the different regions of the soil sample. The highest available potassium content obtained from the bellary district soil sample.

Figure (6d) Sulphur against samples. Depicts the pigeon pea crop field sulphur present in the different regions of the soil sample. The greater and lesser content of the sulphur present in baglkot and belagavi respectively.

Figure (7a) Iron against samples. Determines the pigeon pea crop field iron present in the different soil regions by atomic absorption spectrophotometer. The highest iron content determined from the gadag and baglkot district regions respectively.

Figure (7b) Zinc against samples.represents the pigeon pea crop field zinc component present in the various regions of soil sample by atomic absorption spectrophotometer. The highest zinc content obtained in the gadag district soil sample.

Figure (7c) Copper against samples. Determines the pigeon pea crop field copper present in the various district soil

samples by Diethyl Triamine Penta Acetic acid (DTPA). Three districts regions have more copper content in the soil sample i.e., bijapur, bagalkot, and belagavi respectively.

Figure (7d) Magnesium against samples. Represents the pigeon pea crop field magnesium component obtained from different soil samples. The baglkot and bellary district obtain the larger content of magnesium from the soil sample.

Conclusion

The present scientific report discloses the physicochemical vital parameters to the agricultural chemists for the soil management and plants growth. It is concluded from the data, the salinity of all soil samples is found to be present within range but soon it is expected to cross the limits, rendering a threat to agricultural activities. Monocultures, lack of crop rotation, and improper use of chemical fertilizers are among the major issues identified at all five sampling stations, and they must be tackled as soon as possible at present agricultural practices. The lack of solubilization of fertilizers applied to the crops can be addressed by enhancing the soil enzyme activity in the soil.

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