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AGRICULTURAL SOIL STUDY BASED ON ELECTRICAL CONDUCTIVITY OF SAURASHTRA AREA OF GUJARAT STATE

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ABSTRACT

Agriculture land of three districts of Gujarat state, which falls in Saurashtra region are selected for the present study. Total 180 agricultural soil samples from Kutch, Junagadh and Surendranagar districts of Gujarat state are investigated. Soil samples are collected by authorized locally trained farmers and brought for analysis to Soil Test Laboratory in respective districts approved by Government of Gujarat under soil health card program. Macro and micro nutrients and soil properties of three districts are studied, analyzed and compared by discriminate analysis and correlation analysis. Electrical conductivity of studied samples is in 0 - 2 range i.e. salt free range. The result shows that except some nutrients, macronutrients show positive correlation and micronutrients show negative correlation with EC in studied sites. Present study leads to concludes that the use of statistical analysis can be a strong and scientific analytical tool for agricultural soil evaluation and fertility management.

KEYWORDS: Electrical Conductivity, Junagadh, Micronutrients, Saurashtra, Soil Properties

INTRODUCTION

Soil can be described as the skin of Earth. It is one of the most important natural resource, as well as the most essential factor for agricultural practice so it is important to study and understand the basic requirements of soil for its maximum utilisation. "Quality" of Agriculture soil is the ability of soil to perform functions necessary for its intended application. The quality of soil is determined by physical and chemical properties as well as macro- micro nutrients. Soil provides essential nutrients to crop so proper care, conservation and management is required in order to maintain a high degree of soil fertility system. One of the ways to evaluate the soil fertility status is to get soil sample tested for different soil parameters. Statistical analysis, as powerful tools, can provide such information and assist the interpretation of soil tested data [1-7].

pH and electrical conductivity (EC) are useful to characterize an environment, such as a body of water. pH and EC measurements, can vary greatly and are affected by several environmental factors including climate, local biota (plants and animals), bedrock and surfacial geology, as well as human impacts on the land. Soil pH is one of the most important soil properties that affect the availability of nutrients. Macronutrients tend to be less available in soils with low pH. Micronutrients tend to be less available in soils with high pH. pH value of soil is indicative of acidic/sodic nature of soil.

Electrical conductivity indicates the amount of soluble (salt) ions in soil and is the ability of a material to conduct an electrical current or in other words it is a measure of salinity of soil. It is measured in milliSiemens per meter (mS/m) or in deciSiemens per meter (dS/m). The EC levels of the soil water is a good indication of the amount of nutrients available for crops to absorb and is an important indicator of soil health. It affects crop yields, crop suitability, plant nutrient availability and activity of soil microorganisms, it is an indirect measurement that correlates very well with several soil

physical and chemical properties. It is affected by cropping, irrigation, land use, and application of fertilizer, manure and compost.

The aim of this paper is to do comparative study of 180 samples from three different districts of Saurashtra region of Gujarat state based on EC.

MATERIAL AND METHODS

Study Area: The study area constitutes three districts namely Kutch (Site-1), Junagadh (Site-2) and Surendranagar (Site-3)[8-10].

Site-1 Kutch: Kutch is a district of Gujarat state in Western India, covering an area of 45,652 km², is one of the largest district in India, located between 22.44º to 24.41º North (Latitude) 68.89º to 71.45º East (Longitude). The temperature range is 45º Centigrade (Maximum) and 4º Centigrade (Minimum). Average rainfall is 587 mm. The district has 10 talukas, of which the main towns are Gandhidham, Rapar, Nakhatrana, Mandvi, Anjar, Madhapar, Mundra and Vondh. Kutch has 949 villages. Rann of Kutch is a seasonal marsh region surrounding the main land mass of Kutch. It is a saline lowland, rich in natural gas and a resting/nesting site for migratory Siberian birds. Kutch is virtually an island, surrounded by the Arabian Sea in the West; the Gulf of Kutch in South and Southeast and Rann of Kutch in North and Northeast. The border with Pakistan lies along the Northern edge of the Rann of Kutch, of the disputed Kori Creek. Total geographical area is 1958000 ha. Major soils are black, sandy, hydromorphic[11]. Major field crops are bajra, greengram, castor, groundnut, cotton, wheat, mothbean and major horticultural crops are mango, sapota, papaya, banana, cucurbits[12].

Site-2 JUNAGADH: Geological location of study area is 69.40° to 71.05 ° East (Longitude), 20.44° to 21.40° North (Latitude). 86m (Altitude). The district is located on the Kathiawar peninsula in Western Gujarat. Major crops produced in the district are wheat, oilseeds, cotton, mango, banana, onion and brinjal. Mango and onions are produced in large quantities in the district.

Site-3 SURENDRANAGAR: Surendranagar is situated between 22°43' N Latitude and 71°43'E Longitude can be rightly termed as gateway to Saurashtra. The district occupies an area of 10,489 square kilometres (4,050 sq mi). It is also known as cotton city of India. Major field crops cultivated in the Surendranagar district are cotton, sesame, cumin, bajra, wheat, castor, groundnut, pulses.

Location map of study area is given in figure 1.

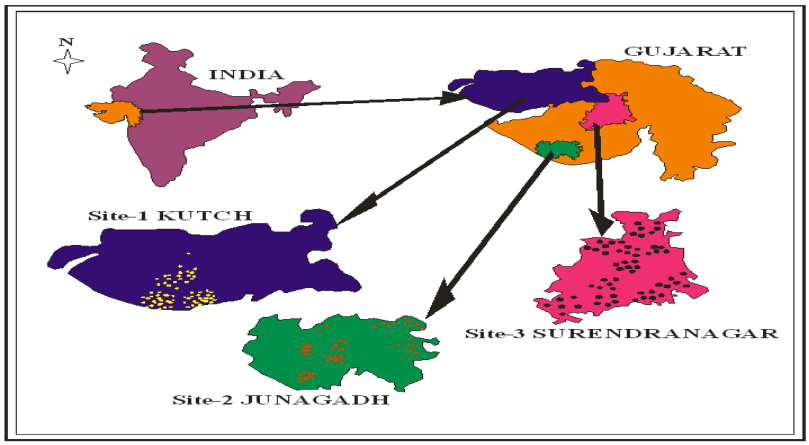

Figure 1: Location Map of Study Area

Table 1

	Site-1 Kutch	Site-2 Junagadh	Site-3 Surendranagar
Total Samples	**60**	**60**	**60**
Mean	0.423333	0.58	0.367667
Median	0.32	0.53	0.29
Std. Deviation	0.214307	0.293066	0.20771
Variance	0.045928	0.085888	0.043144
Minimum	0.94	1.28	0.88
Maximum	0.18	0.16	0.08

RESULTS AND DISCUSSION

Descriptive statistics of electrical conductivity (EC) is shown in table-1, it is varied from 0.18 to 0.94 dSm^{-1} with a mean value of 0.4233 $dSm^{-1}$and median 0.37 dSm^{-1} in Kutch, in Junagadh it is in 0.16 - 1.28 dSm^{-1} range with 0.58 dSm^{-1} mean and 0.53 dSm^{-1} median, in Surendranagar range is 0.08 - 0.88 dSm^{-1}, mean is 0.3676 dSm^{-1} and median is 0.29 dSm^{-1}.

Figures 2(a), 2(b) and 2(c) depict the correlation matrices for pH, EC with available macro and micro nutrients of studied soil sites. The colour code has been chosen such that red denotes the highest and blue the lowest value. One clearly sees domains of correlation differ significantly among different sites.

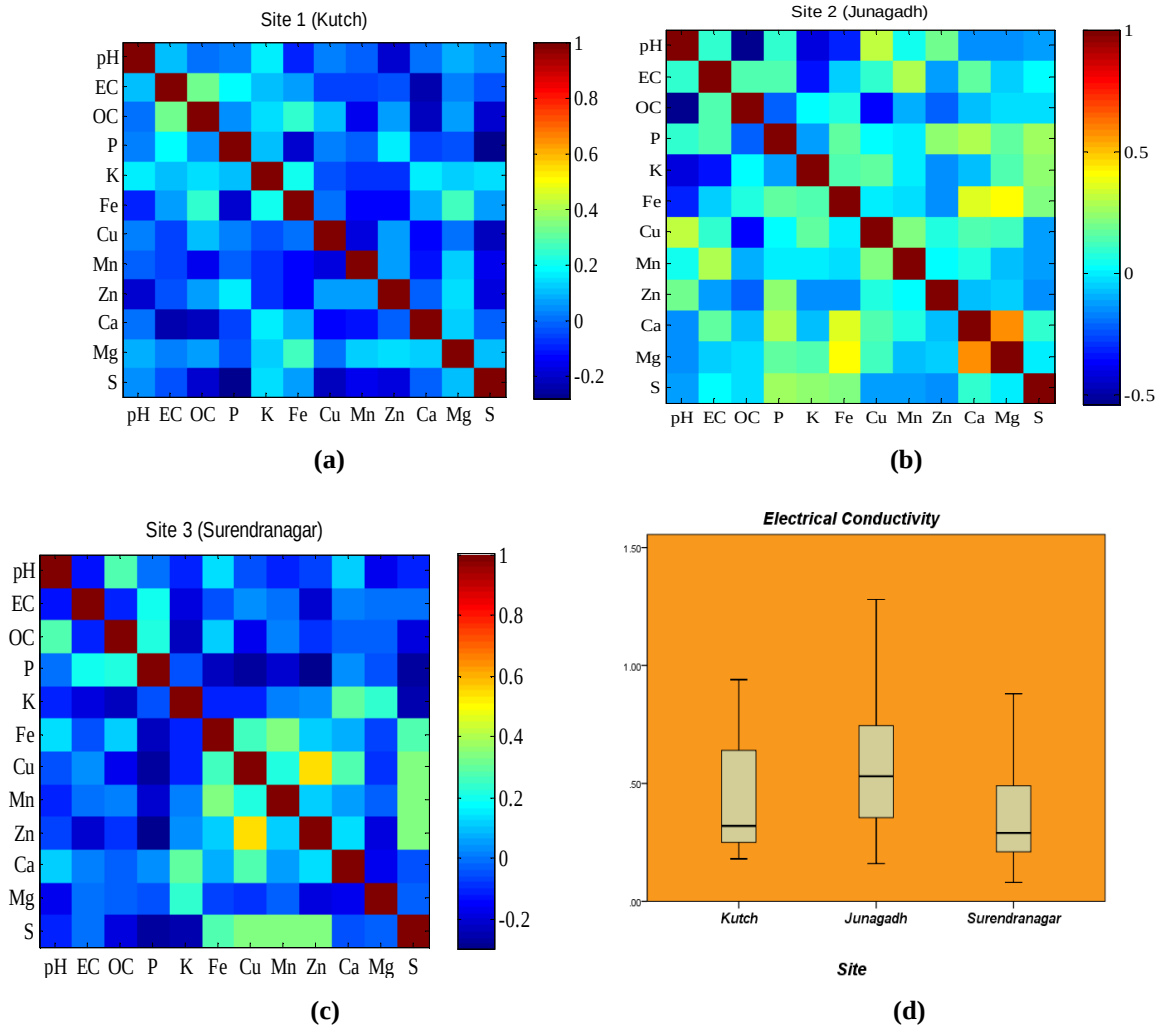

Figure 2: (a), (b), (c) Correlation Matrix and (d) Descriptive Statistics of EC

In site-1(Kutch) EC is positively correlated with available OC (r = 0.3233), P (r = 0.2006), K (r = 0.1043), Fe (r = 0.0807), Mg (r = 0.0324) whereas others are negatively correlated. Maximum negative correlation is with Ca (r = - 0.2237).

In site-2 (Junagadh) Mn (r = 0.2961), Ca (r = 0.1835), OC (r = 0.1415), P (r = 0.1386), Cu (r = 0.1043), S (r = 0.0333) show positive correlation and K (r = - 0.3247) shows maximum negative correlation.

In site-3 (Surendranagar) EC has positive correlation with P (r = 0.2073), Cu (r = 0.0403) and Ca (r = 0.0172).

Figure 2(d) and table 1 depicts statistical description i.e. mean, median, standard deviation, variance, maximum and minimum values of EC of studied sites. The mean and median of EC are almost same in case of Junagadh, as well as EC is positively correlated to maximum number of available nutrients in this site, it can be attributed to good crop, fertility, use of adequate and proper proportions of fertilizers. In Kutch and Surendranagar districts EC is correlated with less number of nutrients as well as their medians and mean are also differ with large degree, shows scientific improvement in use of fertilizer, compost and manure.

Except some nutrients, macronutrients show positively correlation and micronutrients show negatively correlation with EC in studied sites.

Some significant correlations are given as follows:

- In all sites P shows high degree of positive correlation with EC.
- Mn has positive correlation with EC in site-2 (r = 0.2960), whereas it has low degree of negative correlation in
- site-1 and site-3.
- Ca shows high degree of negative correlation in site-1, whereas it is having high positive correlation in other
- two sites with EC.
- Mg is having low degree of negative correlation with EC.
- Between Ca and Mg there is very high positively correlation (r = 0.585538) in site-2 i.e. Junagadh.

CONCLUSIONS

Observation shows except some nutrients there is positive significant correlation between EC and macronutrients whereas negative with micronutrients. Present Study shows that the study area is free from salt. Among three sites Junagadh is showing best agricultural activities based on EC. Present study concludes that statistical methods e.g. correlation analysis can provide a scientific basis for controlling and monitoring agriculture soil fertility management.

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