

CHARACTERISTICS OF GEOCHEMICAL PARAMETERS OF THE SOIL IN CHHOTA UDEPUR DISTRICT, GUJARAT.

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ABSTRACT: *In central Gujarat, Chhota Udepur is the new district having variety of soil that are i.e. hard, medium and sandy black soil. About more than 2 lac hactor land is cultivated area in the district which involves indigenou, low yielding and high value crops. The agriculture department is provided kits with quality sheet and fertilizer in order to increase the fertility with useful information to farmer. Soil fertility largely depends on phosphate fertilizers, pesticides, surface water, and groundwater contamination. The present study has considered geochemical parameters of soil in all six talukas for the period of 2012 and 2017. Over the period of time the amount of major nutrients like Nitrogen (N), Phosphorous (P), Potassium (K) along with S, Zn, Fe and Mn were critically analysed. The study objective is check the availability of nutrients parameters in agricultural soil over the period of time and its degradation, if any. According to standard prescribed by agriculture department of government, the values of geochemical parameters are categorized high, medium, low. The fertility of soil is considerably degraded due to mining regions of the district and the heavy metal investigation is necessary to be done for micro analysis.*

KEY WORDS: *Nitrogen, Phosphorous, Potassium, soil fertility, geochemical parameters*

I. INTRODUCTION

Chhota Udepur district is one of the agricultural state of Gujarat and majority farmers are cultivating indigenou, low-yielding crops. The change over form low yielding crops to high-value crops is quite necessary for farmer's prosperity but at the same time it's expensive too (chhota Udepur-check dams Report).

The state government is providing kits with quality seeds, fertilizers and extension services so that the farmers can cultivate vegetables and high value crops effectively. Water security, irrigation and farm level interventions will result with better agricultural yield and incomes for economically backward tribal people who involved in farming (chhota Udepur-check dams Report) Looking the scenario local farmers will be cultivating Rabi and Kharif crops both and diversify to crops which give them better market returns. Hence, the crop diversification is expected to pull the participating families out of poverty.

As the soil fertility is largely depends upon the use of phosphate fertilizers, pesticides and spatial surface water and ground water contaminants along with land pollution, it is utmost necessary to review the major geochemical parameters of N, P, K and mineral along with heavy metals if available (Areas et al., 2016). Soil texture is an important soil characteristic that could influence water retention capacity, aeration, drainage, and susceptibility to erosion which drives crop production and management. The textual class of soil is determined by the percentage of sand, silt and clay. Soils can be classified into one of four major textural classes including sands, silts, loams and clays (DIPS Report).

Such soil characteristics study is useful to understand for further actions to improve soil health and control the limited usage of fertilizers and its adverse effect up to certain extent.

II. STUDY AREA

Chhota Udepur district area, in general, being located south of Tropic of Cancer and in transition zone of heavy rainfall areas of South Gujarat and arid areas of North Gujarat plains, have sub-tropical climate with moderate humidity. The district area has mostly tribal population and living in rural area. Total population of Rural is about 93.2%. The population of Chhota Udepur District is 10, 71,831 (as per census 2001).

The location of Chhota Udepur district is between latitude 22° 19' 12" N and longitude 74° 00' 36" E in Gujarat. The study area is covering 3,087 km² and is divided into 6 talukas, 889 villages.

The main rivers of the districts are Orsang, Ujeri, Heran, Aani, Sukhi, Ashwani, Menn and Rami (DIPS report of Chhota Udepur, 2016-17). The eastern and the southern part of the district, drained by the Narmada River and its tributaries, like Unch, Heran, Dev, Orsang. Broadly, the entire district, as a River Basin is divided into these three basin, namely the Orsang, the Hiren Basin and the Narmada. Lithology of the district has mainly Basalt Weathered, Quartzite, Basalt, Granite type.

Table: 1 –Talukas of Chhota Udepur

Sr. No	Taluka	Area (Sq.km)	Urban (Sq.km)	Rural (Sq.km)	No. Villages
1	Chhota Udaipur	765.46	4.01	761.45	144
2	Jetpur	805.64	4.41	801.23	212
3	Kawant	607.76	2.04	605.72	132
4	Naswadi	535.17	0.00	535.17	219
5	Sankheda	722.61	31.84	690.78	182
		3436.64	42.30	3394.34	889

The industries such as Agro Based Industries, plastics, glass and ceramics, Mechanical Based industries, live stock industries, mineral and forest based industries and textiles industries (DIPS report of Chhota Udepur, 2016-17).

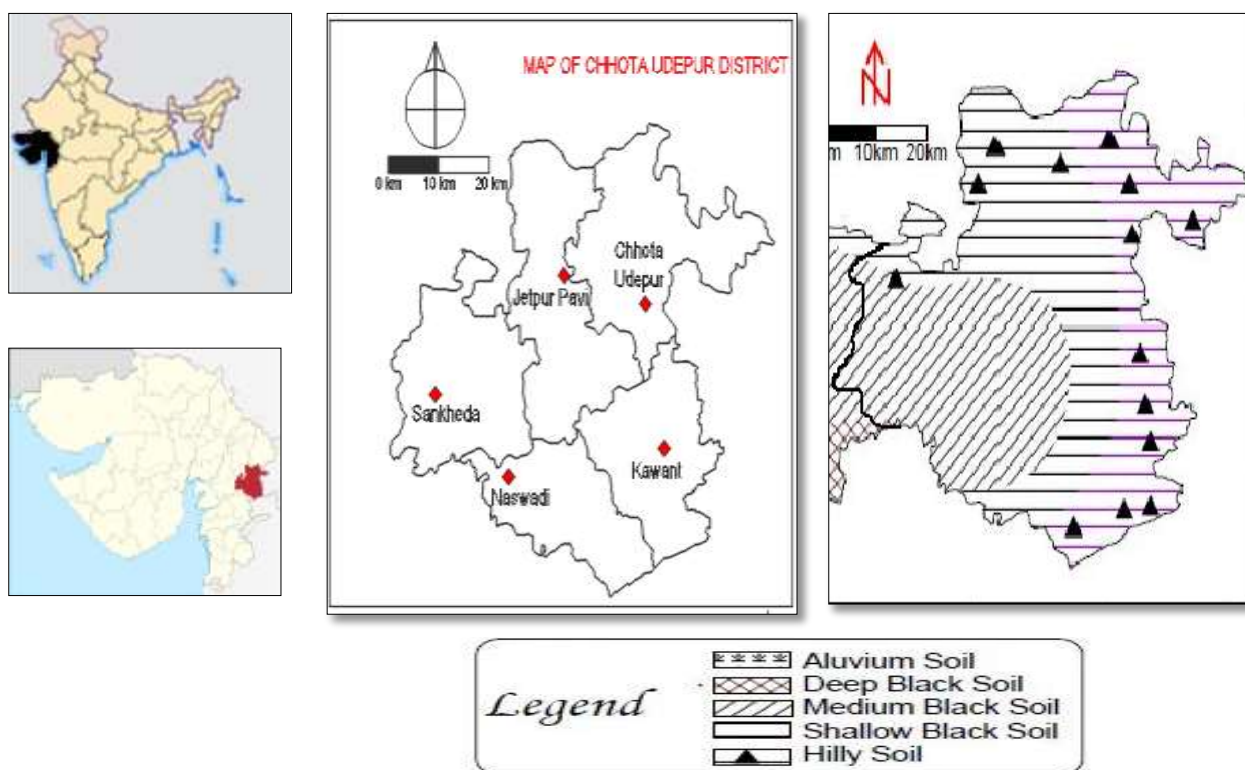


Figure: 1 – Chhota Udepur district (study area) and Soil Classification.

Soil texture is an important soil characteristic that could influence water retention capacity, aeration, drainage, and susceptibility to erosion which drives crop production and management.

The textural class of soil is determined by the percentage of sand, silt and clay. Soils can be classified into one of four major textural classes including sands, silts, loams and clays. Broadly speaking, three textural classes are identified in the districts. Clayey and loamy types are predominant in the districts under fine and medium textured soils. Deep black, medium black to loamy sand (Goradu) soils type texture found in the district.

III. DATA COLLECITON AND METHODOLOGY

After literature review related to soil contamination and soil fertility secondary data of geochemical parameters have been collected from Agriculture department, Jilla seva sadan, Chhota Udepur district, Gujarat and compare with standard prescribed by government. Secondary soil samples locations is shown in figure below with the help of Arc GIS software.

Secondary data included major nutrients and minor nutrients. In major nutrients, Nitrogen (N), Potassium (K) and Phoporus(P).

Data are shown here in the graphical presentation to compare their quality with standard which is prescribed by the agricultural dept. Government of Guajarat.

Table 2- Soil sample location and geochemical parameters of 5 years duration (2012 and 2017)

Sr No.	Taluka-Village	Year-2012							Year-2017						
		N (kg/h)	P (kg/h)	K (kg/h)	S (ppm)	Zn (pp)	Fe (pp)	Mn (pp)	N (kg/h)	P (kg/h)	K (kg/h)	S (pp)	Zn (pp)	Fe (pp)	Mn (pp)
1	Jetpur Pavi-	352.16	54	315	6.21	3.42	10.45	10.27	227.6	46	237	6.88	0.48	6.08	5.33
2	Jetpur Pavi-	342.67	54	362	4.52	1.41	11.42	6.32	236.6	60	356	10	1.16	13.52	5.08
3	Jetpur Pavi-	326.59	53	371	4.63	1.38	10.63	7.24	275.2	42	285	23	0.46	4.26	7.18
4	Jetpur Pavi-	335.28	51	348	4.38	1.25	10.83	8.2	269.3	52	417	12.38	0.67	8.3	7.45
5	Jetpur Pavi-	342.69	53	331	4.29	1.06	11.21	7.63	242.8	37	243	11	0.55	6.4	7.35
6	Chhota Udaipur-	289.12	19	562	26.52	1.37	13.58	11.56	178.1	43	525	8.09	0.48	5.5	6.16
7	Chhota Udaipur-Puniyav	293.41	22	519	29.84	1.44	14.27	11.29	215.0	52	490	5.53	0.55	7.2	5.15
8	Chhota Udaipur-Gabadiy	304.87	21	571	22.43	1.59	11.65	10.81	154.6	38	590	8.09	0.38	4.5	7.66
9	sankhed a-	381.24	37	426	13.66	3.95	12.08	1.59	255.6	48	173	5.2	0.56	10.2	16.04
10	sankhed a-	359.73	43	447	15	2.97	12.34	2.04	226.5	11	199	7.28	0.48	12.2	2.08
11	kavant-Borchap	329.21	14	342	20.31	1.13	10.52	10.52	NA	24	380	31.74	0.94	9.14	9.14
12	kavant-Borchap	295.37	17	299	22.57	1.31	11.04	10.8	NA	75	243	18.52	0.74	10	10
13	kavant-Borchap	314.03	18	378	20.49	1.42	11.62	10.36	NA	59	400	10.58	0.88	8.96	9.1
14	Nasvadi-Thakdw	408.35	34	508	17.82	1.46	12.09	11.47	NA	53	375	11.04	0.98	7.74	10
15	Nasvadi-Thakdw	387.64	46	481	13	1.22	11.8	10.9	NA	22	409	15.64	0.74	10	10

S, Zn, Fe, and Mn are in mg/kg unit. They are categorized into five categories as High, Sufficient, Medium, Low, and deficient.

NOTE: Bodeli was announced as separate Taluka in 2013.

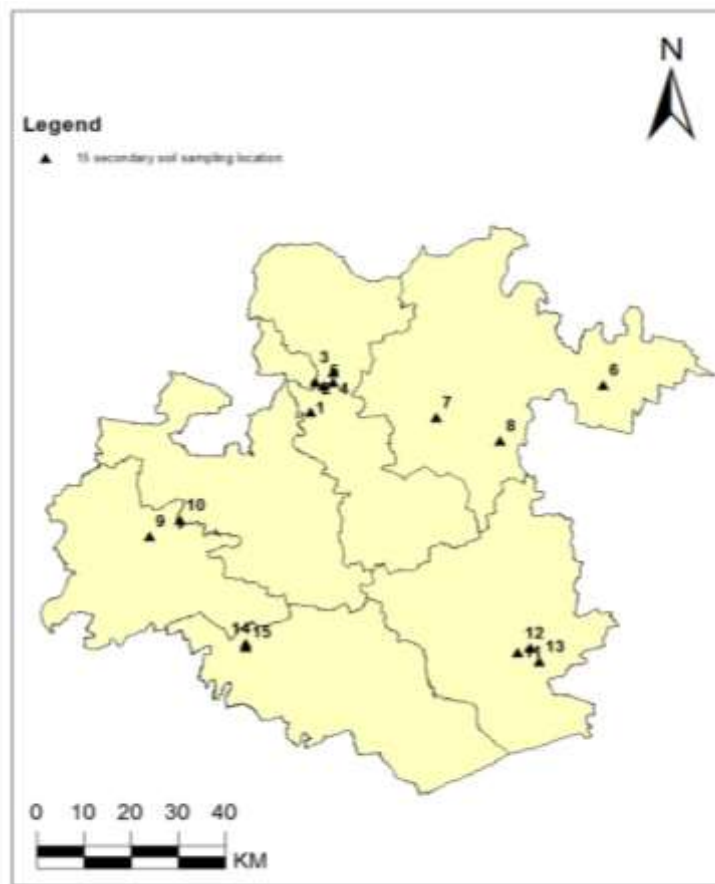


Figure: 2 - Secondary Soil Sampling Location map of the study area

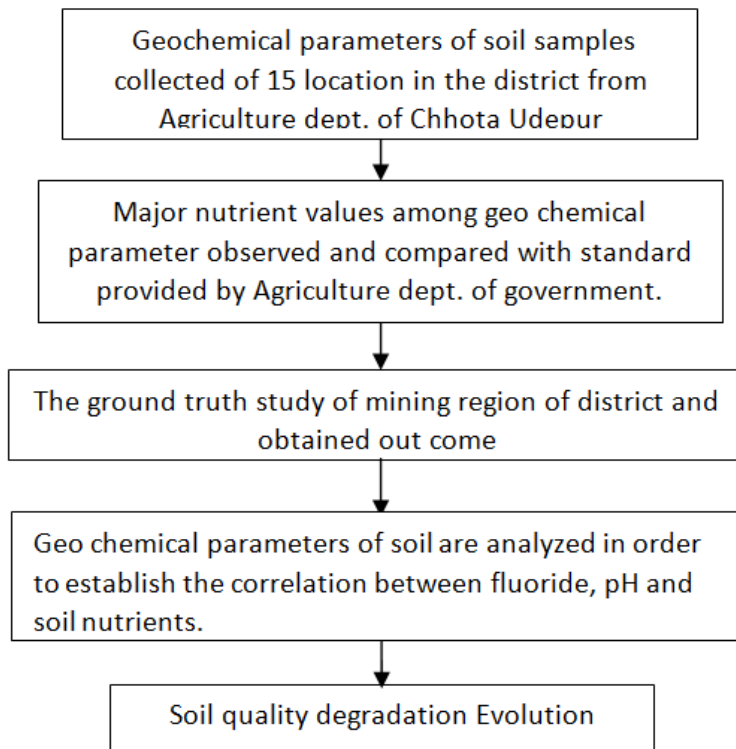
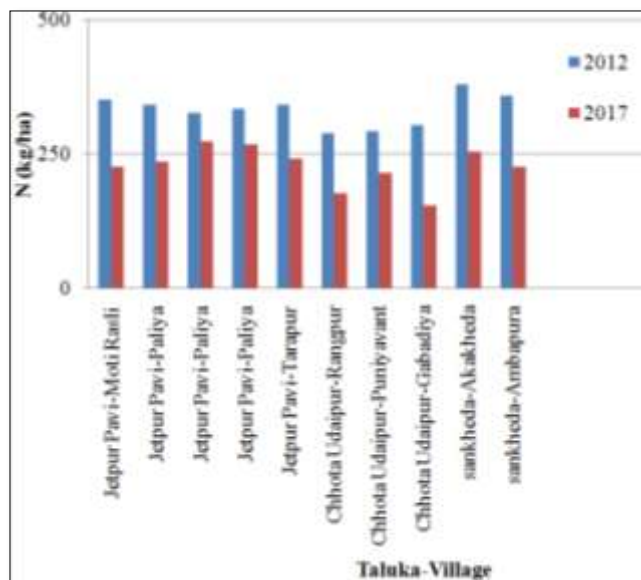


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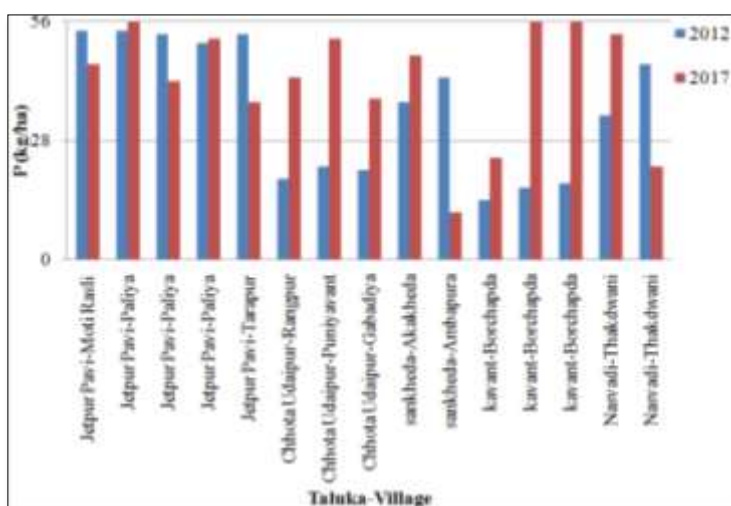
IV. RESULT AND DISCUSSION

Soil fertility classes are given on the basis of amount of nitrogen present in soil. For Soil fertility to be high for the purpose of agricultural activity, amount of nitrogen present in soil should be medium to high according to soil health card given by government of Gujarat. If amount of nitrogen is found to be low, then 25 to 30% of more fertilizer than suggested amount should be added and if it is high then 15 to 20% of less fertilizer than suggested amount should be added into soil. Amount of nitrogen (kg/ha) for different villages of Chhota Udepur district was shown in above figure for year 2012 and 2017.



N (kg/ha)		
Low	Medium	High
<250	250 to 500	>500

Above figure depicts that soil fertility of Chhota Udepur taluka highly degraded due to mining of dolomite mineral. As per above figure the amount of nitrogen present, soil fertility for talukas Jetpur Pavi and Sankheda are in good agreement with standards of soil health card, but it is shown that the concentration of nitrogen is decreasing over duration of five years.

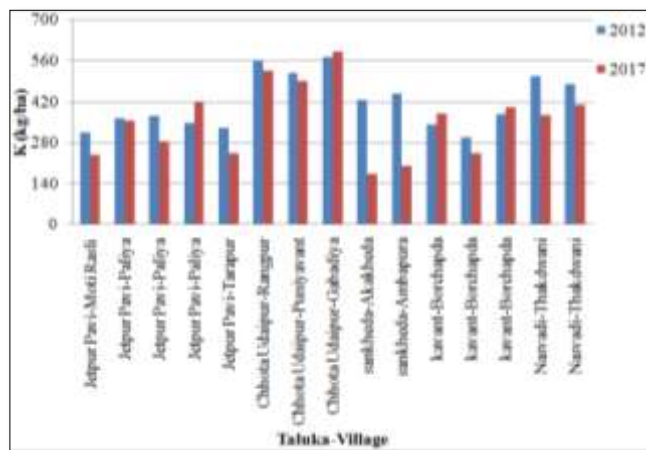


P (kg/ha)		
Low	Medium	High
<28	28 to 56	>56

Soil fertility classes are given on the basis of amount of phosphorus present in soil. For Soil fertility to be high for the purpose of agricultural activity, amount of phosphorus present in soil should be medium to high according to soil health card given by government of Gujarat. If amount of phosphorus is found to be low, then 25 to 30% of more fertilizer than suggested amount should be added and if it is high then 15 to 20% of less fertilizer than suggested amount should be added into soil.

suggested amount should be added and if it is high then 15 to 20% of less fertilizer than suggested amount should be added into soil. Amount of phosphorus (kg/ha) for different villages of Chhota Udepur district was shown in above figure for year 2012 and 2017.

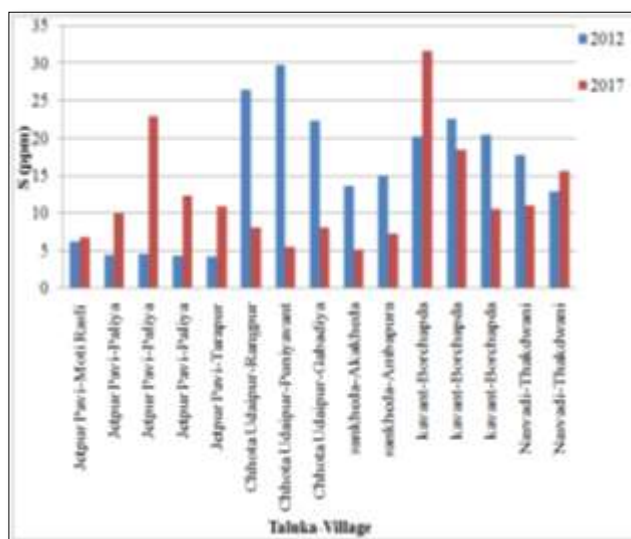
Above figure depicts that soil fertility of almost all villages is improved due to guideline suggested by Soil Fertility Atlas Project of agricultural department. Soil fertility for villages Ambapura and Thakdwani for year 2017 is shown diminishing.



K (kg/ha)		
Low	Medium	High
<140	140 to 280	>280

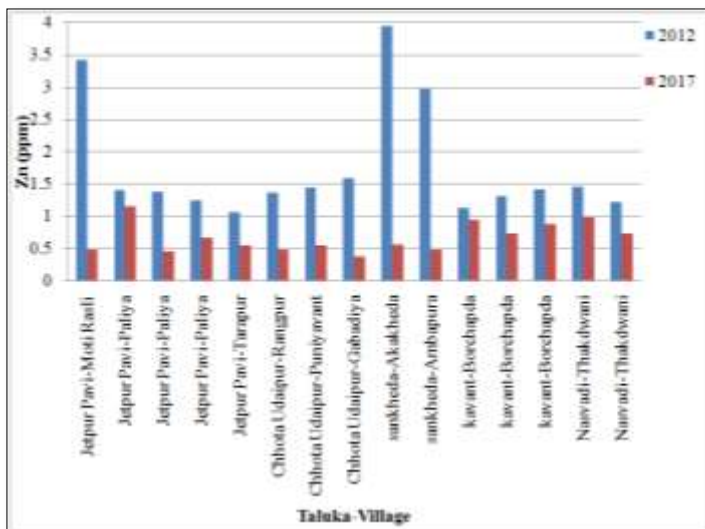
Soil fertility classes are given on the basis of amount of potassium present in soil. For Soil fertility to be high for the purpose of agricultural activity, amount of potassium present in soil should be medium to high according to soil health card given by government of Gujarat. If amount of potassium is found to be low, then 25 to 30% of more fertilizer than suggested amount should be added and if it is high then 15 to 20% of less fertilizer than suggested amount should be added into soil. Amount of potassium (kg/ha) for different villages of Chhota Udepur district was shown in above figure for year 2012 and 2017.

Above figure depicts that soil fertility of all villages falls in good agreement with high soil fertility standard, but one fact is observed that amount of potassium is decreasing over period of five years. Thus, it suggests increasing use of fertilizers in those regions.



S (ppm)				
Low	Medium	High	Sufficient	Deficient
5 to 10	10 to 20	>23	20 to 23	<5

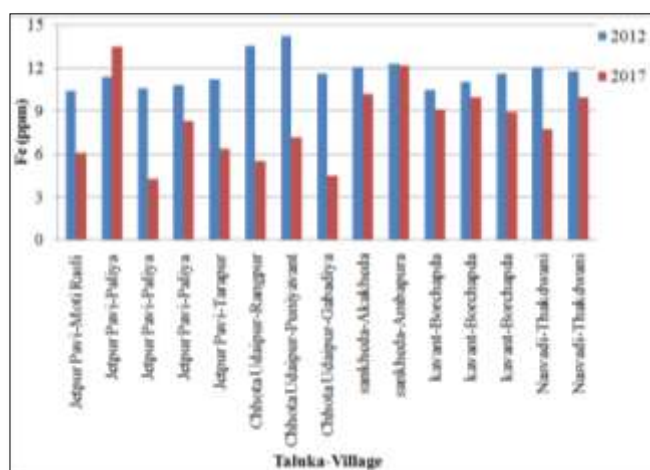
Soil fertility classes are given on the basis of concentration of Sulphur present in soil. For Soil fertility to be high for the purpose of agricultural activity, concentration of Sulphur present in soil should be sufficient to high according to soil health card given by government of Gujarat. If concentration of Sulphur is found to be low to medium, then 500kg/ha of gypsum should be added and for Sulphur present in high concentration, then there is no need to add Sulphurous fertilizer into soil. Concentration of Sulphur (ppm) for different villages of Chhota Udepur district was shown in above figure for year 2012 and 2017. Above figure suggests that soil fertility of Chhota Udepur Taluka is highly degraded, while soil fertility of Kavant and Nasvadi Taluka also diminishes significantly.



Zn (ppm)				
Low	Medium	High	Sufficient	Deficient
0.3 to 0.5	0.5 to 1	>2	1 to 2	<0.3

Soil fertility classes are given on the basis of concentration of zinc present in soil. For Soil fertility to be high for the purpose of agricultural activity, concentration of zinc present in soil should be sufficient to high according to soil health card given by government of Gujarat. If concentration of zinc is found to be low to medium, then 500kg/ha of zinc Sulphate should be added and for zinc present in high concentration, then there is no need to add zinc Sulphate as a fertilizer into soil. Concentration of zinc (ppm) for different villages of Chhota Udepur district was shown in above figure for year 2012 and 2017.

Above figure suggests that soil fertility of all villages is highly degraded over the period of five years.

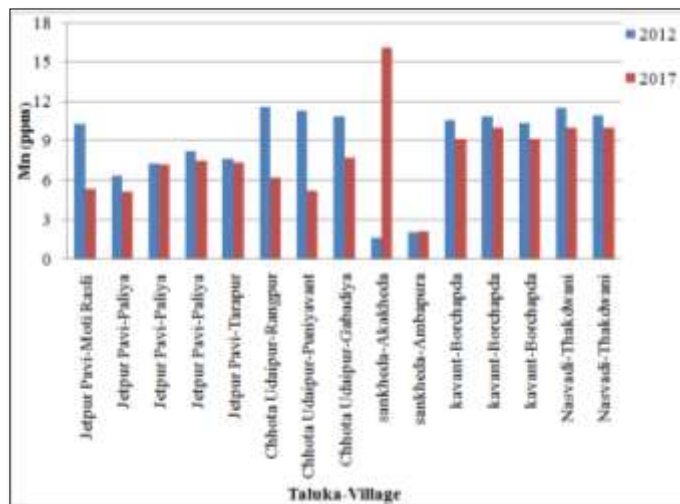


Fe (ppm)				
Low	Medium	High	Sufficient	Deficient
3 to 5	5 to 10	>13	10 to 13	<3

Soil fertility classes are given on the basis of concentration of iron present in soil. For Soil fertility to be high for the purpose of agricultural activity, concentration of iron present in soil should be sufficient to high according to soil health

card given by government of Gujarat. If concentration of iron is found to be low to medium, then 15 to 20kg/ha of ferrous Sulphate should be added and for iron present in high concentration, then there is no need to add ferrous Sulphate as a fertilizer into soil. Concentration of iron (ppm) for different villages of Chhota Udepur district was shown in above figure for year 2012 and 2017.

Above figure suggests that soil fertility of all talukas is highly degraded except Sankheda taluka, but concentration of iron is found decreasing over the period of five years from 2012 to 2017.



Mn (ppm)				
Low	Medium	High	Sufficient	Deficient
3 to 5	5 to 10	>13	10 to 13	<3

Soil fertility classes are given on the basis of concentration of manganese present in soil. For Soil fertility to be high for the purpose of agricultural activity, concentration of manganese present in soil should be sufficient to high according to soil health card given by government of Gujarat. If concentration of manganese is found to be low to medium, then 10kg/ha of Manganous Sulphate should be added and for manganese present in high concentration, then there is no need to add Manganous Sulphate as a fertilizer into soil. Concentration of manganese (ppm) for different villages of Chhota Udepur district was shown in above figure for year 2012 and 2017.

Above figure suggests that soil fertility of Jetpur Pavi and Chhota Udepur talukas and Ambapura village is highly degraded, while soil fertility of Akakheda village and Kavant and Nasvadi taluka is on critical value.

V. CONCLUSION

Geochemical parameters of soil secondary data reveal that necessary soil nutrients i.e. Nitrogen (N), Phosphorus (P) and Potassium (K) are degraded in last five years along with Zn and S are also not sufficient for agriculture growth. Above figure suggests that soil fertility of Jetpur Pavi and Chhota Udepur talukas and Ambapura village is moderately degraded.

The Author come to know while study area visit that the Fluorspar mining had been stopped since last 7-8 years, but over extraction of Fluorspar before 2010 was carried out and that contributed to the higher residual Fluoride content in groundwater and effect of mining of that mineral has not been neutralized till date. Thus, it can be stated that it major reason for degrading soil quality.

ACKNOWLEDGMENT

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