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Soil Quality Assessment of Some Selected Villages Of Tehsil Todaraisingh Of Tonk Dist. (Rajasthan)

Raghvendra Singh Nama[1]*, Dr. Manjul Mishra[2]

1*Research Scholar, Chemistry Department, Apex University, Jaipur, Rajasthan, India, Email: raghv_ tonk@rediffmail.com
2 Professor, Chemistry Department, Apex University, Jaipur, Rajasthan, India, E-mail: manjulmishra7@gmail.com

*Corresponding Author: Raghvendra Singh Nama
*Research Scholar, Chemistry Department, Apex University, Jaipur, Rajasthan, India, Email: raghv_ tonk@rediffmail.com

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ABSTRACT

Soils are very rich in nutrients and they are natural filters to remove the contaminants from the water. The soil with sufficient organic matter, well developed structure, good physical and chemical characters can promote crop growth which leads to strong yields. Although soil is a non-renewable natural resource, humans have increasingly used it as a contaminant sink. So, assessing the soil quality is crucial for determining the best management strategies to use for sustainable crop production. 10 villages of Todaraisingh block of Tonk district were selected for the study of soil quality in agriculture fields. It is observed that soil of all the selected villages is highly alkaline whereas its Electrical Conductivity is very low. Soil has very low amount of organic carbon and organic matter which is not suitable for agriculture. Phosphorus was found to be below optimum values. Cu, Fe and Zn were found to be almost at optimum values in most of the samples. Sulphur is found only in moderate amount in all the selected sites. Study shows that due to over exploitation of soil and ground water, this area will be converted into barren area in a very short duration.

Key Words- Contaminants, Minerals, Nutrients, Non-renewable, Soil Health, Sustainable crop production, Soil quality, Todaraisingh

INTRODUCTION:

One of the most vital industries supporting human life is agriculture. The term “soil quality” originates in the observation that soil quality influences the health of animals andhumans via the quality of crops (Warkentin, 1995)[7]. Assessment of prospective land use will probably result in a prediction of the sort of productive land use that is possible. (Dadhwal et al., 2011)[1]. Productivity capacity of soil is a grasp, at the same time an exact concept in terms of agricultural activities (Dengiz and Saglam, 2012)[6]. Without taking into account the unpredictability of the overall production system, agricultural intensification and enormous infrastructural expansion in recent years have increased the danger of soil erosion and fertility loss. (Singh et al., 2007)[4]. One of the most crucial components of soil is organic matter, which increases soil fertility when there is a sufficient amount present. Depletion of organic carbon, soil micronutrients, and soil macronutrients, erosion-caused loss of topsoil, altered physical characteristics, and increased soil salinity are the main land use restrictions. (Kumar et al., 2017)[3]. USDA classified soil quality indicators into four categories that include visual, physical, chemical and biological indicators. The physical indicators are related to the organization, the particles and pores, reflecting effects on root growth, speed of plant emergence and water infiltration; they include depth, bulk density, porosity, aggregate stability, texture and compaction. Chemical indicators include pH, salinity, organic matter content, phosphorus availability, cation exchange capacity, nutrient cycling and the presence of contaminants etc. The biological indicators include measurements of micro and macro- organisms, their activities (Meena et al., 2020).[8]

The present study is aimed to investigate the soil quality of selected Todaraisingh blocks of Tonk district through collection of soil samples and their analysis for different soil parameters.

STUDY AREA:

The study is conducted during the session of 2022-23 at Todaraisingh Block of Tonk district under Ajmer division of Rajasthan state. It is a rural area situated near the Banas river at 26°01'26" N latitudes and 75°29'02" E longitude of Rajasthan state. It is located 42 KM towards west from District head quarter. Todaraisingh is surrounded by Deoli Tehsil towards South, Tonk Tehsil towards East, Kekri Tehsil towards west and Malpura Tehsil towards North.

This region is quite unique because of its historical, cultural and geographical heritage. The climate of that area is dry or semi humid. The black cotton growing soils are significantly recorded in the vast portion of the area. It is supposed to be suitable for oil yielding crops, as these have got a favorable character of moisture retention for oil yielding plants. As of 2011 India census, Toda has a population of 146,870. Most of it depends on agriculture. Here, crops like pearl millet, sorghum, wheat, groundnut and mustard etc. are grown throughout the year. The crop cycle here is mainly based on monsoon, but the percentage of agriculture based on ground water irrigation is continuously increasing since last decade.

RESEARCH METHODOLOGY:

The soil tests (Rathore et al., 1995) [9]are used to be the criteria to delineate the deficient regions. It involves collecting the soil samples, preparation for chemical and physical analysis, interpretation of analysis and finally making fertilizer recommendations for the crops (Claire et al. 2019)[10].

1. **Collection of soil samples-**

For the present investigation, fields located in 10 different villages were selected due to their remoteness and extensive sowing in that area. 4 kg soil sample from each farm was collected to check various parameters and assess the soil quality.

2. Physical and chemical analysis of soil:

Some selected physico-chemical and chemical tests such as determination of pH, EC, mineralizable nitrogen, available phosphorous and potassium are usually carried out to evaluate such of the soil properties which are known to have direct impact on the productivity of the soil as well as its fertility status.

I. **Soil pH-** The aqueous suspension of soil (5:1 V/W) was used to determine the soil pH with digital pH meter. Using this procedure, we get the accurate measurement of pH in Soil sample.

II. Electrical Conductivity (EC)

Methods given in the manual authored by Dhyaan Singh, PK Chhonkar & B.S. Dwivedi (2013)[11], was used to calculate EC.

III. **Soil Organic Carbon(OC)-** The organic carbon in the soil was estimated on percentage basis by Walkey and Black (1934)[5]. The measurement of Organic Carbon represents the concentration of available Organic Carbon in the Soil sample. Organic carbon is calculated by following method:

$$Organic\ Carbon\ (\%) = \frac{5\ (Blank - Sample)}{Blank} X\ \frac{0.003\ X\ 100}{Weight\ of\ Soil\ (gm)}$$

IV. Soil Organic Matter (OM)

It was evaluated as per the guidelines of the manual issued by agriculture department, government of Rajasthan.

% Organic Matter (O.M.) = Organic Carbon(O.C.) x 1.724 (O.M. contains 58% O.C.)

V. **Soil Nitrogen-** Nitrogen in the soil sample was estimated by Micro kjeldhal method.

VI. **Soil Phosphorus-** The soil phosphorus was estimated by Vanadomolydate method of Jackson (1971)[2] for the preparation of standard curve. Following formula has been employed to calculate soil phosphorous.

P_2O_5 (kg/ha.) = R x 2.83

Where, R = colorimetric reading of sample

VII. **Soil Potassium-** The measurement of potassium will give the concentration of available potassium in the Soil sample. Methods given in the manual Dhyan Singh, PK Chhonkar & B. S. Dwivedi (2013)[11] was used to calculate Potassium.

VIII. **Soil Sulphur-** It calculates the amount of sulphur in soil samples. Following formula is used to calculate the sulphur content.

Sulphur (ppm) = R x 1.9,

Where,

R = calorimetric reading of sample

IX. **Micro-Elements-Method of Soil & Water** Test, given by Dhyan Singh, PK Chhonkar & B.S. Dwivedi (2013)[11] were used to calculate microelements like Cu, Fe and Zn. Concentration of microelements in soil sample (ppm) = (R–B) x 2

Where, R = Absorbance reading of filtrate

B = Blank reading

2 = Dilution factor

RESULTS & DISCUSSION: Different Soil Parameters were observed and studied in the soil samples, collected from different villages of Todaraisingh area. These observations are summarized in the given Table-1.

Soil Parameters	SAMPLES COLLECTED FROM VILLAGES									
	Pathraj Kalan 1	Bhanwta 2	Mor 3	Hameerpur 4	Khuhada 5	Nayabas 6	Indokia 7	Lamba Kalan 8	Gedia 9	Kalyanpura Jatan 10
pH	8.60	8.38	8.50	8.81	8.69	8.27	8.50	8.41	8.50	7.50
EC	0.36	2.34	0.20	0.73	0.26	0.36	0.23	0.18	0.15	0.20
OC	0.32	0.39	0.4	0.36	0.34	0.4	0.37	0.36	0.37	0.44
OM	0.55	0.67	0.69	0.62	0.59	0.69	0.64	0.62	0.64	0.65
N	0.027	0.033	0.034	0.031	0.029	0.034	0.031	0.031	0.031	0.037
P	46.0	42.0	43.0	40.0	43.0	39.0	43.0	37.0	40.0	44.00
K	430	349	349	362	430	336	396	416	389	310
S	10.00	10.01	11.10	13.9	10.1	12.12	10.4	11.1	13.9	14.00
Cu	0.78	0.60	0.68	0.46	0.56	0.30	0.52	0.60	0.68	0.44
Fe	4.99	4.14	5.00	4.51	4.48	4.56	4.90	4.54	4.98	5.00
Zn	0.79	0.70	0.82	0.54	0.60	0.62	0.6	0.58	0.66	0.68

Table: 1 Observed Values of Different Soil Parameters in Collected Samples

A Comparative assessment of the above results of different physical and chemical parameters of collected soil samples are displayed in Fig. 1.

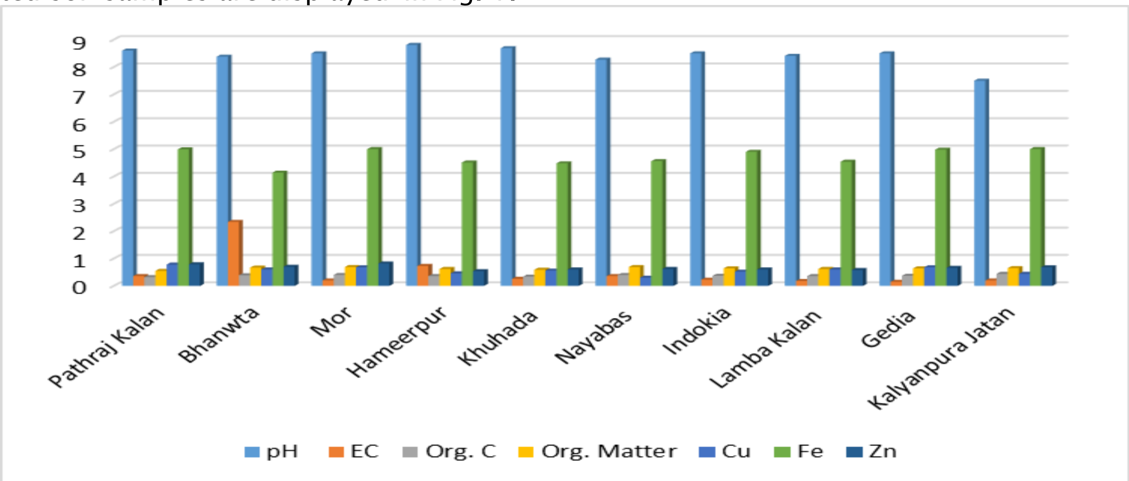

Fig. 1 Graph showing comparative assessment of Soil Parameters

The optimum levels/values of various soil elements have been prescribed by ICAR, which are given in Table-2.

Table: 2 Soil Properties and Optimum Level of Soil Elements

S.No.	Soil Properties	Optimum Level
1	pH	between 7.0-8.5
2	EC (DS/M)	till 1.5
Major Soil Nutrients		
1	Organic Carbon	more than 0.75
2	Available N (%)	More than 0.053
3	Available P (kg/ha.)	more than 56.0
4	Available K (kg/ha.)	more than 336.0
Secondary & Minor Soil Nutrients		
1	Sulphur (PPM)	10.0 or more
2	Zinc (PPM)	0.6 or more
3	Boron (PPM)	0.5 or more
4	Iron (PPM)	4.5 or more
5	Manganese (PPM)	2.0 or more
6	Copper (PPM)	0.2 or more

A comparative assessment of individual soil parameters, studied in collected samples of all the selected sites, is depicted in the Figures (2-12).

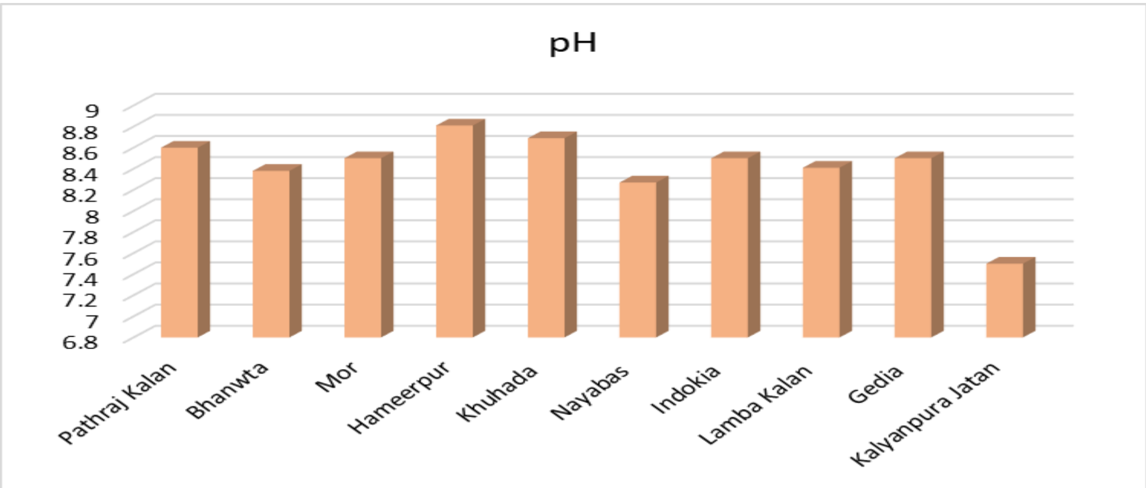

Fig.2- Graph showing pH values in selected sites

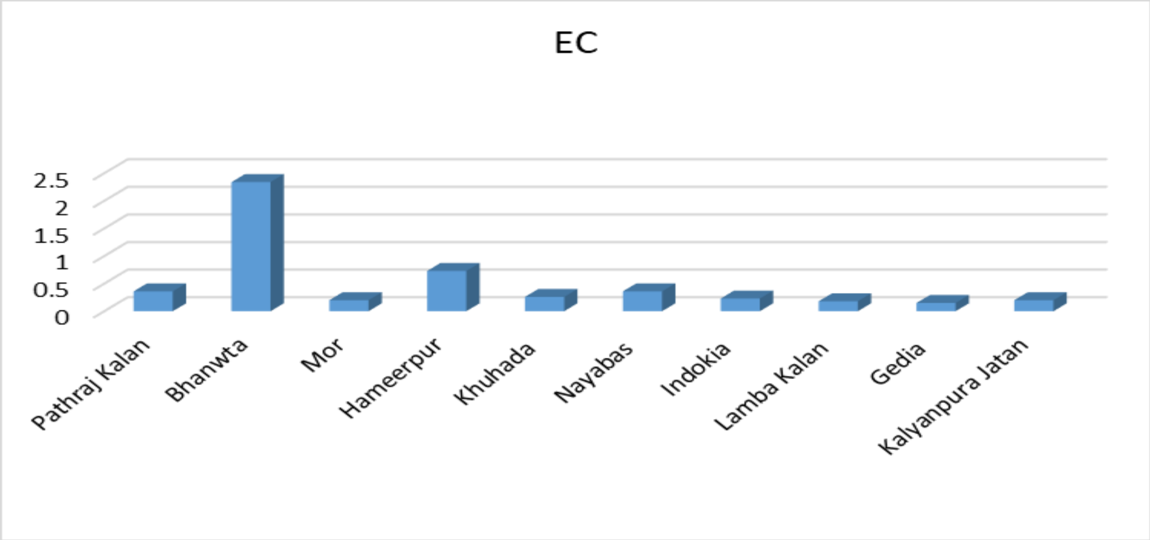

Fig.3- Graph showing EC values in selected sites

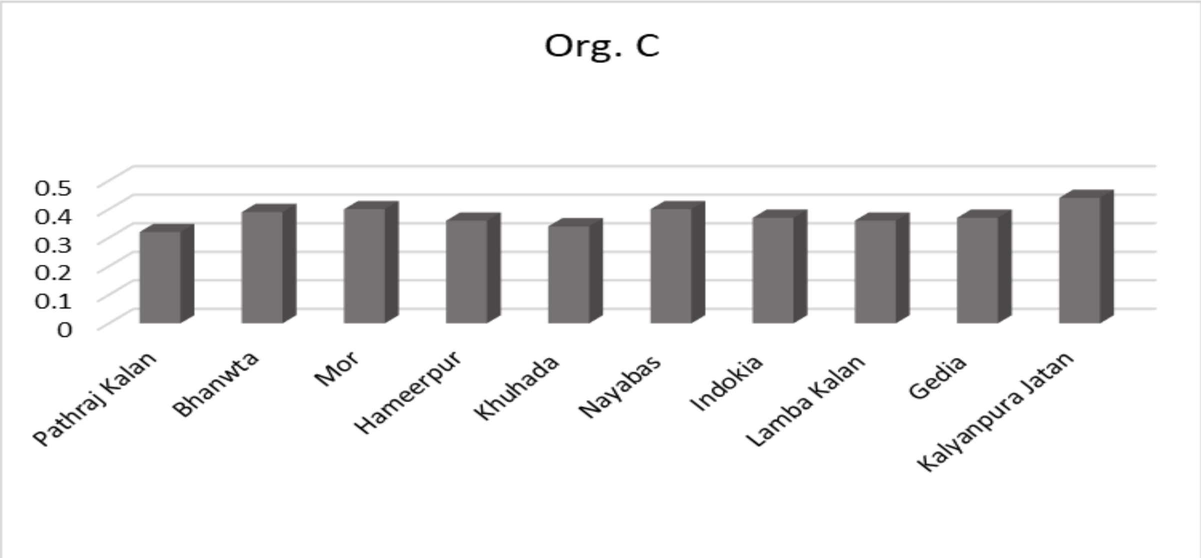

Fig.4- Graph showing OC values in selected sites

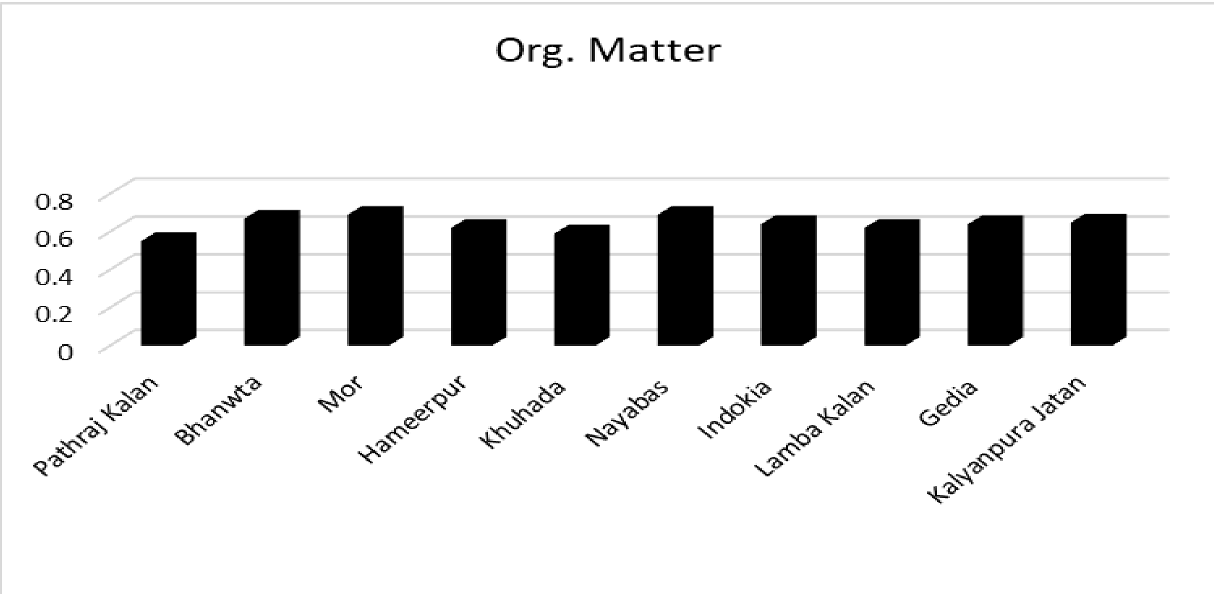

Fig.5-Graph showing OM values in selected sites

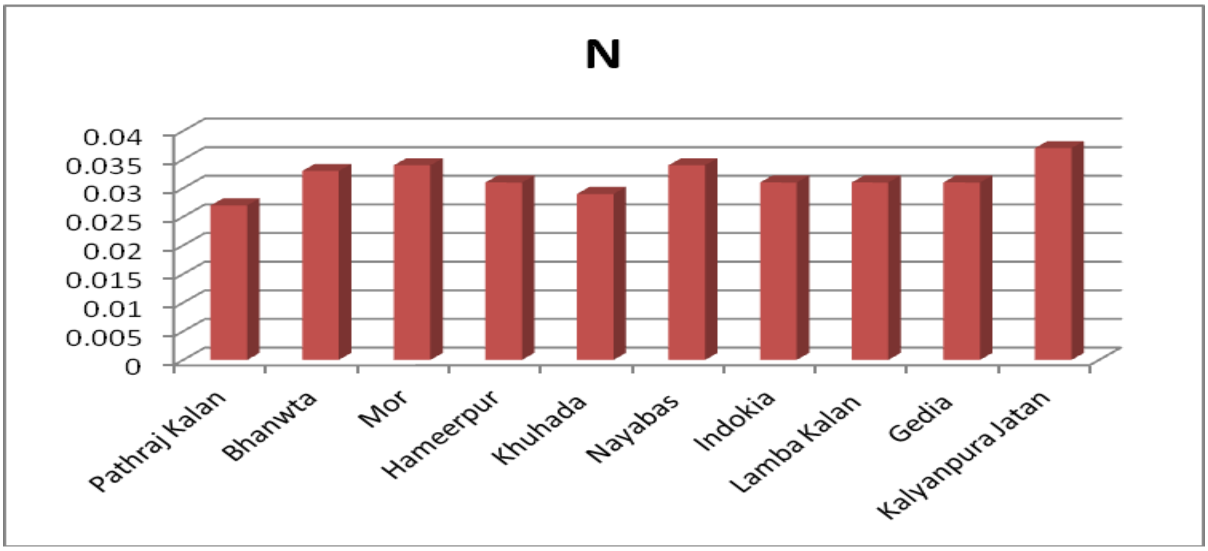

Fig.6- Graph showing N values in selected sites

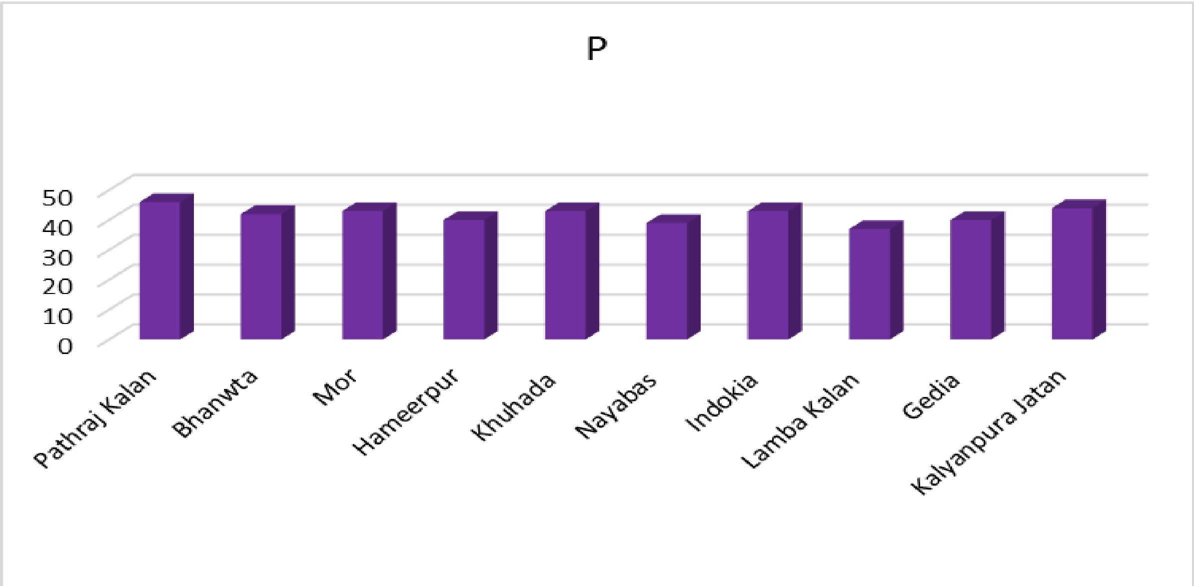

Fig.7- Graph showing P values in selected sites

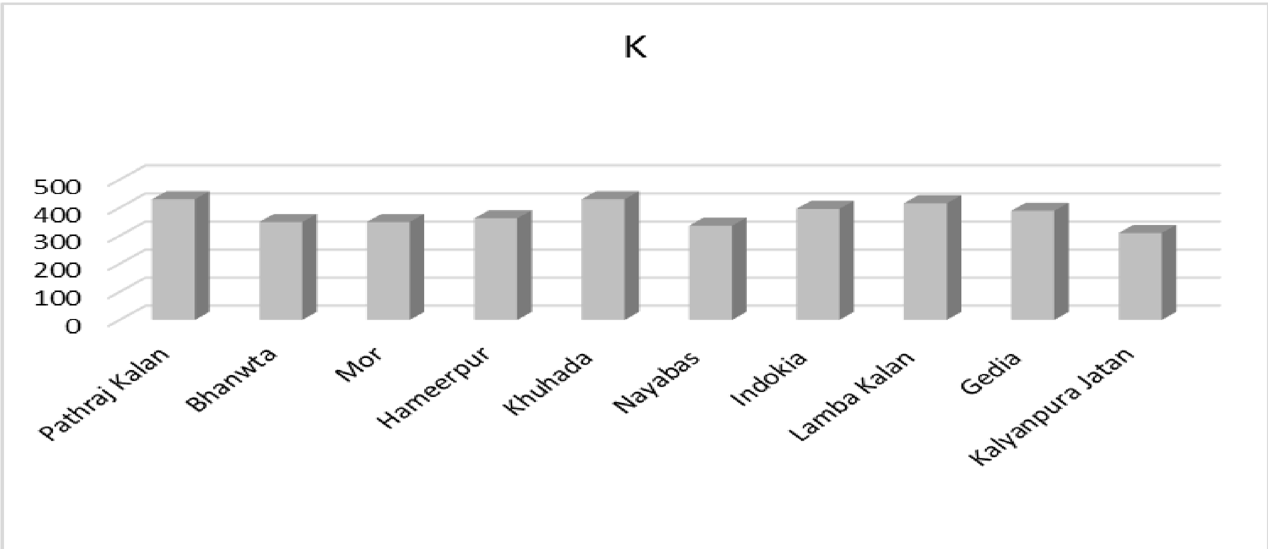

Fig.8- Graph showing K values in selected sites

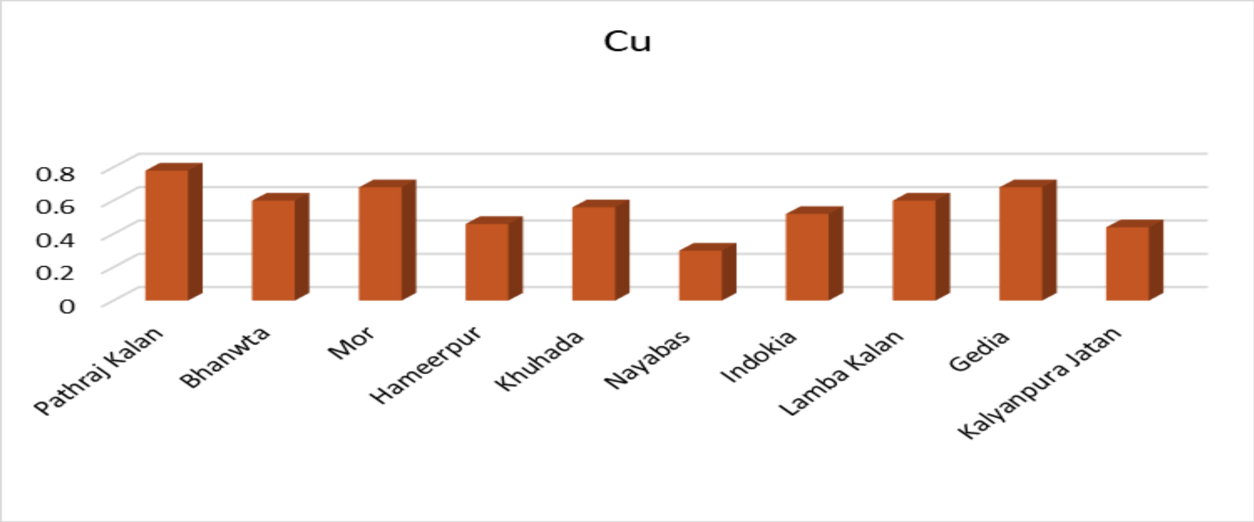

Fig.9- Graph showing Cu values in selected sites

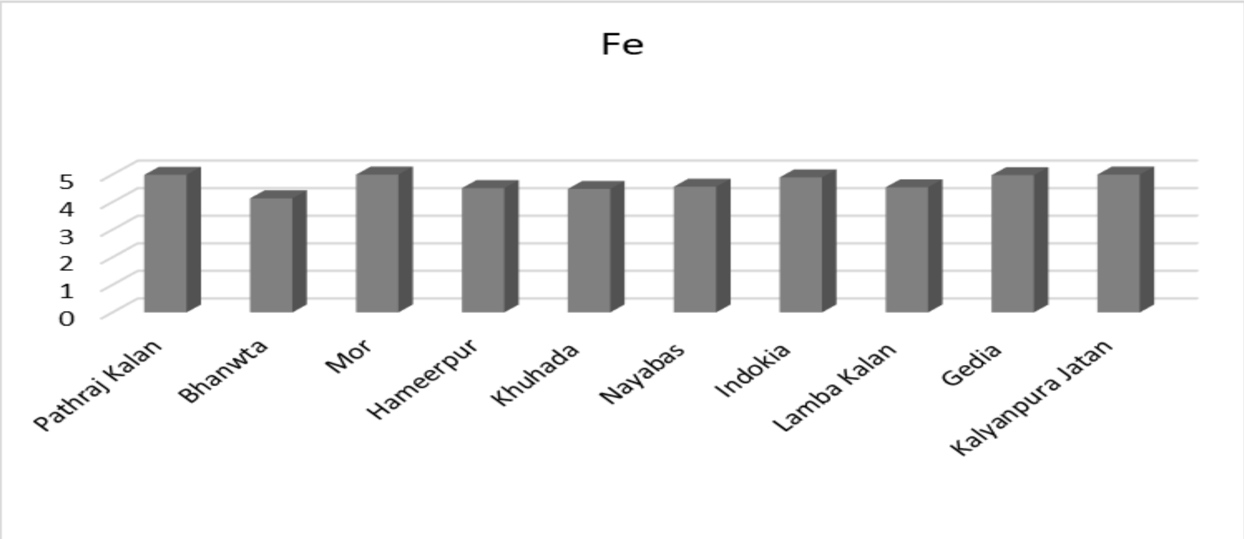

Fig.10- Graph showing Fe values in selected sites

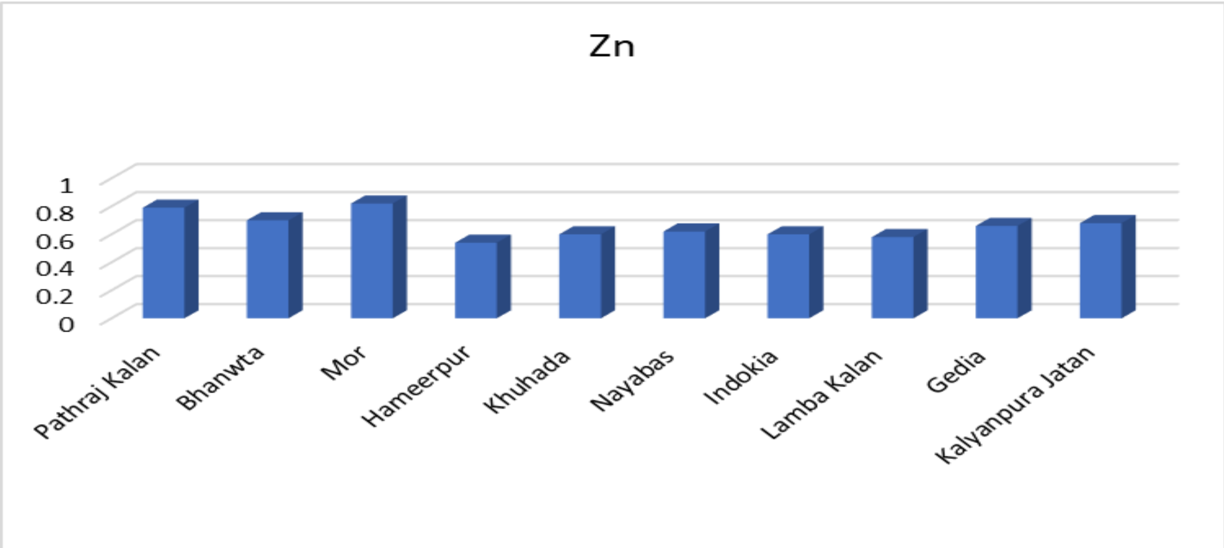

Fig.11- Graph showing Zn values in selected sites

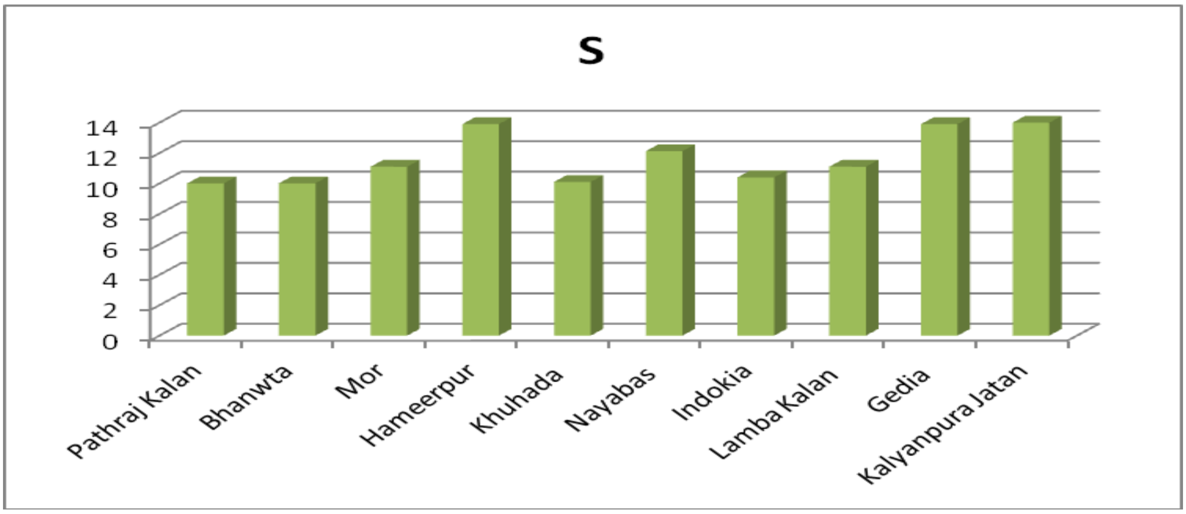

Fig.12- Graph showing S values in selected sites

From the above figures (2-12), following observations are concluded which are summarized below-

- pH is maximum and highly alkaline in Hameerpur village (8.81) whereas minimum in Kalyanpura Jatan (7.50). Except Bhanwta, Nayabas, Lama Kalan and Kalyanpura Jatan, all villages have higher pH than optimum level of ICAR (Table-2; Fig.2).
- Maximum EC of 2.34 is observed in Bhanwta and minimum EC in 0.15 of Gedia village. Bhanwta has highest level of EC (Fig.3), which should be till 1.5 according to ICAR data (Table-2).
- Maximum values of Organic Carbon (0.44) is observed in Kalyanpura Jatan and minimum in Pathraj Kalan (0.32) with minimum value of Organic matter (0.55) which is maximum in Mor and Nayabas (0.69) (Table-1, Fig.4). Organic carbon should be more than 0.75 but none of the selected village soil contains this much of carbon.
- Maximum value of Nitrogen is 0.037 of Kalyanpura jatan and its minimum valueis 0.027 of Pathraj kalan. But this is very less than the recommended value 0.053 (Table-2, Fig.6).
- Maximum values of P and K are in Pathraj Kalan; 46 and 430 respectively. Amount of P should be more than 56 but all the selected villages have less amount of P. K should be more than 336 (Table-2; Fig.7,8) and except Kalyanpura jatan all villages have more amount of K which is suitable for the agriculture purposes. Khuhada village also have higher values of K. P is minimum in Lamba kalan and K is minimum in Kalyanpura jatan.
- S is maximum in Kalyanpura jatan (14) and minimum in Pathraj kalan (10.00) (Table-1, Fig.12).
- Maximum value of Cu is observed in Pathraj kalan and minimum in Nayabas 0.78 and 0.30 respectively (Fig.9). Amount of copper should be more than 0.2 (Table-2)that is found in all the selected sites.
- Value of Fe is maximum in Mor and in Kalyanpura jatan (5) and minimum in Bhanwta (4.14) Fe should be more than 4.5 (Table-2) which is observed in almost all the sites except Bhanwta and Khuhada (Fig.10).
- Zn is maximum in Mor (0.82) and minimum in Hameerpur (0.54) (Fig.11). Hameerpur and Lamba kalan have less amount of Zn.

Values of pH are very high and EC are very low as compared to the standard values provided by ICAR in various soil samples collected; While OC & P were found to be below optimum values. Similarly, Cu, Fe and Zn were found to be almost optimum values in most of the samples.

CONCLUSION:

Although the soil samples collected from the study area which are less or more than the suggested optimum level of elements can be full-filled by adding the required quantities. But, panchayat Samiti Todaraisingh is classified under sensitive (dark) category. In the year 1984, only 38% of the available ground water was used every year, but now 92% is being harnessed. In 1984, water available was at an average depth of 9 m. which is now increased to 15 m. These figures show that if ground water exploitation continues at this pace, the cultivated soil of the selected study area will soon become completely barren. On which any type of fertilizer or manure will not be affected and the entire agricultural system will be destroyed. Therefore, considering the irregularities of various mineral nutrients in the soil, organic farming seems to be the best solution.

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