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Analysis of soil samples for its physical and chemical parameters from Mehsana and Patan District

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Abstract

The human activities that are toxic to the natural ecosystem are tr ansport, agriculture, industrial and domestic waste disposal. The environmental pollution in soil is due to multifarious activities of man. The soil forms the intermediate zone between earth's atmosphere, the lithosphere, and the rock cover. The soil can be described as the earth's uppermost weathered crust layer in which mixed organisms and the products of their death and decay are present. In present study it was preferred to investigate the soil samples for its chemical analysis and physical analysis. The Seven soil samples were collected from Mehesana and Patan district in different area. The results depends on quality of Seven representative soil samples were obtained and analyzed for its P^H, Electrical conductivity, Temperature, moisture content, water holding capacity, phosphates, chloride, alkalinity, carbonate, bicarbonate and organic content present in soil .

Keywords: Physico-chemical, EC, PH, phosphates, chloride, alkalinity, carbonate, bicarbonate and organic content

Introduction

Rock debris and organic materials are soil mixture on earth's surface. The soil can be defined as the earth's uppermost weathered layer in which mixed organisms and their death and decline products are found. Parent material, climate, time, and biodiversity including human activities are the major factors affecting soil formation. India is a diverse nation with a range relief patterns, land types, climatic realms and vegetation.

These have contributed in the development of various types of soils in India. India is predominantly an agricultural country. Indian farming depends on the extent and soil qualities. India is a country and experiences the diverse climatic conditions and other natural conditions. Climate, natural vegetation and rocks are the factors determined the quality of soil in a location. The soil contains 50-60% mineral, 25-35% water 5-25% air and little percentage of organic matter. The soil from the intermediate zone between the atmosphere and the rock cover of the earth is lithosphere. There are many methods for soil analysis of chemical and nutrient properties [1]. The management of soil testing-based nutrients has emerged as a key issue in efforts to increase agricultural productivity and production. Because optimal use of nutrients based on soil analysis will increase crop productivity and reduce the waste of these nutrients, thereby mitigating environmental impacts leading to bias through optimal production. The research work should be conducted on the crop in a particular area and the management practices of the concerned farmer. The result of the soil analysis confirms which fertilizer recommended was the actual connecting link between agricultural research and its practical application in the fields of the farmer. Farmers use large quantities of chemical fertilizers as nutrients, without soil analysis. For plant growth a small amount of fertilizer is needed. The farmer finds difficulty in knowing the proper use of fertilizers, which would match soil of their field. Farmer must take into account that what is the requirement of fertilizer to their crops. Soil analysis is the solution to this problem of the farmers. Analysis is based on various physical and chemical parameters. Soil analysis can improve the crop fertility, productivity and wastage of fertilizers. Soil is composed of both organic and inorganic matter and it is essential for life on earth to exist. Soils are 45% mineral particle size, 5% organic matter, 25% air and 25% water etc. The combination of texture, structure, porosity, chemistry, colour and temperature are the properties of soil.Soil is made up of different- sized particles. Sand particles tend to be the biggest [2]. Present study is an attempt to determine the amount of nutrients in Soil of Mehasana and Patan District, Gujarat. This knowledge will help farmers determine how much fertilizer they will apply to the soil to make production economical. The objective of this paper was to analyze the trend in physico-chemical status of soils of Mehasana and Patan District of Gujarat State.

Methodology

Material:

Seven Soil Samples were collected from Mehesana and Patan district. Soil samples collected (from the 0 to 10 cm depth) from field were cleaned from herb and plant remains.

Soil samples were collected in plastic sample bags. Plant residues and stone pieces were removed by hand. Soil sample were air dried and passed through a 2 mm brass sieve. Samples were stored at 30°C Temperature in oven until use. Then 100g soil sample was transferred to sample bag. Sampling date, Location of the sampling and sampling number were marked on the bags and soil samples were brought to the laboratory. Seven samples were selected and study was carried out based on wide range of physio-chemical properties and chemical properties.

Table 1 List of Collected Soil samples.

Sr. No	Sample Name
1	Sahathal Kailash Tekri (NR)
2	Jogdimata Borvadi Mata Ladol (R)
3	Jogdimata Borvadi Mata Ladol (NR)
4	Malekpura Kheralu Bahecharpura (R)
5	Amarpuri Mhasaj Basna (R)
6	Ransipura Vijapur (R)
7	Dharelamatanu Mandir Patan (NR)

Methods:

The soil samples were brought to laboratory for further analysis. The soil reaction (pH) and electrical conductivity (EC) were determined as per the procedure described by Jackson [3]. Temperature of a soil is measured with help of a routine mercury thermometer in a metal cone by penetrating it into the soil up to 2 cm depth. Water holding capacity of soil usually refers to amount of maximum water which can be held by

saturated soil. Place a filter paper in the approximate dimension of the brass box to cover perforated bottom of the box. Take the weight of the box plus filter paper (W1). Now transfer the sample dried in oven at 100^0C. The dried sample is placed inside the perforated dish at bottom of circular soil box and weighed (W2). The box was placed in Petri dish of 10cm diameter containing water up to depth of 1cm. After some water has been absorbed by soil, by adding water, restore depth of water in petri- dish and keep it overnight, so that water enter the box and saturates the soil. On next day soil box is taken out from water, whipped and recorded the weight (W3).

The soil moisture content also called water content is an indicator of the amount of water present in soil. The test sample must be selected in such a way that it is adequately representative of the soil from which it is collected. For the measurement of natural moisture content, the appropriate mass of specimen is about 100 gm. Put soil sample immediately in the moisture can and close it to prevent loss of moisture by evaporation. Remove the lid from the container and place the moisture can in the oven at 105-150^0C. This takes approximately 24hours. Allow the sample to cool for the sometime in the oven. Then close the can sand put them in the desiccators for further cooling. When it is cooled, replace the lids on the container and weigh.

Chloride is soluble ion exists as chloride ion chloride, a very soluble ion in nature. Its role in plant is believed to be osmotic and in balancing cell cationic. Amount of chloride vary from 0.2 to 2%. Prepare 1:5 soil suspensions in distilled water. Stir for one hour. Filter with Whatman filter paper no.50. 50 ml of filtrate in conical flask 2ml of 2% K2CrO7 solution (indicator). Titrate against 0.02 AgNO3 until red colour appears.

Calcium Carbonate: The method used in this study, for the determination of the solubility of calcium carbonate, was the one developed by Weyl[4], as modified by Hassett[5], and further modified by the author.

Total Alkalinity is the measure of capacity of the soil samples to neutralize a strong acid. The alkalinity is generally given by the salts of carbonate, bicarbonate, phosphate etc. Prepare 1:5 soil solution take 100ml of sample in conical flask add two drops of phenolphthalein. If the solution remains colorless, PA=V1=0 and TA is determine described. If color changes to pink after addition of phenolphthalein, titrate it with 0.1NHCl until the color disappears point. This is PA. Now add 2-3 drops of methyl-orange to the same sample and continue titration further until the yellow color changes to pink, the end point. This is TA.

Soil carbonate is usually quantified by acid dissolution followed by the volumetric analysis of the released carbon dioxide (CO_2). Soil carbonate and Bicarbonate extracted by employing (0.5 M NaHCO3) as described by Olsen et al., [6]

Organic matter is oxidized with chromic acid (Potassium Di-chromate, + H2So4). This method is widely used in Indian Laboratories. The total organic content of the soil samples was estimated by using the [3] Titration method.

Results and Discussions

Physical parameters:

The seven soil samples were investigated from different locations and results were found of physical parameters such as pH, Temperature, water holding capacity, EC, moisture content. The result was seen in (Table – 2 and Fig.1) and represented in bar graphical chart.

The acidity or alkalinity of the soil can be study by soil reaction or PH. The PH is very important property of the soil is it determines the capacity. The PH values fluctuated less than 7.6(table-2). The PH value for soil if acidic then it is < 6.5, if it is Normal 6.5-7.8, Alkaline 7.8- 8.5, Alkali > 8.5. This one of the most important soil properties which affect crop growth.. The major source of heat is sun and heat generated by the chemical and biological activity of the soil is negligible.

Total soluble salts are estimated by aqueous soil extracts from the Electrical Conductivity value of Seven soil

samples were ranges from 1.17mS/cm to 3.7mS/cm (Table 2), Electrical conductivity is used to estimate the soluble salt concentrations in soil and is commonly used as a measure of salinity. Soil with EC below 0.4mS/cm are considered marginally or non-saline, while soils above 0.8 mS/cm are considered severely saline.

The water holding capacity ranged from 0.14 ml/g to 0.42 ml/g and the moisture content ranged from 7.4% to 5.4% from seven different locations of Mehsana and Patan Districts. The soil type was found to be sandy. The differences in texture can affect many other physical and chemical properties of the soil. Soil texture plays a prominent role in soil production. Soils with predominantly large particles tend to drain quickly and have lower fertility. Very fine texture soils may be poorly drained, tend to become waterlogged, and are therefore not well-suited for agriculture[7]. The same study was done by Swanti A. Jain *et. al.[8] and* Chandak Nisha *et al* .[1] on the physico - chemical study of soil is based on various parameter like a pH, Electrical conductivity (EC) from soil lunawada Taluka, Dist mahisagar, Gujarat state and stated high PH of soil of Sujatpura region of Kadi city respectively. PILANIA P.K *et. al* .[9] investigated soil of "Great Rann of Kutch of Kutch district of Gujarat State in India. They studied different physical and chemical parameters like study area field capacity, electrical conductivity, organic carbon and organic matter.

Chemical analysis of soils:

The seven soil samples were investigated for chemical analysis parameters such as calcium carbonate, alkalinity, carbonate, bicarbonate, organic content and chloride. The results obtained from the present investigation as well as relevant discussion have been summarized under following tables and represented in bar graphical chart (fig 2, 3.4, 5, 6).

The Calcium Carbonate (CaCO3) and carbonate content (fig 2, 4) of soil samples from seven sites showed in range 1.4 to 3.6% and 4-16 ppm/l. Soils from seven samples are sandy lightly Calcareous and Moderately Calcareous. The pH values indicated that soils from these seven places are Alkaline as values of alkalinity ranges from 300 to 500 meq/l (fig 3). The values of electrical conductivity showed that all soils from all seven sites are normal i.e. sandy saline in nature. Calcium carbonate is one of the cementing agent the participate in the binding of soil particles together through physico-chemical mechanisms and presumably create a stable soil structure Pravin R Chaudhari *et. al.[10]* evaluated similar type of study for calcium carbonate in different locations of Karnatakta, Tamilnadu, Uttarakhand and Madhya Pradesh states of India. Marshal soni. [11] Showed similar result alkalinity present in soil collected from different locations of Punjab in India.

Table 2: Physical parameters of seven different locations from Mehsana and Patan.

Sr. No	Sample Name	pH	Temperature (°c)	Water holding capacity (mg/g)	EC (µS/cm)	Moisture content (%)
1	Sahathal Kailash Tekri (NR)	7.0	21.4	0.25	2.73	6.938
2	Jogdimata Borvadi Mata Ladol (R)	7.2	21.6	0.42	2.341	6.484
3	Jogdimata Borvadi Mata Ladol (NR)	7.3	22.1	0.31	2.780	5.547
4	Malekpura Kheralu Bahecharpura (R)	7.4	22.3	0.33	3.700	5.645
5	Amarpuri Mhasaj Basna (R)	6.9	22.4	0.17	1.157	6.123
6	Ransipura Vijapur (R)	6.2	22.3	0.30	1.243	7.467
7	Dharelamatanu Mandir Patan (NR)	7.5	22.2	0.14	1.297	6.155

Table 3 Chemical parameters of seven different locations from Mehsana and Patan.

Sr No	Sample Name	CaCo3 (%)	Alkalinity (meq/l)	Carbonate (ppm/l)	Bicarbonate (ppm/l)	Organic content (%)	Chloride (mg/l)
1	Sahathal Kailash Tekri (NR)	3.1	400	12	4	1.70	0.4331
2	Jogdimata Borvadi Mata Ladol (R)	3.5	350	4	6	2.72	O.4615
3	Jogdimata Borvadi Mata Ladol (NR)	1.4	450	16	7	6.81	0.3976
4	Malekpura Kheralu Bahecharpura (R)	2.5	500	4	6	3.27	0.4189
5	Amarpuri Mhasaj Basna (R)	3.6	400	12	4	6.81	0.3834
6	Ransipura Vijapur (R)	3.05	350	10	3	3.40	0.4757
7	Dharelamatanu Mandir Patan (NR)	2.05	300	14	8	2.27	0.4828

Figure 1. Physical analysis of pH, temperature and moisture content at seven different locations from Mehsana and Patan

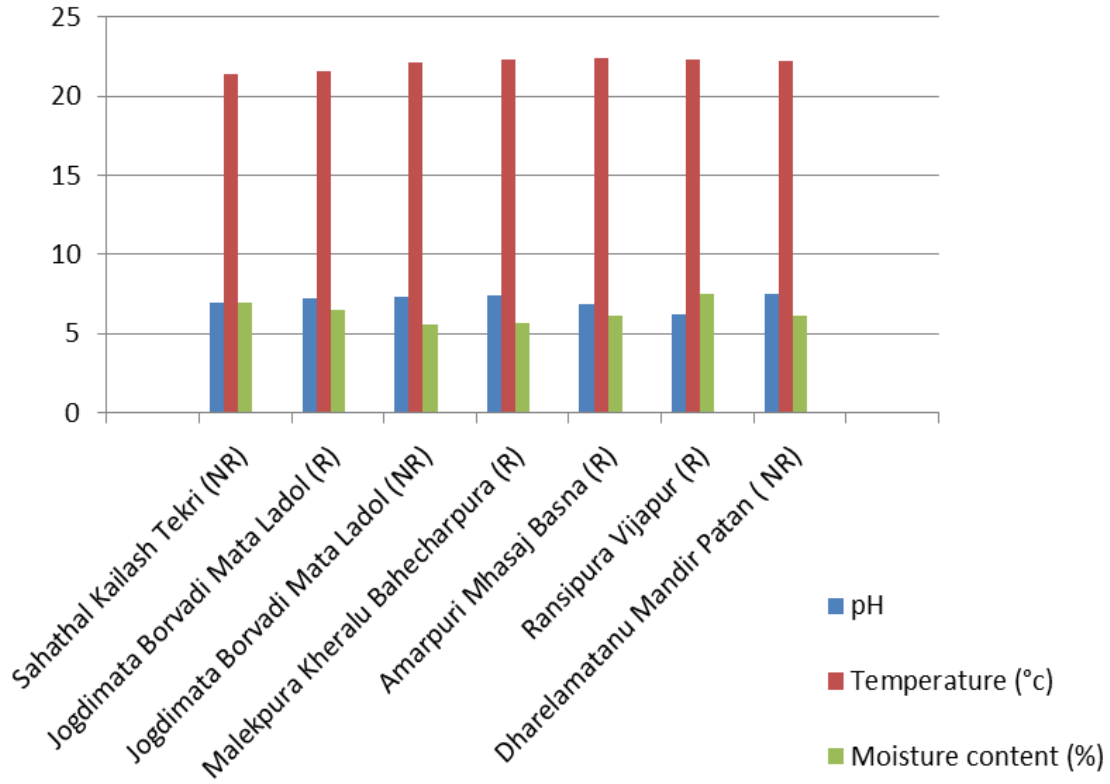


Figure 2. Chemical analysis of Calcium Carbonate content in soil at seven different locations from Mehsana and Patan

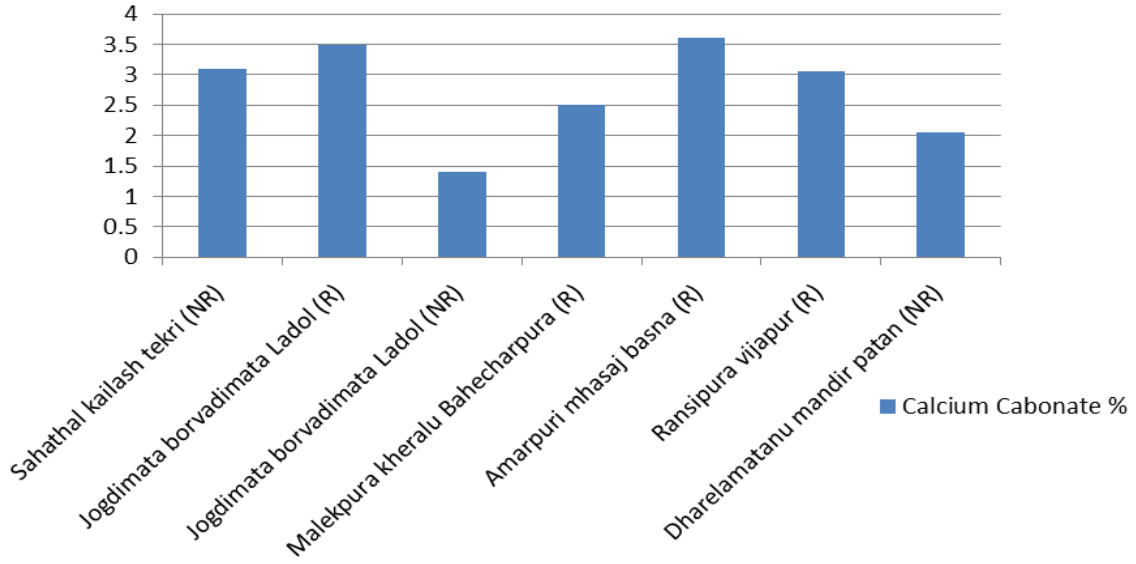


Figure 3. Chemical analysis of Alkalinity content in soil at seven different locations from Mehsana and Patan

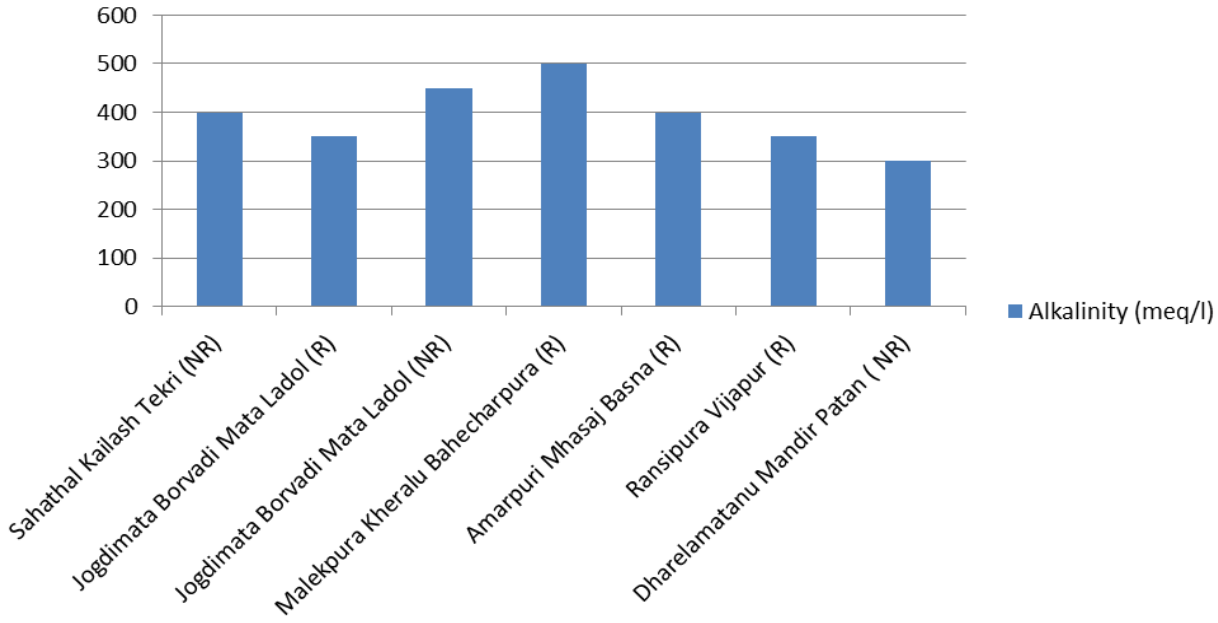


Figure 4. Chemical analysis of Carbonate content in soil at seven different locations from Mehsana and Patan

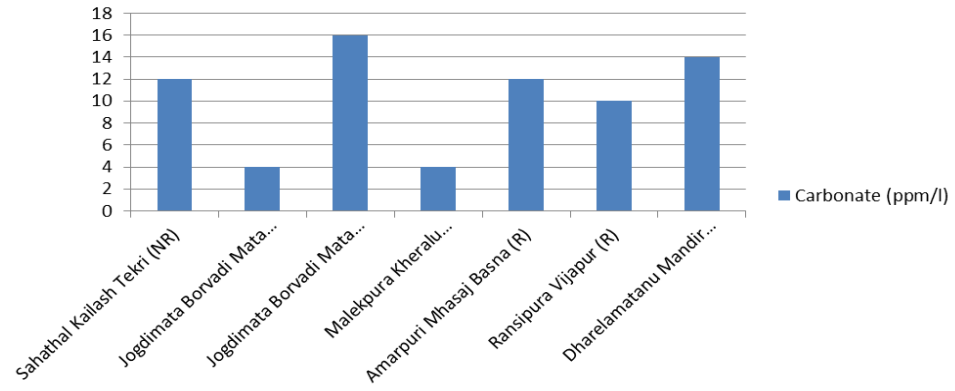


Figure 5. Chemical analysis of Biocarbonate content in soil at seven different locations from Mehsana and Patan

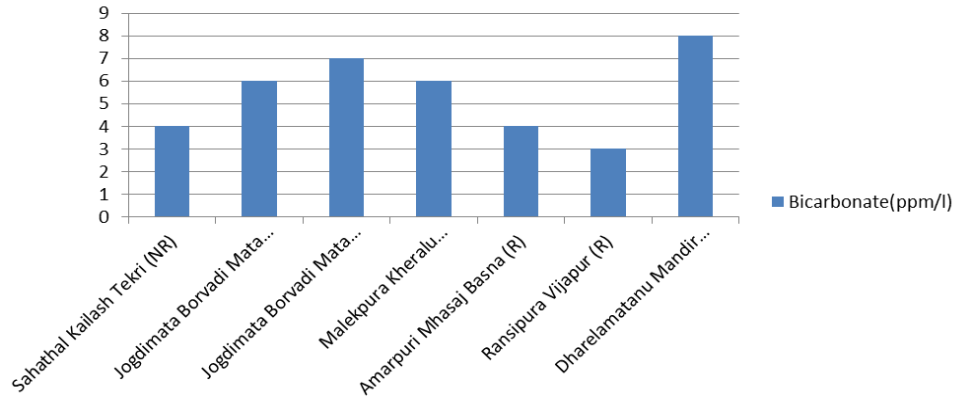


Figure 6. Chemical analysis of Organic matter content in soil at seven different locations from Mehsana and Patan

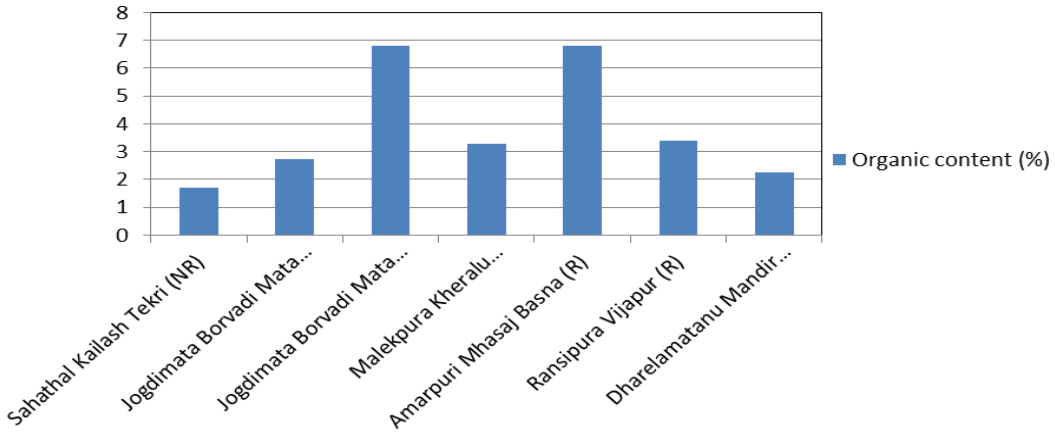
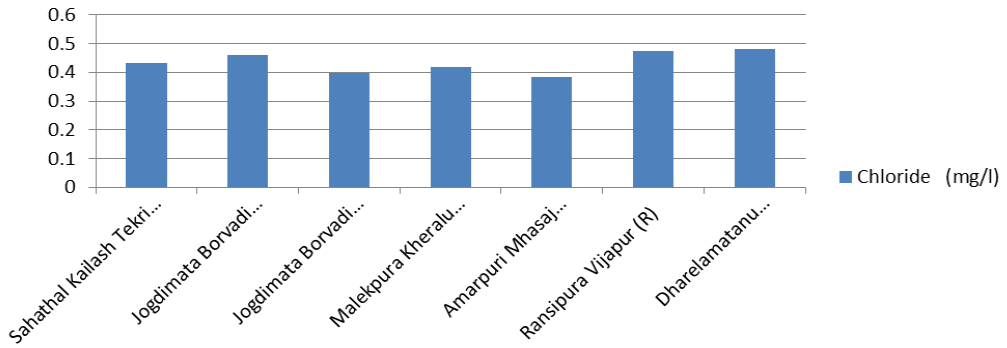


Figure 7. Chemical analysis of Chloride content in soil at seven different locations from Mehsana and Patan



The organic matter (%) ranges from 1.4 to 3.6 % (Fig 6). The organic soil matter includes all the dead plant materials and live or dead animals. Most living things in soils including plants, insects, bacteria and fungi are dependent on organic matter for nutrients and energy. Soils have varying organic compounds in varying degrees of decomposition. Organic matter holds soils open, allowing the infiltration of air and water, and may hold as much as twice its weight in water. Organic matter is required for plant growth and metabolism. Inorganic phosphate supplied to the soil as a fertilizer is rapidly converted into unavailable form. Swanti A. Jain *et. al. [8]* studied the physico - chemical study of soil is based on various parameters like a Total organic carbon, available Nitrogen (N), available phosphorus (p2o5) of soil lunawada Taluka, Dist Mahisagar, Gujarat state. Oyeyiola G.P.and Agbaje A.B.[12] also studied physico – chemical characters like pH, water holding capacity, moisture content and organic matter at Ilorin, Main Campus.

In present study chloride content were ranges from 0.38 to 0.48 mg/l in seven soil samples of Mehsana and Patan District. Plants take up chloride as Cl^- ion from soil solution. It plays some important roles in plants, including in photosynthesis, osmotic adjustment and suppression of plant disease. However, high concentrations of chloride can cause toxicity problems in crops and reduce the yield. The same result was studied by Marshal soni [11] from collected soil samples for chloride at different locations Punjab in India. The chemical Parameters present such as calcium carbonate, Bicarbonate, Organic content and chloride was very low in all the soil samples.

Conclusion

The soil Contain a low soluble salt and are poor in organic matter. Sandy soils are of open character usually loose and friable. Sand facilitates drainage and aeration. The soil survey data of Mehsana district clearly indicates that the soils are slightly neutral to moderately alkaline in reaction with low soluble salt content. The soils of Mehsana district were low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium status. On the basis of overall nutrient index, soils of Mehsana and Patan district are very low in available nitrogen, adequate in available phosphorus

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Conflicts of interest: The authors stated that no conflicts of interest.

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