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Acidity and Alkalinity analysis of farmland of Chuda taluka, Dist Surendranagar

Chemistry

KEYWORDS: Acidity, alkalinity, quality, subsoil, farmland, chuda

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ABSTRACT

World's surface area is remarkably covered with the different chemical nature of soil; they are acidic or alkaline in nature. There are numbers of directly or indirectly factor influenced the acidity or alkalinity of soil. For study of acidity and alkalinity we have taken samples from different villages of chuda taluka dist. Surendranagar for analysis of pH to deliver the information about the quality regarding acidity or alkalinity and its way to resolved. Also the important of this study result is to provide guidance that which crops are suitable for this soil and have observed areas of stunted crops in their fields to take a subsoil sample in these studied areas. Some of farmland has found an acidic and some of alkaline in nature. These acidic or alkaline soils should be applied as early in the fall and turned as deep as possible.

1. Introduction:

Earth's surface covers all or part of the land which have acidic or alkaline profile significantly. There are different properties as depend on its acidity and alkalinity of soil indicated by pH to understanding the behavior and nature also. This is very important at agriculture and environment point of view to analysis the process of acidification and in alkalization of soil.

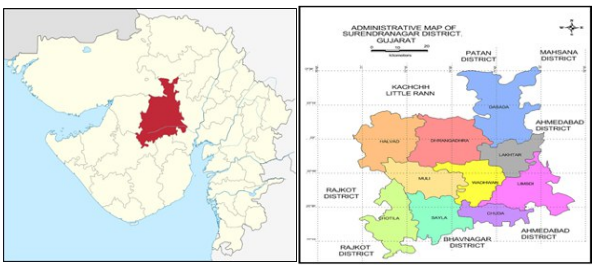
pH is the mainly common analytical study made on soil. Usually a high acidity and alkalinity cause environmental problems and difficulties with growing plants. Soil's pH value reveals its chemical and mineral components with the solutions that presents in soil pores.

The pH data of a soil sample reveals the dissociation of weak and strong acids and bases that are associated with the minerals, salts, organic compounds and solutions which are make up the soil materials. The change in pH values mostly depends on carbon, nitrogen and sulfur cycle also some human activities in the form of agriculture and industry like uses of fertilizers and lime in farm, industrial effluents, irrigation, evaporation conditions or acid rain and waste disposal.

Soil pH differs at different levels in various regions. The purpose of this analysis is an effective management of soil acidity and alkalinity at the field for more crop production, control water quality and land degradation.

2. Study Area:

Chuda is a one of the taluka out of 10 from Surendranagar ditrict. Geographically surendranagar district covers 10489 sq. km area. Chuda is located between North latitudes 22° 8' and 23° 3' and East longitudes 70° 58' and 72° 12' shown in figure no.1.The district has 11 towns and 651 villages. This district is surrounded by different district someone dry and someone belong as a desert. Chuda taluka located between latitudes 220 19'N and longitudes 710 35'E with an altitude of 63m above the mean sea level.



3. Method:

All soil samples were sampled by collected as per proper sampling method below the surface at 0 to 20 cm depth. The samples were required to dry and pass through a 2 mm sieve to prepare them for analysis. The samples were tested according to "Methods Manual-Soil Testing in India".

pH meter were used to determine pH values of different sample sites. There are 10 g soil sample was mixed with 20 ml distilled water in 1: 2 ratio. The suspension was constantly stirred with glass rod with some intermittently approx 30 minutes and left it's for one hour. The combine electrode was dipped into suspension and pH was recorded. The pH value as a measure of the hydrogen ion concentration of the soil water system and determine the acidity and alkalinity of the soil. It is a useful property of soil as it determines the level of nutrients, microbial activity and physical condition of soil.

Table 1: pH data of different villages of Chuda taluka, district Surendranagar

No.	Land Survey No.	Village	pH	No.	Land Survey No.	Village	pH
1	105/2	Acharda	8.98	**29**	67/02	Bhaneja	8.7
2	50/1	Acharda	7.5	**30**	35/01	Bhaneja	8.49
3	61/2/2	Acharda	7.72	**31**	65	Bhaneja	8.32
4	53/2	Acharda	7.93	**32**	31	Bhaneja	8.14
5	13	Khadia	8.85	**33**	158/3	Mojidad	6.3
6	28/1	Khadia	7.02	**34**	156	Mojidad	6.9
7	77	Khadia	6.84	**35**	356/4	Mojidad	7.57
8	95	Khadia	7.17	**36**	157	Mojidad	7.87
9	370	Chachan	8.85	**37**	84/1	Rangpur	7.99
10	169	Chachan	8.56	**38**	71/1	Rangpur	7.8
11	377	Chachan	7.76	**39**	85/2	Rangpur	7.03
12	358	Chachan	7.68	**40**	65/1	Rangpur	8.37
13	191/2	Chachka	7.09	**41**	157	Vanara	7.99
14	191/1	Chachka	7.01	**42**	138	Vanara	7.38
15	135/4	Chachka	7.85	**43**	120/3	Vanara	6.55
16	181/1	Chachka	7.24	**44**	122/1	Vanara	7.17
17	117/p3	Chatriyal	7.99	**45**	114/1	Vaniyava	8.75
18	155/p2/1	Chatriyal	3.27	**46**	115/5	Vaniyava	8.7
19	114	Chatriyal	8.78	**47**	92/1	Vaniyava	8.59
20	36/p2	Chatriyal	8.19	**48**	111/4	Vaniyava	8.49
21	34	Chalara	7.99	**49**	52/2	Veravada	8.88
22	35/4	Chalara	8.11	**50**	56/2	Veravada	8.74
23	57	Chalara	7.02	**51**	59/1/2/1	Veravada	8.49
24	58/2	Chalara	4.38	**52**	64/1/2	Veravada	7.99
25	52	Nagnesh	8.7	**53**	152/01	Sejakpur	8.73

26	50/2	Nagnesh	8.59	**54**	161/01	Sejakpur	8.71
27	182/2	Nagnesh	8.32	**55**	156	Sejakpur	8.79
28	31/2	Nagnesh	7.99	**56**	149/02	Sejakpur	8.33

Table 2: Interpretation of soil pH properties

Parameters	Interpretation	
pH	< 4.6	Extremely acidic
	4.6 – 5.5	Strongly acidic
	5.6 – 6.5	Moderately acidic
	6.6 – 6.9	Slightly acidic
	7	Neutral
	7.1 – 8.5	Moderately alkaline
	> 8.5	Strongly alkaline

4. Result and Discussion:

From the above analysis data of pH range from 3.27 to 8.98 of various sample reveled various properties of soil.

- Only 5 samples lie in acidic nature below 7.0 pH.
- There is no neutral pH sample data in table.
- Rest all are indicated alkaline soil nature.

Here PH less than 2.0 indicates that soil; may have sulphuric material. A pH less than 4 suggest the presence of free acid generally from oxide. A pH from 7.3 to 8.5 indicates that presence of Calcium Carbonate in the soil.

A pH > 8.5 indicates that the significant amount of exchangeable presence of sodium carbonate.

Hence the data proves most of the soils are moderately alkaline and in this situation the solubility of minerals decreases, makes nutrient deficiencies in the soils.

In alkaline soils, the ionic forms Na^{+}, K^{+}, Cl^{-}, and NO_3^{-} predominate with increasing presence of bicarbonate and other complex forms of sulfate and bicarbonate. The increasing presence of bicarbonate and borate, and possibly the aluminates ion, often due to evaporative concentration and limited leaching can result in very high soil pH and plant toxicities. Trace metal elements are present in such low concentration that Fe^{+2}, Mn^{+2} and Zn^{+2} become deficient.

In acidic soils, the ionic forms K^{+}, Ca^{2+}, Mg^{+2}, Na^{+}, Mn^{+2}, Fe^{+2}, SO_4^{-2} and Cl^{-} predominate, with complex forms of aluminum (Al) with organic legends, F and OH. As pH decreases, increasingly are the very toxic Al^{+3} released. The main ionic forms listed occur at close to 100% of the element present in solution and are therefore readily available to plants and significantly, may also be readily leached. Deficiency for elements such as K^{+}, Ca^{+2} and Mg^{+2} of plant nutrient can be common at low soil pH, usually because leaching loss has impoverished the soil.

The acidity or alkalinity property of soil solution is measured by pH scale. The ion activity product of water at 25^{0} C is 14.0 and at a pH of 7, the activities of H^{+} and OH^{-} ions are 10^{-7} mol L^{-1}. The pH of a soil solution of samples is the -ve logarithm value of the hydrogen ion activity:

$$pH = -\log_{10}[H^{+}]$$

Most soil pH values are range in between 5 to 8.5. Acidic soil conditions may result in soil pH values as low as near 2 and alkaline soil may have pH values above 10.

Acidic and basic compounds in soils are defined by Bronsted and Lowry as being proton donor and acceptor, respectively. The dissociation rate of strong acids and bases are high in solution. Most acids and bases are weak and are commonly dissociated about 1%.

The dissociation rate of these acids and bases only buffers the pH of the soil solution significantly over a range of 1 pH unit on either side of its pKa. Because most of soils are a mixture of various mineral and organic components that are acids and bases, titration of soil materials with acids or alkali gave buffer curves that reflect the net contribution from these different components and may not appear same as the buffer curves expected from. In surface layers of soils where organic matter usually accumulated, weakly dissociated organic acids buffer soil pH. Where soil pH is above 6.5, the concentrations of carbonate and bicarbonate anions increase and it is the presence of different minerals and salts of these anions, particularly $NaHCO_3$ that results in the very high pH values of alkaline soil. Acid sulfate soils result as the oxidation of sulfides to produce sulfuric acid and, if the neutralizing capacity of acid is low of the soil sample, pH values below 3.

The ions present in soil solution differ in amount and form depending on whether the soil pH is acidic or alkaline, reflecting the charge properties, equilibrium state and mineral and organic materials that make up the soil. Most soil systems are not closed, that is, they are subject to solutions and gases entering and leaving the profile and are therefore also in states of changing chemical equilibrium. The specific form of ions present in solution are critical, especially as alkalinity or acidity increases, as species that are toxic to many biological processes, soil organisms and plants increase in concentration.

5. Conclusion:

Where the pH is lower than criteria, then it is suggest applying lime stone in soil for enhancement of pH.

A soil PH value is more than about 8.0 due to high concentration of calcareous rock (calcium carbonate). Hence it is suggest applying sulfur powder or phosphorus, iron , copper and zinc to soil because such element are less available to plants in calcareous soil.

The pH range lower than 7.0 suggest cultivating potatoes, corn, crops, rice, soya beans, wheat, watermelon crops. The pH range more than 7.0 suggest for sugar beets.

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