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Study of presence of available potassium in soil of Lunawada Taluka territory

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ABSTRACT

This physico-chemical study of soil is based on various parameters like PH conductivity total carbon Available Nitrogen Available Phosphorus (P_2O_5) and Available Potassium (K_2O). This study lead us to the conclusion of the nutrient's quantity of soil of Lunawada Taluka, Dist : Panchmahal Gujarat. Results show that Lunawada taluka have medium & high potassium content. The fertility index for potassium for Lunawada taluka is 1.23 to 6.4. This information will help farmers to decided the problems related to soil nutrients amount of Fertilizers to be added to soil to make the production economic

Key words: Quality of soil, fertility index, Lunawada, Gujarat

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INDRODUCTION

Soil in its traditional meaning, is the natural medium for the growth of land plants. can grow, if water and temperature are adequate at least the minimum nutrients, are available, and toxic substances are in low concentration. Soil test based nutrient management has emerged as a key issue efforts to increase agriculture productivity & production since optimal use of nutrients based on Soil analysis can improve crop productivity and minimize wastage of these nutrients thus minimizing impact an environmental leading to bias through optimal production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas. [1,2].

Several state including,Gujarat, Haryana, Karnataka and Uttar Pradesh have made commendable progress in soil testing programme in various ways such as expansion of soil testing facilities state wise and highlight main issues in soil testing programme compendium on soil health [3].

One of the group [4] studied soil samples of 19 different villages of tribal area surrounding Lunawada. The physicochemical properties such as moisture content, specific gravity, PH measurement and estimations of Mg^{2+}, Na^{+}, K^{+} and Cl^{-}, HCO_3^{-}, PO_4^{3-}, No_3^{-} of soil were well studied. The fertility of the soil depends on the concentration of N,P,K organic and inorganic materials and water. Nitrogen is required for growth of plant & nucleic acid. Potassium is found in its mineral form and affect plants cell division, carbohydrate formation, translocation of Sugar, various enzyme action and resistance to certain plant disease, over 60 enzymes are known to require potassium for activation. Amount of nutrients to be added to soil for crop production depend on their present amount in that soil. Fertilizer addition is recommended, now a day an STR

(Soil Test Recommendation) basis in which contents of major nutrients (N, P, K) are determined following standard methods before sowing. Their values suggest quality of soil in terms of its nutrients contents i.e. high, medium, or low nutrients. These nutrients content are than deduced from required amount of nutrients for following crop and this much amount of nutrients is now recommended for addition to soil [5]. Quality characteristics of soil such as PH, electrical conductivity(EC), Calcium(Ca^{2+}), Magnesium (Mg^{2+}), Bicarbonate (HCO_3^{-}), Chloride (Cl^{-}),

Available potassium K_2O were determined as per standard methods. Results show that 20% soils are deficient in organic carbon where as 95% soils are deficient in available Potassium [6].

There is no intent with this system to make any interpretation as to the potential environment impact of sensitive nutrients, such as potassium. This interpretation system is meant strictly for the determination of current soil suitability for agronomic or horticulture crop production. While nutrient availability can be important in gauging the potential for adverse environment effects, it is only one factor in the overall picture. Slope, ground cover, incorporation of nutrient sources, timing of application and other considerations all affect the potential movement of nutrients off-site and their potential for adverse environment impact of surface and ground water [7,8]. In cold climate, rapid root development early in the season is important.

To encourage this, a small amount of starter fertilizer may be recommended for some crops even though the available level in the soil may be rated optimum or even excessive. Soil fertility testing is really the combination of three discrete but interrelated processes: analysis, interpretation, and recommendation [9]. Stefanic's definition [10] approaches the most the fundamental biologic feature of soil fertility.

Fertility is the fundamental feature of the soil that results from the vital activity of micro- population of plant roots, of accumulated enzymes and chemical processes, generators of biomass, humus, mineral salts and active biologic substance.

This definition has the quality to be analytical. Understanding the definition in detail, the analyses of soil samples can be used for quantifying the level of soil fertility.

Present study is an attempt to find out the nutrient's quantity in soil Lunawad taluka Dist : Panchmahal, Gujarat. This information will help farmers to decide the amount of fertilizer to be added to soil to make the production economic. The objective of this paper was to analyze the trend in fertility status of soils of Lunawada taluka of Gujarat State.

MATERIALS AND METHODS

The soil test data are the best source available to assess soil fertility status. Eighteen villages from Lunawada taluka covering North, South, East and West were selected for this study. A representative soil sample were collected following standard quadric procedure and taken in polythene bags. In laboratory these samples were analyzed for different chemical parameters following standard methods [12].

DETERMINATION OF AVAILABLE OR EXCHAGEBALE POTASSIUM

Potash (K_2O) in Indian soils range from 0.05-3.5 percent out of which 95% part is present in completed form 1.10% part in relatively non available from 2% part in available.The term available potassium includes both exchangeable & water soluble forms of the potassium present in soil. The available K (reading exchangeable water soluble K is usually determine in neutral normal ammonium acetate (1N CH_3COONH_4) extract of soil.The degree of agitation during extraction & the extraction time can affect CH_3COONH_4) extrable K & this effect may very among soils (Grava 1980). To estimate exchangeable K first water soluble K is estimated in a saturation extract & the same is deduced from the ammonium acetate extractable K.[1]

PRINCIPLE :

Potassium is extracted from the soil with the help of suitable extractant CH_3COONH_4 by shacking followed by filtration or centrifugation & is determined in the extract using flame photometer. The analysis photometer is based on the measurement of the intensity of characteristic lime emission given by the element to be determined .

When a solution of a salts is sprayed into a flame the salt gets separated into its component atoms because of the high temperature.

The energy provide by flame excites the atoms to higher energy levels (the electrons of atom go to high energy level).

When the electrons return back to the ground or unexcited stage. They emit radiation of characteristic wave length cline emission spectrum. The intensity of these radiations is proportional to the concentration of particular element in solution which is measured through a photo cell in the flame photometer.

EQUIPMENTS :-
(1) Erlenmeyer flask (150ml).
(2) Flame photometer with k filter.
(3) Centrifuge with centrifuge tubes.
(4) Volumetric flask (100ml).

REAGENTS :-
1.0 N ammonium acetate solution of PH 7. Dissolve 154g ammonium acetate in distilled water & dilute it to 1-8 Litres mix the grouchily adjust PH to 7-0 with dilute NH_4OH or acetic acid as required & make to 2 litres or take 700ml of distilled water. Add 57ml 99.5x%glacial acetic acid & then 69ml of concentrated NH_4OH in it. Dilute to a volume 900ml & adjust PH to 7.0 by the addition of more f NH_4OH or CH_3OOH & make up 1 litre store in pyrex or polypropy bottle.

STANDARD KCl SOLUTION :-
Dissolve 1.908g AR grade KCl (dried at 60^0 C for 1hr) in distilled of deionized water make volume to 1 litre. This will give stock solultion of 1000 ppm. Now take 100ml this stock solution & diluted it with neutral normal ammonium acetate
(extracting sol^n) up to 1 litre. This gives solution of 100 from ppmk.

From this solution take 0,5,10,15 & 20ml in volumetric flask of 100ml capacity acetate solution.This will give a selies of standard solutions having 0,5,10,15 & 20 ppm K respectively.

METHOD :-
The ammoniums acetate extract of soil can be obtained by shaking of followed by filtration (Schollen ber ger & simon **1945**) or shaking followed by centrifugation (Knudsen etal. **1982**).

SHAKIGN & FILTRATION :-
(1). Place 5g air dried soil in a 150ml Erlen meyer flask & pour in 25ml of neutral normal ammonium acetate.
(2). Shake on a mechanical shaker for 5 min & immediately filter through whatman filter paper No.1. First few ml of the filtrated may be discarded.

SHAKIGN & CENTRIFUGATION :-
(1). Place 5g air dried soil into 50ml centrifuge tube.
(2) Add 25ml of neutral normal ammonium acetate sol^n stopper & shake the tube for 10 minutes.
(3) Decant the supernatant liquid into a 100ml volumetric flask.
(4) Make three additional extraction in the same manner. Dilute the combined extracts to 100ml with CH_3COONH_4 & mix.
(5) Determine K in the extract prepared by either of the above methods with the help of flame photometer keep air pressure at 5 lbs & adjust the gas feeder so as to have a blue sharp flame cones.
(6) Adjust zero reading on the scale by feeding extract solution (CH_3COONH_4) in the flame photometer.
(7) Feed standard KCl solution of the highest value in the standard series (20 ppmk) and adjust the flame photometer to read full scale i.e 100 reading. Now take reading of each standard solution plot a standard curve between cone & reading of standard K solution.
(8) Take extract of sample & feed in flame photometer note the reading for sample & determine K content in the sample with the help of standard curve.

AR grade reagents and double distilled water ware used for soil analysis. Results were compared with standard values [15] to find out low, medium or high nutrient's content essential for STR. The available phosphorus value can be calculated by multiplying a standard factor. Based on the soil test values for different nutrients, soil samples are generally classified into three categories, low, medium, and high (Table 1). Using these fertility classes nutrient/ fertility index was calculated.

RESULTS AND DISCUSSION

Table 1 represent the range of Low, Medium and High potassium content as per standard of soil analysis, it is the permissible standard according to Anand Agriculture University. This values are used to determine the category of soil whether the soil sample have Low, Medium or High content of Potassium

Experimental values of quality characteristics especially for available Potassium of soil of the Lunawada Taluka with their fertility index are presented in the Table 2. This table represent the number of samples lies in Low,

Medium and High Potassium content. The same table represent the calculated values of fertility index for available Potassium of the soil for all these 19 villages. Data presented in Table 2 shows that soils of few villages contain lower available Potassium and very few villages have high range of available Potassium that might be due to poor or excessive use of fertilizer. Wide range of infect average all the samples lies in medium range indicates good quality of soil suggest sufficient amount of presence of available Potassium and hence no need of nutrient supplements to this soil. Results are in tune with farming practices followed by farmers of this region. Most of the farmer's are using compost and chemical fertilizers, urea and phosphatic fertilizers only, since last 25 to 30 years which contains concentrated amount of nitrogen and organic carbon, potassium and phosphorus . On the basis of these results farmers are advised to use integrated nutrient management practice to maintain optimum concentration of all the essential nutrients for plants. Farmers are also advised to add biofertilizers containing organic carbon and nitrogen solubilising bacteria. The graphical representation clearly confirms the recent status of all 19 villages for the presence of available Potassium in their soil. Table 3 represents the taluka wise status of Low, Medium and High category of samples having Potassium.

Figure 1, represents the village wise category for Number of sample lies in Low, Medium and High Potassium. This clears that how many samples were collected from the village and what is the status of Potassium level in that sample whether it has Low, Medium or High nitrogen content. Using these fertility classes nutrient / fertility index was calculated as per the following equation.

Fertility index = (NL*1+NM*2+NH*3)/100

Where NL, NM and NH are number of sample falling in low, medium and high classes of Potassium status of samples analyzed for a given are. Figure 2 shows the fertility index for available Potassium is finally used for recommendation of fertilizers and crop selection.

Table 1 : Range of Low, Medium and High category of Available Potassium in the form of K_2O

Category	Total Available Potassium
Low	**<140kg K_2O/Ha**
Medium	**140-280 kg K_2O/Ha**
High	**>280kg K_2O/Ha**

Table 2 : Study of Presence of Potassium Content in the soil of Lunawada taluka territory District : Panchmahal

Sr. No.	Village Name	Number of samples	No.of samples in Low Potassium content	No.of samples in Medium Potassium content	No.of smaples in High Potassium content	Fertility index
1	Ankalva	253	0	0	253	7.59
2	Aritha	154	12	91	51	3.47
3	Chansar	122	9	49	64	2.99
4	Chunvan Muvada	64	0	0	64	1.92
5	God Na Muvada	170	35	70	65	3.7
6	Hadmatia	47	5	5	37	1.26
7	Kaka na Bhesavada	195	3	13	179	5.66
8	Kankachiya	275	19	141	115	6.46
9	Kankalia	105	22	65	18	2.06
10	Kauchiya	223	27	118	78	4.97
11	Mota Soneal	287	52	131	104	6.26
12	Moti Charel	112	5	33	74	2.93
13	Nani Zanzari	75	5	39	31	1.76
14	Rampatel Na Muvada	212	22	130	60	4.62
15	Vadi Na Gorada	110	9	63	38	2.49
16	Sajjanpur	42	0	0	42	1.26
17	Soniya Na Muvada	43	0	6	37	1.23

Figure 1 : Number of samples of all 17 Lunawada taluka lies in Low, Medium and High Potassium content range

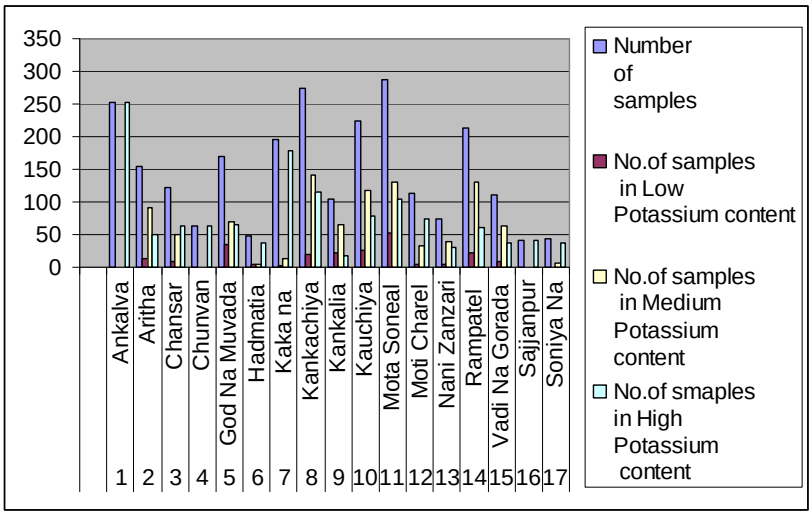
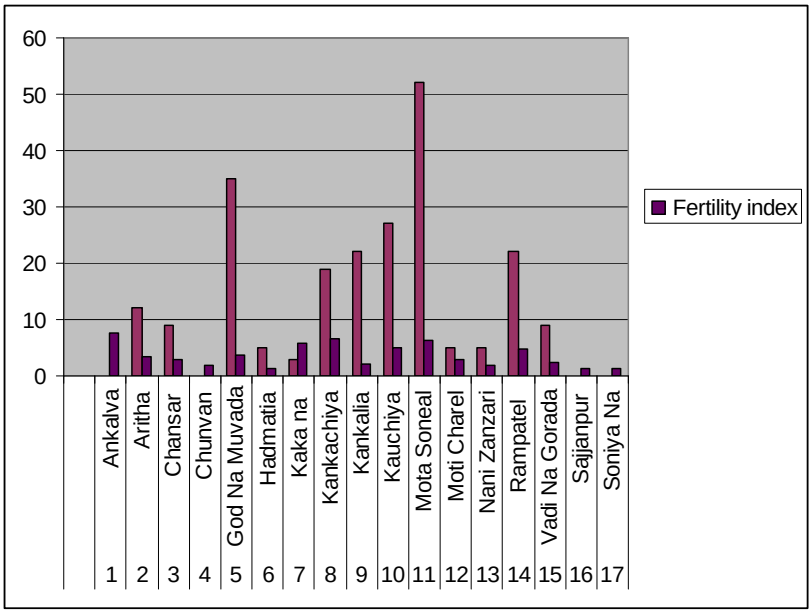


Figure 2 : Fertility index for Potassium content of Lunawada Taluka territory of Panchmahal District



CONCLUSION

This can be concluded from this study that the available Phosphorus deficient soil is recommended for Phosphorus rich fertilizer. Average all villages have medium category of available Phosphorus so no need to add Phosphorus contained fertilizers. This study evaluate soil fertility status for making fertilizer recommendations. To classify soil into different types of soil groups, fertility groups for preparing soil maps and soil fertility maps which are presented in form of graphics. To predict the probable crop response to applied nutrients. To identify the type and degree of soil related problems like salinity, alkalinity and acidity etc. and to suggest appropriate reclamation / amelioration measure. To find out suitability for growing crops and orchard. To find out suitability for irrigation. To study the soil genesis.

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REFERENCES

[1] P K Gupta, Methods in Environmental analysis water soil and Air 2nd Edition Agrobios, Kota, India **2000**, 101
[2] H Kaur, Environmental Chemistry 2nd Edition, Pragati Prakashan **2002**,416
[3] R. Raws,Earth is first Organics, Chemical Engineering News, Compendium on Soil health Report American Chemical Society, **1997**, 20-22
[4] B S Patel and H R Dabhi, *Asia Journal of chemistry*,**2009**, 12(2), 1155-1158.
[5] R W Miller and R.L. Donahul, Soils in our Environment 7th edition Prentice Hall Ine, New Jersey-07362,**1995**, 67-68.
[6] Mayur Shah, Prateek Shilpkar, Ajay Shah, Amit Isadara and Anilsinh Vaghela, *J Adv.Dev. Res*. **2011**,2(1), 50-53.
[7] Dilip. H Patel and Milan M L, *Archives of Applied Science Research* **2013**, 5{4} : 24-29
[8] J L Lemunyon and R G Gilber, *Journal of Production Agriculture*, **1993**, 6(4):483-486.
[9] D Beegle, Interpretation of Soil Testing Result, IN Recommended Soil Testing Procedures for the Northeastern United State. University of Delaware Ag. Experiment Station Bulletin no.493, second edition UK **1995**, 84-91.
[10] D J Eckert, Soil test interpretations: Basic cation saturatin ratios and sufficiency levels, IN Soil testing Sampling, correlation, calibration, and interpretation. J R Brown editor, SSSA Special Publication No.21. Soil Science Society of America. **1987**,53-64.
[11] G Stefanic, *Romanian Agricultural Research* **1994**, 2, 107-116.
[12] B R Hoskins, Soil testing handbook for professionals in agriculture, horticulture, nutrient and residuals management. Third edition. Formely "Soil Testing Handbook for professional Agriculturalists", Phosphate requirements. Maine Soil Testing Service / Analytical Lab Maine Forestry & Agricultural Experiment Station University of Maine **1997**, 34-35.
[13] M L Jakson, Soil Chemical analysis, Prentice-Hall of India Pvt. Ltd., New Delhi.**1967**,123-126
[14] S R Olsen, C.V.Cole, F S Watanbe, L A Dean. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circular No. 939. **1954**.
[15] S R Olsen and L E Sommers, Phosphorus- IN Methods of Soil Analysis, Agronomy no. 9, part 2, second edition. American Society of Agronomy. **1982**,416-422
[16] www.ifc.org