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Study of presence of available potash in soil of Godhra- Kalol Taluka territory

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ABSTRACT

This physico-chemical study of soil is based on various parameters like pH, conductivity, Total Organic Carbon, Available Nitrogen (N), 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 Kalol and Godhra Taluka, District- Panchmahal, Gujarat. Results show that average all the villages of both these taluka have medium and high potassium content. The fertility index for available potassium for both this taluka is 2.18. This information will help farmers to decide the problems related to soil nutrients amount of fertilizers to be added to soil to make the production economic.

Introduction

Soil is the critical component of the earth system, functioning not only for the production of food, fodder and fiber but also in the maintenance of local, regional and global environmental quality. Farmers in Asia, for centuries, have practiced a cultural system that ensured modest but stable yields, yet maintained a desired level of fertility in soil. This equilibrium was disturbed by the need to increase production through introduction of high yielding varieties, intensive use of chemical fertilizers and pesticides and extensive tillage. There are now concerns whether the dramatic increase in production, which followed the Green Revolution is sustainable. Soil test based nutrient management has emerged as a key issue in efforts to increase agricultural productivity and production since optimal use of nutrients, based on soil analysis can improve crop productivity and minimize wastage of these nutrients, thus minimizing impact on environmental leading to bias through optimal production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas. Several States including Andhra Pradesh, Gujarat, Haryana, Karnataka and Uttar Pradesh have made commendable progress in soil testing programme in various ways such as expansion of soil testing facilities, popularization of the programme in campaign mode, development of soil fertility maps and use of information technology in delivering soil nutrient status and appropriate recommendation to farmers. This compendium is an effort to put together existing status of soil testing facilities state wise and highlight main issues in soil testing programme Compendium on soil health[1]. Soil is important to everyone either directly or indirectly. It is the natural bodies on which agricultural products grow and it has fragile ecosystem [2,3].

The soil samples from 10 different villages of tribal area surrounding Dahod were collected. 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 studied by Dabhi et al [4]. 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 and is a constituent of chlorophyll, plant protein, and nucleic acids. Phosphorus is most often limiting nutrients remains present in plant cell nuclei and act as energy storage. It helps in transfer of energy. Potassium is found in its mineral form and affect plant cell division, carbohydrate formation, translocation of sugar, various enzyme actions 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 on 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]. One of The communication deals with quality of soil of Dahegam Taluka. Soil samples were collected from forty different villages of Dahegam Taluka. Quality characteristics of soil such as pH, Electrical Conductivity (EC), Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Bicarbonate (HCO_3^-), Chloride(Cl^-), Total Organic Carbon, Available Nitrogen (N), Available Phosphorus (P_2O_5) and Available Potassium (K_2O) were determined as per standard methods. Results show that 20% soils are deficient in organic carbon whereas 95% soils are deficient in available potassium[6].

Soil fertility testing is really the combination of three discrete but interrelated processes: analysis, interpretation, and recommendation[7]. Ştefanic's definition[8] 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 substances. The fertility level is related with the potential level of bioaccumulation and mineralization processes, these depending on the programme and conditions of the ecological subsystem evolution and on anthropic influences". This definition has the quality to be

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

The key to soil test calibration is to determine the "critical" test level for each major nutrient for each crop. The critical level is the minimum test level which statistically correlates to maximum yield. In other words, it is the lowest test value necessary to support the highest yields attainable in the area [9, 10]. Adding a nutrient to raise the soil test level above this critical value will not produce an economic return on the cost of that addition. Once the critical soil test level for a nutrient is reached, crop yield will be limited by some other factor such as soil moisture, length of growing season, weed pressure, an insect or disease problem, or another nutrient level.

Potassium is an essential nutrient for agricultural crops because it plays an important role in several physiological processes in plant. There are about 50 enzymes, responsible for energy transfer and formation of sugars, starch and protein that are affected by potassium presence in plant[11, 12]. Potassium content in soils depends on the type of parent material and degree of soil and mineral weathering. Soil K exists in four forms that are in equilibrium, each differing in its availability to crops. These forms, in increasing order are: mineral, non-exchangeable (fixed or difficultly available), exchangeable, and solution[13]. The equilibrium reactions between K forms markedly affect whether applied potassium is taken by plant, leached into lower soil layers or converted into un-available forms[14]. Knowing the equilibrium constants is very important for predicting the status and supply of potassium for plant[15]. Different approaches or methods are used to evaluate the status and availability of potassium. Potassium extracted by 1 N ammonium acetate is considered as good indicator for potassium availability[16], while other investigators[17,18,19] stressed on the contribution of acid extracted K on potassium nutrition and plant uptake.

Potassium is one of the three major fertilizer elements required by plants. In general potassium status of soils is satisfactory only when enough potassium is added to compensate for the potassium removed in the crops. This is because any excess potassium added is largely retained in the soil by sorption on clays and organic matter. In areas where crops have been grown for many years without the addition of adequate potassium containing fertilizers, yield gradually decrease as the potassium from between the illite layers is slowly removed. If potassium fertilizer is then added, the increase in yield is not as great as might be expected. This is because the potassium returns to the illite structure rather than remaining immediately available for plant growth. As a consequence the formers are faced with the high costs of potassium fertilizers without receiving a comparable increase in crop yield. High yields of any crop can be sustained only by replacing the nutrients removed with the crop[20].

Present study is an attempt to find out the nutrient's quantity in soil of Kalol and Godhra Taluka, District-Panchmahal, Gujarat. This information will help farmers to decide the amount of fertilizers to be added to soil to make the production economic. The objective of this paper was to evaluate the status of potassium in selected soil samples using the traditional Flame photometric method of K analysis (NH_4OAc , -K).And to analyze the trend in fertility status of soils of kalol and Godhra taluka of Gujarat State.

Experimental:

The soil test data are the best source available to assess soil fertility status. Eighteen villages from kalol and one from Godhra taluka covering North, South, East and West, were selected for this study. A representative soil sample was collected from each village which represent soils of 4 to 10 farm's depending upon area of village. Representative soil samples were collected following standard quadric procedure and taken in polythene bags. In laboratory these samples were analyzed for different chemical parameters following standard methods[21]. AR grade reagents and double distilled water were used for soil analysis. Results were compared with standard values[22] to find out low, medium or high nutrient's content essential for STR.

Soil is shaken with neutral normal ammonium acetate. During the extraction ammonium ions replace potassium ions absorbed on the soil colloids.

Colloid K^+ + CH_3COONH_4 --------→ Colloid NH_4^+ + CH_3COOK

Being the almost similar ionic radii, K^+ is more effectively replaced by NH_4^+. The extract is then filtered and potassium is determined with flame photometer.

The procedure for Potassium measurement is- Take 5 gm soil in 150 mal conical flask or plastic bottle. Add 50 ml of 1 N ammonium acetate solution and shake for 30 minutes on a horizontal shaker. Filter the content through a Whatman No.1 filter paper. Feed the filtrate to the flame photometer and note the reading. Take blank reading also.

The available K_2O value can be calculated from this photometric reading 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 index was calculated.

Results and Discussion:

Table 1 represents the range of Low, Medium and High potassium content as per standard of soil analysis, it is the permissible standard according to Anand Agricultural University.

Experimental values of quality characteristics especially potassium of soil of the Kalol and Godhra Taluka with their fertility index are presented in the Table 2. This table represents the number of samples lies in Low, Medium and High potassium content. The same table represents the calculated values of fertility index for available K_2O of the soil for all these 19 villages. Data presented in Table 2 shows that soils of few villages contain lower potassium and some of the villages have high range of potassium that might be due to the excessive use of fertilizers. Rest of the samples lies in medium range indicates good quality of soil suggest sufficient amount of presence of 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 chemical fertilizers like potash since last 25 to 30 years which contains concentrated amount of potassium and no nitrogen, organic carbon and phosphorus. Due to higher cost and rare availability of phosphatic fertilizers they are less preferred. 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 potassium in their soil. Figure 1 represents the village wise category for Number of samples lies in Low, Medium and High potassium. This clears that how many samples were collected from the village and what is the status of nitrogen level in that sample whether it has Low, Medium or High potassium content. Using these fertility classes nutrient 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 samples falling in low, medium and high classes of potassium status of samples analyzed for a given area. Figure 2 shows the fertility index for available potassium is finally used for recommendation of fertilizers and crop selection.

Conclusion:

This can be concluded from this study that the potassium deficient soil is recommended for potash rich fertilizer. Thus 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 measures. To find out suitability for growing crops and orchard. To find out suitability for irrigation. To study the soil genesis.

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

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

Figure 1: Numbers of samples of all 19 villages of Kalol and Godhra taluka lies in Low, Medium and High available potassium content range

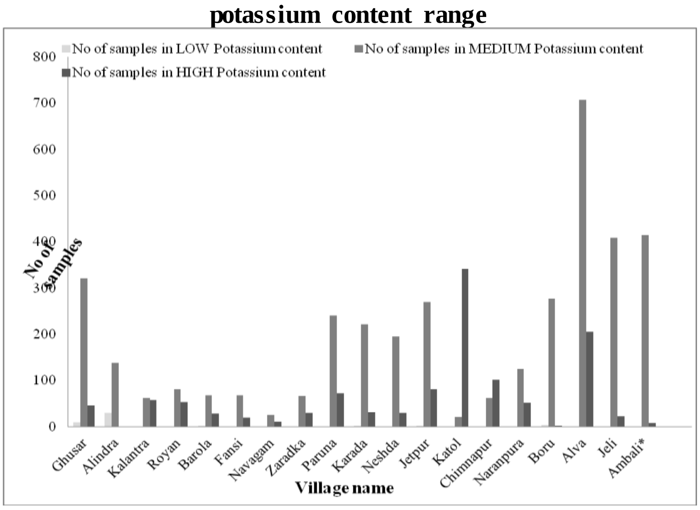

Figure 2: Fertility index for Potassium content of Kalol and Godhra Taluka territory of Panchmahal District

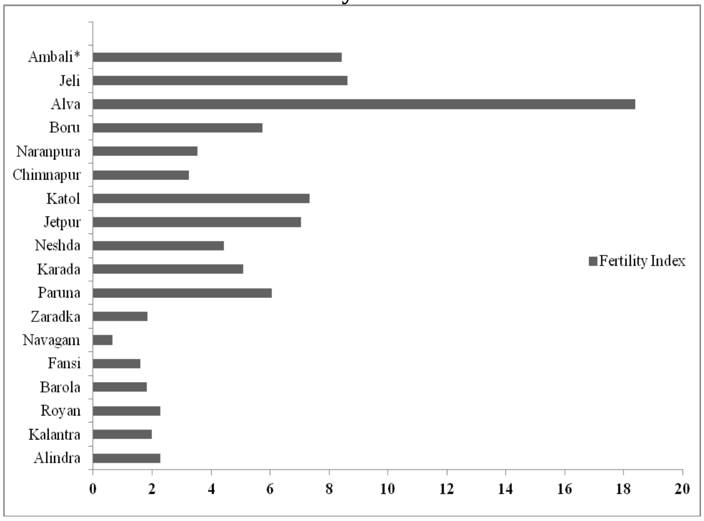

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Table 2: Study of Presence of Potassium Content in the soil of Kalol and Godhra taluka territory
District : Panchmahal TALUKA: 1 to 18 –Kalol and 19- Godhra

Sr No	Village Name	Number of samples	No of samples in LOW Potassium content	No of samples in MEDIUM Potassium content	No of samples in HIGH Potassium content	Fertility Index
1	Ghusar	375	9	321	45	7.86
2	Alindra	168	30	138	0	3.06
3	Kalantra	119	0	62	57	2.95
4	Royan	134	0	81	53	3.21
5	Barola	96	1	67	28	2.19
6	Fansi	87	0	67	20	1.94
7	Navagam	35	0	25	10	0.8
8	Zaradka	95	0	66	29	2.19
9	Paruna	313	0	241	72	6.98
10	Karada	254	2	221	31	5.37
11	Neshda	224	0	195	29	4.77
12	Jetpur	351	1	269	81	7.82
13	Katol	363	0	21	342	10.68
14	Chimnapur	163	0	62	101	4.27
15	Naranpura	176	0	124	52	4.04
16	Boru	282	3	277	2	5.63
17	Alva	912	0	707	205	20.29
18	Jeli	431	0	409	22	8.84
19	Ambali*	422	0	414	8	8.52
		5000				

Table 3: Status of Potash in form of available K_2O in the soil of Panchmahal District

Sr. No	Taluka	Element	Category of potash			Total No of Samples	Fertility Index
			Low	Medium	High		
1	Kalol	Potash	46	3353	1179	4578	2.18
2	Godhra	Potash	0	414	8	422	2.18
3	Panchmahal District	Potash	46	3767	1187	5000	2.23

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