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SOIL ANALYSIS FOR GOOD CROP PRODUCTION

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Abstract

In nature, the environment is pure. However, due to various human activities, the environment becomes polluted and is referred to as environmental pollution. Therefore, in this study, it was more appropriate to focus on the soil sample for its physicochemical analysis of certain parameters. Seventeen representative samples were collected and analysed for their texture and colour, as well as for their pH, EC and Potassium.

Key words

Types of soils, texture, colour, pH (Potential of Hydrogen), EC (Electron Conductivity), k (potassium).

Abbreviations

Soil analysis is a valuable tool for your farm as it determines the inputs required for efficient and economic production. A proper soil test will help ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrients already present in the soil.

INTRODUCTION

Soil is one of the most important natural resources that civilization relies on. Agricultural production depends on the quality of the soil, and as the soil deteriorates, so does the crop yield. Soil quality is not only important for farming, but it's also important for protecting the environment. Soil scientists need ways to measure soil quality changes if they want to develop better methods that will help them understand how to manage the soil and crop system. Soil testing can be used to figure out what nutrient's plants need and to assess the environment. Some soils don't have enough nutrients, but other soils have had enough in the past. Harvesting crops has created reserves of nutrients, so soil testing is now used widely in the world's most advanced crop production areas. It can also help figure out how much fertilizer to use on certain waste materials that contain nutrients or other things that could hurt the environment. Animal manures and other waste materials like industry by products can give plants lots of nutrients, but if you use too much of them on soils designed to get rid of the material quickly and cheaply, you could end up with a lot of nutrients that are harmful to plants, animals, or humans. It's important to use soil testing to figure out how much of certain elements can be harmful to the environment and to know the limits for application rates. Soils are routinely tested for the three primary nutrients: Phosphorous (P), Potassium (K) and Nitrogen (N). In certain areas, soils are routinely tested for additional primary nutrients that crops require in very small quantities: Boron (B), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Zinc (Zn), etc. Soils that receive waste materials are routinely tested for elements like arsenic (As) among others. Nitrogen and phosphorus are two primary plant nutrients that can have a detrimental impact on the environment when used in excess. Excessive nitrogen and phosphorus application to agricultural fields and in-situ nutrient, soil and water conversation practices are leading to an increase in nutrient pollution in many parts of the world. Furthermore, soil testing principles also apply to other elements such as Phosphorus, which is included in the group of relatively low mobility elements in soils (Ca and Cd, respectively). Nitrogen, particularly in the nitrate form, is also included in this group, which includes B, CJ and Sand, among others. Key concepts to consider include the concept of soil testing value, the quality of soil testing, the utilization of soil testing to identify economically optimal nutrient application rates and the use of soil testing in environmental assessments. It is very challenging for the farmers to know what kind of fertilizer would suit their soil. When choosing a fertilizer, they need to consider the needs of their crops and the properties of the soil. The primary purpose of a soil-testing program is to provide farmers with a service that result in improved and more cost-effective fertilizer use and improved soil management techniques for increased agricultural output. It is not possible to achieve high crop yields without the application of adequate fertilizers to address existing deficiencies. Fertilizer use is an important part of any program designed to increase agricultural production. In such a program, farmers will need to use increasing amounts of fertilizers to reach the desired yield levels. The amount and types of fertilizers needed vary from crop to crop, and even from field to field, depending on the soil. Using fertilizers without soil testing is like taking medication without first consulting a doctor to determine what is needed. Fertilizers increase yields and farmers know this. But are they applying the right amount of the right type of fertilizer at the right time in the right place to make maximum profit? Without fertilizer recommendations based on soil testing, a farmer may apply too much of a necessary plant food element and not enough of another element that is the main factor inhibiting plant growth. Not only does this lead to an inefficient use of fertilizer, but in some instances, crop yields may decrease due to improper kinds or amounts of fertilizers. A soil testing laboratory's fertilizers recommendation is based on thorough soil analysis and current agronomic knowledge of the crop, thus representing the majority of scientific data available for the purpose of fertilizing the crop in the field. Each soil-specific recommendation is based on the results of these precise analyses, previous crop data in the specific soil areas, and the farmer’s management practices. Soil testing with the fertilizer recommendation is the real connection between agronomics research and the practical application of agronomics to the farmers’ fields. However; soil testing isn’t a goal in itself. It’s a tool. A farmer who only follows the recommendations of a soil test is not guaranteed a good crop. A good crop is the result of good management practices, including proper tillage, effective water management, quality seed, and appropriate plant protection measures. Soil testing is important and is the first step in achieving high yields and maximizing the return on your fertilizer investment. Soil is composed of a combination of minerals and organic matter that is deposited on the surface of the earth. Potassium plays an essential role in the development of a plant. The mineral component of soil is classified into three particle size classes: sand, silt, and clay. Additionally, there are other minerals that are essential for the growth of plants and industry, such as potassium (K), calcium, and iron (Fe). Consequently, any alteration in the potassium content of soil will have a direct impact on the plant growth. Potassium helps protect plants from disease by making them stronger, making the cuticle (the layer on the leaves) thicker, reducing the risk of water loss, controlling the pressure inside the plant so it doesn't wilt, and increasing the size, taste, and growth of the fruit. Potassium is found in soil in three different forms; trapped between the clay layers (not very accessible), adsorbed (changeable) on the surface of the soil colloids (changeable), or in the soil solution (changeable). The amount of potassium available for maximum crop yield depends on the nature of the clay mineral in the parent soil material (some minerals contain more potassium than others), and its ability to resist weathering. Potassium isn't usually seen as a problem in Kansas surface water, and it's pretty common in most Kansas soil. But there are times when low K levels can stop your crop from growing, and too much K in the soil can stop your plants from taking in other nutrients like magnesium or calcium. So, keep an eye on your farm's K levels to make sure they're good for your crop, but not too high.

TYPES OF SOILS

The following are the main soil types in India:

Soil types in India are as follows:

1. ALLUVIAL SOIL
2. BLACK COTTON SOIL
3. RED SOIL
4. LATERITE SOIL
5. MOUNTAINOUS OR FOREST SOIL
6. ARID OR DESERT SOIL
7. SALINE AND ALKALINE SOIL
8. PEATY AND MARSHY SOIL

1. ALLUVIAL SOIL

These soils are found along rivers and are representative of the soil material that has been deposited during flood events. These soils are typically very fertile, but many of them have low nitrogen levels, humus levels and phosphorus levels.

2. BLACKCOTTONSOIL

These are mostly clay soils and make deep cracks during the dry season. You may notice an accumulation of lime at different depths. These are called "Black cotton soils" because they are dark brown in colour and suitable for growing cotton. They are also called "Indian regurs". They are low in nitrogen, phosphorus and high in organic matter, rich in calcium, potassium and magnesium.

3. RED SOIL

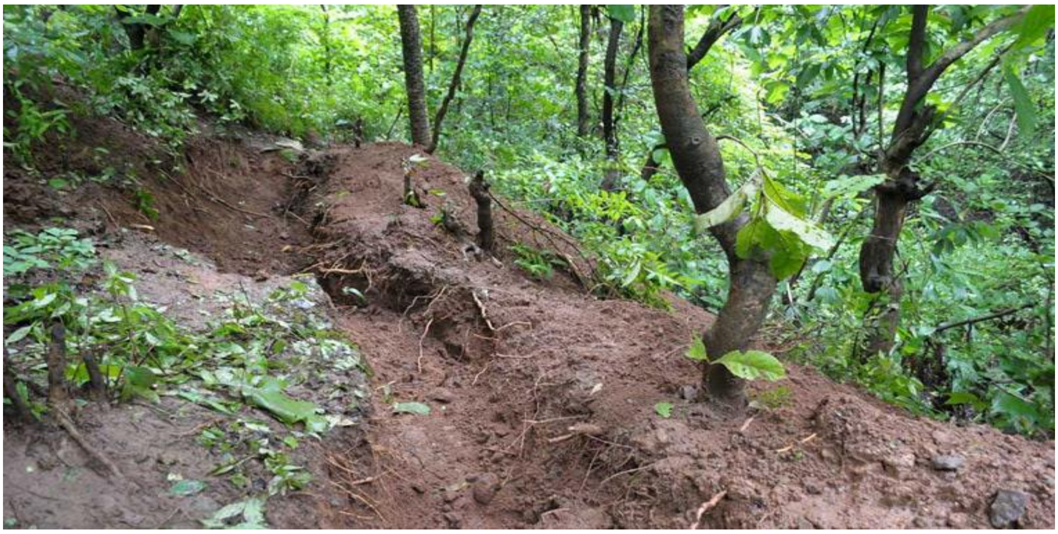
Red soil is a soil type that develops in warm, moist conditions under deciduous forest or mixed forest. Red soil is characterized by the presence of thin, organic and organic minerals on top of a yellow-brown, leaded, alluvial red layer.

4. LATERITE SOIL

Their soils are reddish-to-reddish yellow in colour and contain low levels of N.P.K lime and magnesium. They are formed in sites with high rainfall with alternating dry and wet periods due to heavy rainfall. Due to the excessive leaching of soil colloids and soil silica, the soils are porous.

5. MOUNTAINOUS OR FOREST SOIL

These soils are found at both high and low elevations where the rainfall is high enough to support trees. They are extremely shallow, steep, and stony soils that are not suitable for field crops. They serve a very important function by supplying forest producers with timber and fuel.



6. ARID OR DESERT SOIL

These soils are mostly sandy and occur in low rainfall areas. They are rich in soluble salts but low in nitrogen, organic matter and high in pH. They are relatively fertile and are often exposed to wind erosion.

7. SALINE AND ALKALINE SOIL

These soils are found in slightly higher rainfall areas than desert soils. They have white discoloration of calcium, magnesium and sodium salts on the surface. They have poor drainage and are sterile.

8. PEATY AND MARSHY SOIL

These soils are black in colour, heavy and very acidic. When drained and properly fertilized, they yield good quality rice.

OBJECTIVES OF SOIL TESTING

- In order to determine the level of fertility of a soil in order to provide an indicator of the availability or supply of nutrients in the soil.
- Figuring out how likely it is that you'll make money from using lime and fertilizer.
- To give you an idea of how much lime and fertilizer you should use.
- Soil test summaries can help you figure out how fertile a soil is on an area-by-area basis.
- These summaries are useful for the development of farm level programmers as well as nutrient manage programmers.

MATERIALS AND METHODOLOGY

SOIL TESTING SAMPLING

Soil sampling is really important for getting a representative sample of the field for the next step in making fertilizer recommendations based on soil test results. It's really important because only a tiny fraction of the huge amount of soil - 22.4 lakhs kilograms up to 15 cm in a hectare - is actually used in the lab for analysis. So, if you make a small mistake or something goes wrong during the sampling process, it can be magnified or not reported at all. So, when you're taking soil samples, make sure to think about the following things.

- The area needs to be represented correctly in the sample.
- A field is only considered to be a single unit if it is homogeneous in all aspects.
- The shape, color, growth and management of the crop should be varied.
- It is necessary to collect a distinct set of composite samples from each of these areas to be taken into consideration.

A. TIME OF SAMPLING

- Sample collection is most effective during the summer months when there is no harvest.
- Under high-intensity growing conditions, sampling should be conducted annually, with sampling once every three years.
- If you need to take samples during the growing season, you can take them between two rows.
- It is essential to sample at similar.

B. PLACES TO BE AVOIDED IN THE FIELD WHILE SAMPLING

Recently fertilized plots, bunds, channels, marshy tracks and spots near trees, wells, compost pits or other non-representative locations, must be carefully avoided during sampling.

C. TOOLS USED IN SAMPLING

I. Soil tube (auger)

II. Screw type auger

III. Post-hole auger

IV. Spade and Shovel

V. Khurpi (a common gardening hand tool)

D. NUMBER OF PLACES TO BE SAMPLED IN A GIVEN AREA AND DEPTH OF SAMPLING

I. Field Crops

- The size of the sample should be 0.15cm, i.e. the plough layer should be at least 10-15 well-distributed random spots from every unit of root over 2-4 hectares (5 to 10acres).
- In the case of deep-rooted crops or long-lived crops such as sugarcane, sampling must be obtained from various depths/layers depending on the requirements.
- In case of saline – alkali soils, salt crusts.
- Typically, a soil sample can be taken from a depth of 0 to 15 cm.

II. Orchard Crops

- In the case of plantation or fruit crops, samples should be taken for each foot of depth up to six feet at planting time.

E. PRECAUTIONS

- It is essential to take the necessary precautions when handling the soil sample to protect it from contamination. Rusted and old tools should be avoided when sampling for micronutrient analysis.
- It is essential to abstain from any contact with any chemicals, fertilizers, or manures.
- Don't use cotton, jute, or plastic bags that used to have fertilizer, salt, or lime in them.
- It is recommended that soil samples be stored in either a clean cloth bag or a polythene bag.

F. SAMPLING PROCEDURES

- The various stages of collecting representative soil samples from the field and their handing over are outlined in the accompanying data.
- In order to collect a composite sample, it is necessary to identify the sampling units by determining their soil color, slope and crop growth. Each block/unit should be sampled separately, and small portions of soil should be collected up to a depth of 15 cm from 10 to 15 spots in a zig zag fashion, as indicated in each sampling unit. At each selected spot, the litter should be removed from the surface and a 'V' shape pit should be dug up to 15 cm in depth, and a thin, uniform slice of soil should be taken.
- Lower depth tube augers and spades (Khurpi) are the most suitable tools for soft soil and most soil types. Screw type augers are best for hand dry soil and post hole augers are useful for wet soil such as rice field.
- Soil collected in this way from various locations should be carefully mixed and evenly distributed on a clean sheet of cloth or polythene or thick paper. The bulk of the soil should be reduced by half, and approximately 500g of composite sample should be left behind.
- Dry the soil in the shade at room temperature in an air-dried bag with appropriate description and identification marks in a cloth/polythene bag.
- Use a carbon pencil to write a label on the inside and outside of the bag with information about the location and depth of the samples. Then securely tie the bag. You can also attach a tag with information on the outside of the bag as well. Send the sample along with the information sheet to the closest soil testing laboratory.

G. LABELLING

In addition to the survey number, the location, the name of the cultivator, and identification marks, appropriate information on slope, drainage, previous irrigation history, fertilizers, etc., must be provided on a specimen of information sheet to be completed in the appendix. This may be adjusted to reflect local conditions.

SAMPLE COLLECTION:

REGISTRETION OF SAMPLES AT LABORATORY

Once the samples get to the lab, they'll be marked with the date and other important info that's included in the record. The sheet of the sample register is the most valuable permanent record of a soil testing laboratory. All records must be carefully documented in a systematic way.

PROCESSING OF SOIL SAMPLES FOR ANALYSIS

Air – dried soil (after removing large pebbles and gravels etc.) is pounded with a wooden mortar & pestle and passed through a sieve of 2mm. Plant residues, gravel & other foreign matter left on sieve is to be disposed of. If gravel content is high, a similar rate can be made to determine organic carbon. If grinding is required, it passes through a fine mesh sieve (0.2 mm).

SOIL TEST METHODOLIGIES

Soil testing labs usually do a few physical and chemical tests to check out the soil's properties that have a big effect on how productive the soil is and what its fertility status is. They'll also do a qualitative test to see if the soil is free of calcium carbonate, if it is, and if it's neutral or alkaline to see if it can help acid and alkali soils. Different labs use different methods to make fertilizer recommendations for crops.

SOIL TEXTURE

The texture is determined by the rapid feed method, which is when you rub the soil between your fingers and thumb. In this process, you learn how to do it by practicing and comparing it to other samples of the same textural class that have been determined using standard quantitative methods.

STEPS FOR TEXTURE DETERMINATION

- ✓ Mix a small amount of dry soil with water and spread it evenly on a glass/porcelain plate to make a soft ball, then work until still and squeeze out between thumb/fore – finger.

- ✓ You can feel how easy it is for your fingers to stick to the ball, whether it's in the form of soil ribbons, or just crumbles and squeezes etc. The texture can be divided into the following categories:

A. VERY COARSE TEXTURES

Sand: It's very hard, it doesn't make a ball, and it won't stain your finger.

Coarse texture: Very hard, makes a ball, but very easy to smash, lightly stains fingers.

Sandy loam: Moderately rough, makes relatively firm balls that are easy to crush, definitely stains fingers.

B. MEDIUM TEXTURES

Loam: It's not very hard or smooth, it makes a solid ball, but it doesn't make a ribbon, finger noticeable.

Silt loam: Texture: Smooth or sticky, with a buttery texture Forms firm ball Stains: Slightly Forms ribbon with a flaky texture.

C. FINE TEXTURES

Clay loam: Moderate stickiness, slightly gritty texture, forms a medium hard ball on drying, stains ribbons when squeezed, but breaks easily, like silt loam.

D. VERY FINE TEXTURES

Clay: It has a very sticky feel, moulds into a ball that, when dry, cannot be crushed with fingers, leaves a deep stain, and pours out at the right level of moisture into long ribbons.

DETERMINATION OF SOIL REACTION (pH)

Principle:

The pH (Hydrogen Ion Activity) of the Soil-Water System indicates whether the soil reacts with acidity, neutral pH or alkalinity. Because crop growth is affected by both very low and very high pH, proper reclamation measures are necessary. Measurement of pH refers to the electrostatic force or electrostatic potential that is generated between the glass electrode and Calomel electrode when the glass electrode is immersed in the test solution and passed to the galvanometer by means of resistance (Fig.1).

Reagents:

Standard Buffer Solutions: These can be pure water or other reagents with an expected pH value of 4.0 – 7.0 – 9.2. If you are using buffer tablets (which are available commercially), you will need to dissolve a single piece in freshly prepared, double distilled water, and make up to 100ml. A fresh buffer should be prepared every few days, as the solutions don't last very long, even when stopped.

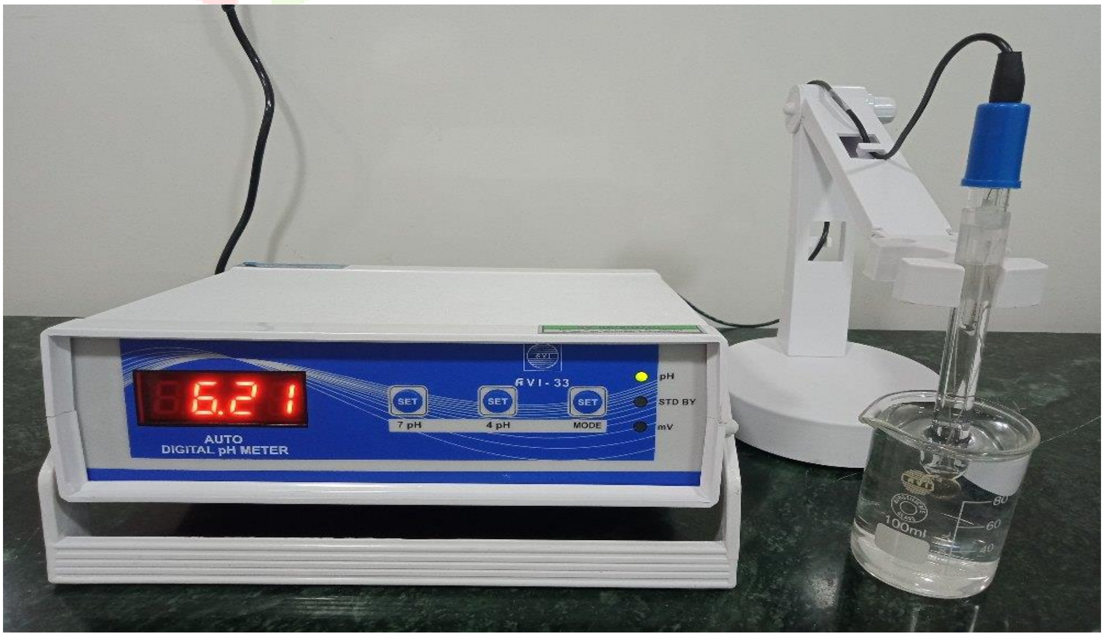


Figure 1: pH METER

pH IN SOIL-WATERSUSPESION

- Take20gmsof soil in a 100 ml beaker.
- Add 40ml of distilled water and stir the suspension at regular intervals for about 30 minutes.
- Carefully insert the combined electrodes in the suspension and measure.

Note:

- The suspension must be stirred. Well just before immersing the electrodes and readings are taken.
- Before each determination the electrodes mist be washed a jet of distilled water and dried with the help of a piece of filter paper or tissue paper.

DETERMINATON OF ELECTRON CONDUCTIVITY (EC):

Principle:

Due to the fact that ions are the transmitters of electricity, the level of electrical conductivity of a soil water system increases with the amount of soluble salts present. Consequently, the measure of electrical conductivity indicated will represent the level of soluble salts present in soil at any given temperature. The conductivity meter operates according to ohms law, which is the difference between the electrical potential in volts and the strength of current in amps. Solutions provide some resistance for the flow of current due to the presence of ions. Thus, conductance is the inverse of resistance (Fig.2).

Reagent:

Standard Potassium Chloride Solution (0lN): 0.7456 g dry potassium chloride (A R grade) is dissolved in freshly prepared, double distilled water and made up to one liter at 25°C. Potassium chloride has an electrical conductivity = $1411.8*10^{-6}$(0.0014118) Mohs/cm or $1.41 dSm^{-1}$

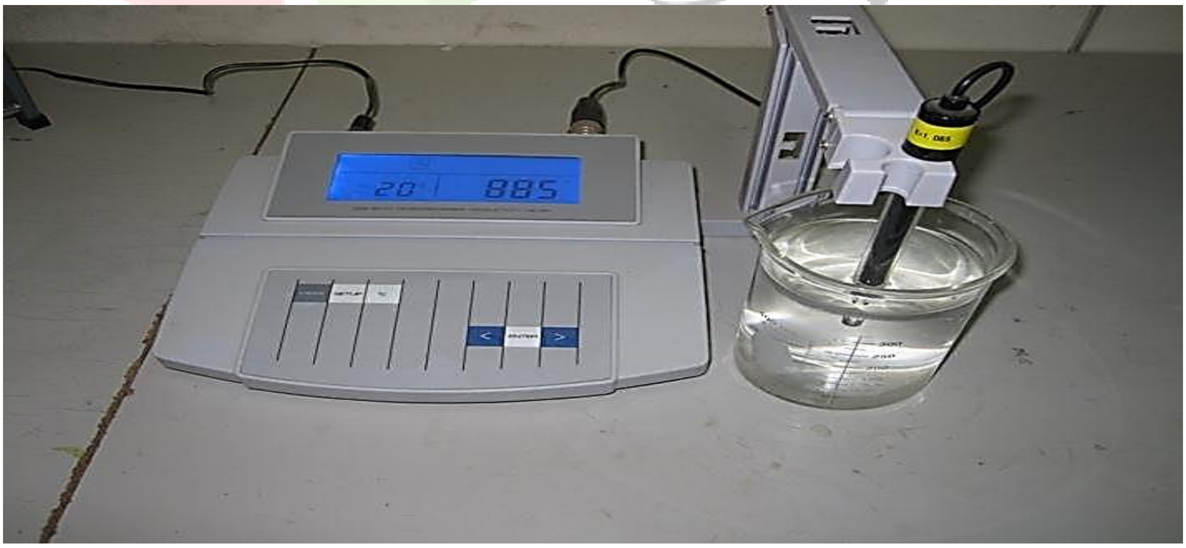


Figure2: EC METER

Procedure:

- A 20gm soil sample should be weighed and one 100 ml beaker should be taken.
- Add 40ml of distilled water to the mixture and stir continuously for one hour.
- Allow to stand until clear supernatant liquid is obtained alternatively, the clear extract after pH determination, can be also used for electrical conductivity.
- The conductivity bridge can be determined with the aid of a standardized KCL solution, and the cell constant can be determined.
- The conductivity meter is used to determine the electron conductivity of a supernatant fluid. The temperature of the solution is typically 25°C, and the knob is adjusted for this purpose.

Note:

Even if your scale is labeled directly in dSm^{-1} it, you'll still need to test and calibrate it using the KCI. You should test and calibrate your instrument once a week.

ESTIMATION OF AVAILABLE POTASSIUM:

Principle:

To extract potassium from the soil, neutral normal ammonium acetate solution is used. The ammonia ions are replaced by K+ ions which are absorbed on the soil and collide with the soil solution. These K+ ions enter the soil solution. The concentration of the K+ ions present in the filtrate is determined by feeding it directly into the flame photometer. The flame photometer reads the intensity of the K ion present in the sample.

Instruments:

A Flame photometer, a Mechanical Shaker and a pH meter.

Reagents:

- To Make Neutral Normal Ammonium Acetate, Dissolve 15 ug of Ammonia Acetate in 500 ml of distilled water, make up to 2 litres, and adjust pH to 7.0 using acetic acid or ammonium solution.
- Potassium chloride solutions: Dissolve 1.9707 gm of AR grade potassium chloride (dried at 600C for 1hr) in distilled water and make upto1litre to give 1000 ppm K stock solution.

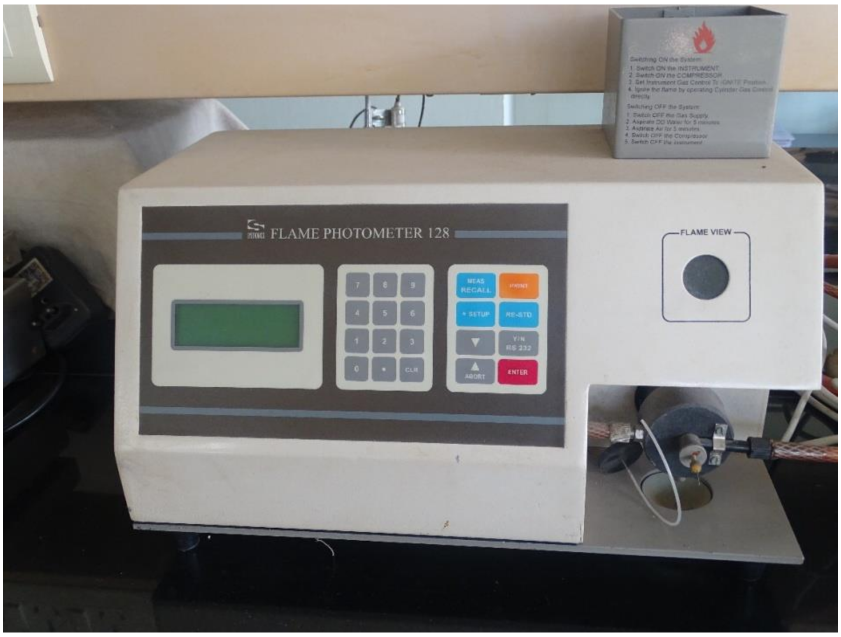


Figure 3: FLAME PHOTOMETER

Procedure:

- Measure 5 grams of soil into a 100 ml conical flask.
- Add 25 ml of neutral normal ammonium acetate solution and shake for 5 mins.
- Filter it right away with a dry filter papers (what man No l) and measure the concentration of potassium in the extract using a flame photometer after necessary setting and calibration of instrument.

Standard curve for potassium:

- From the 1000 ppm K stock solution, take 1,2,3,4,5 and 6 ml in 100 ml volumetric flasks and dilute with ammonium acetate solution to give 10 to 60 ppm of K.

- After placing appropriate filter and adjusting the gas, record the flame photometer reading by setting the blank to zero and 60 ppm K to 1000 reading. The curve is obtained by plotting different concentration (10,20,30,40,50 and 60 ppm) of K on horizontal axis against the flame photometer readings on the vertical axis. Any fluctuation in gas or air pressure does not allow steady reading in the meter and must be taken care of.

Calculation:

Available K_2O (kg ha^{-1}) =

$$R \times \frac{Volume\ of\ the\ extract\ (25)}{Weight\ of\ the\ soil\ taken\ (5)} \times \frac{2.24 \times 10^6}{10^6} \times 1.2$$

Where R = ppm of K in the extract

= R × 13.44

Available K_2O (kg/acre) = R × 5.44

Note:

- If the reading of the extract exceeds100 it is better to dilute and take the reading again multiply the concentration with dilution factor.
- The filtrate must be transparent in order to prevent the choking of the capillary tube of a flame photometer, which occurs frequently.
- Potassium standard should be prepared trash after every 2 – 3 weeks.

Result and discussion:

Seventeen soil samples (Table1) collected from the study areas were analyzed as per parameters. The soil quality results are mentioned in table from the result obtained following observations can be made.

TABLE 1: STUDY OF PRESENCE OF POTASSIUM CONTENT IN THE SOIL SAMPLES OF PEDAPUDI MANDAL.

S. No	MANDAL	VILLAGE	TEXTURE	COLOUR	Ph	EC ds/m	K READING	AVAILABLE POTASSIUM (K) kg/ha	RATING
1	PEDAPUDI	A P TRAYAM	SL	BR	7.4	0.41	31.02	204.422	MEDIUM
2	PEDAPUDI	CHINTHAPALLI	CL	BR	6.56	0.83	51.01	336.156	HIGH
3	PEDAPUDI	DOMADA	CL	BL	6.78	0.9	40.95	269.861	HIGH
4	PEDAPUDI	G.MAMIDADA	SCL	BR	8.24	1.68	200	1318	HIGH
5	PEDAPUDI	GANDREDU	CL	BR	8.65	0.18	34.26	225.773	HIGH
6	PEDAPUDI	KAIKAVOLU	CL	BR	7.5	0.92	20.87	137.533	HIGH
7	PEDAPUDI	KANDREGULA	SCL	BR	7.7	3.4	200	1318	HIGH
8	PEDAPUDI	KARAKUDURU	CL	BL	8.15	2.5	95.07	626.511	HIGH
9	PEDAPUDI	KUMARAPRIYAM	CL	BR	8.3	0.95	106.79	703.746	HIGH
10	PEDAPUDI	PEDAPUDI	CL	BR	8.8	0.57	60.77	400.474	HIGH
11	PEDAPUDI	PEDDADA	CL	BR	8.46	1.6	101.1	666.249	HIGH
12	PEDAPUDI	PUTTAKONDA	CL	BL	6..4	0.7	71.82	473.294	HIGH
13	PEDAPUDI	PYNA	CL	BR	7.9	1.83	200	1318	HIGH

14	PEDAPUDI	RAJUPALEM	CL	BR	7.9	0.48	70.68	465.781	HIGH
15	PEDAPUDI	SAHAPURAM	CL	BR	8.1	3.5	93.38	615.374	HIGH
16	PEDAPUDI	SAMPARA	CL	BL	7.84	1	200	1318	HIGH
17	PEDAPUDI	VENDRA	CL	BR	8.8	0.54	69.07	455.171	HIGH

Based on the soil analysis, the pH indicates whether the soil is acidic or alkaline. The percentage of hydrogen in a soil colloid determines the pH, which in turn determines the Acidity of the soil and/or its alkalinity. It is extremely important to understand this in the context of soil analysis. If the soil is highly acidic, nutrient availability will be adversely affected. Reclamation in acidic soils, usually by liming, is used to maintain the soil pH within the optimal range necessary to ensure adequate nutrient availability. In alkali soils the reclamation (pH in water suspension exceeding 8.5) requires gypsum.

Table 1 shows the range of low mid and high potassium content according to the standard. In the case of soil analysis, it is the acceptable standard according to the soil test laboratory. The above values are used to establish the category of soil according to which the soil sample has low, middle or high potassium content. Table 2 shows the experimental values of quality characteristics specific to available potassium of soil from the Pedapudi Mandal with their fertility index. Table 2 shows the number of samples lying in low, middle and high potassium content.

TABLE 2:

Range of low, medium and high category of available potassium.

CATEGORY	**TOTAL AVAILABLE (K)**
Low	125 kg/ha
Medium	125-250 kg/ha
High	250 kg/ha

The soil rating is determined by the amount of potassium present in the soil.

- Low: Available potassium (K_2O) less than 125kg/ha
- Medium: Available potassium (K_2O) between 125 and 250kg/ha
- High: Available potassium (K_2O) more than 250 kg/ha

The same table represents the calculated values of available potassium (K) kg/ha of the soil for 17 villages. Data presented in table 2 shows that soil of one village contain medium available potassium and remaining 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 lies samples lies in the medium range indicates good quality of soil suggest sufficient amount of presence of available potassium and hence no need of nutrient supplements to the soil. Results are in tune with farming practices followed. By farmers of this region most of the farmers are using compost and chemical fertilizers, urea and phosphatic fertilizers only.

CONCLUSION

The content of total reserve and exchangeable forms of potassium depends on soil texture, soil pH and soil layer. The most suitable form is potassium soluble in water.

- The low range for a nutrient crop will be deficient and can be improved either in quality or quality by the supplementation of the deficient nutrient. If available potassium is low increase the dose of fertilizer by 50%.
- For most crops, the medium range is generally considered to be sufficient.
- This high range is also sufficient for crop development and yield and may be required for heavy feed crops. If soil nutrients are abundant, reduce the fertilizer dose by 25%.
- In conclusion, the purpose of this study was to contribute to the literature on the significance of nutrients and provide guidance on the appropriate fertilizer to be used by farmers in the sampled areas.

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