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Study of Soil fertility: An Analytical approach

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ABSTRACT
Soil is an ecosystem that can be managed to provide nutrients for plant growth, absorb and holdrain water for use during dryer periods, filter and buffer potential pollutants for leaving ourfields, serves as a firm foundation for agricultural activities and provide habitat for soil microbesto flourish and diversity to keep the ecosystem running smoothly. Native material soil wasevaluated for Physico-Chemical property and for nutrients as a requirement for improvement ofsoil fertility. Soil sample were randomly collected from two sample sites which are Gwalior and

Jhansi and brought to laboratory to determine the ph., Organic Carbons, Water holding capacity,Bulk density, Total Dissolve Solid, Specific Gravity, Alkalinity, Moisture contents, etc. Thevarious results obtained from this studied are suggested that pH is within the range in all sample.Bulk density and Organic Carbon revealed healthy soil, among nutrients parameters.

KEYWORDS
Soil, Fertility, Organic carbon, Total available potassium, Water holding capacity, Physico chemical parameters.

INTRODUCTION:
Soil may be defined as a thin layer of earth's crust which serves as a natural medium for thegrowth of plants. It is the unconsolidated mineral matter that has been subjected to, andinfluenced by genetic and environmental factors - parent material, climate, organisms andtopography all acting over a period of time. Soil differs from the parent material in themorphological, physical, chemical and biological properties. Also, soils differ among themselvesin some or all the properties, depending on the differences in the genetic and environmentalfactors. The horizons (layers) in the soil profile which may vary in thickness may bedistinguished from morphological characteristics which include colour, texture, structure etc.Whitney in their research defined Soil as a natural body of mineral and organic constituentsdifferentiated into horizons usually unconsolidated, of variable depth which differs amongthemselves as well as from the underlying parent material in morphology, physical makeup,chemical properties and composition and biological characteristics (Whitney, 1982).Generally,the profile consists of three mineral horizons -A, B and C. The A horizon may consist of subhorizonsricher in organic matter intricately mixed with mineral matter. Horizon B is below A and shows dominance of clay, iron, aluminium and humus alone or in combination. The Chorizon excludes the bedrock from which A and B horizon are presumed to have been formed.Thus some soils are red, some are black; some are deep and some are shallow; some are coarse- texturedand some are fine-textured (Franzluebbers et al. 1999). They serve in varying degree asa reservoir of nutrients and water for crops, provide mechanical anchorage and favourable tilth.

According to Soil Science Society of America soli is defined as, "The unconsolidated mineralmatter on the surface of the earth that has been subjected to and influenced by genetic andenvironmental factors of parent material, climate (including moisture and temperature effects),macro and microorganisms and topography, all affecting over a period of time and producing aproduct, that is "SOIL" that differs from the material from which it is derived in many, physical,chemical, biological and morphological properties and characteristics"

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(SSSA, 2015).Thecomponents of soils are mineral material, organic matter, water and air, the proportions of whichvary and which together form a system for plant growth; hence the need to study the soils inperspective. The quality and scarcity of soil has always affected human civilization with aburgeoning human population and dwindling resources for agricultural input, the wise use of soil

will be ever more critical in the years to come. Soil is a mixture of broken rocks and minerals,living organisms and decaying organic matter called humus .humus is dark, soft and rich innutrients. Soil also includes air and water.(Franzluebbers, 2002). Organisms in the soil need airand water to survive, having these essential material air, water and organic matter makes itpossible for plants, bacteria, fungi and small animals like earthworms and insects to live in soil.Organisms in the soil need air and water to survive having these essential material air, water andorganic matter makes it possible for plants, bacteria, fungi and small animals like earthwormsand insects to live in soil. A study of the soil profile is important from crop husbandry point ofview, since it reveals the surface and the sub-surface characteristic and qualities namely, depth,texture, structure, drainage conditions and soil moisture relationship which directly affect theplant growth.

METHOD AND MATERIAL :

A study of soil profile supplemented by physical, chemical and biological properties of the soilwill give full picture of soil fertility and productivity. Physical properties of the soil includewater holding capacity, aeration, plasticity, texture, structure, density and colour etc. Chemicalproperties refer to the mineralogical composition and the content of the type of mineral such asKaolinite, illite and montmorillonite, base saturation, humus and organic matter content. Thebiological property refer to a content of extent and types of microbes in the soil which includebacteria, fungi, worms and insects (DAC, 2011).Soil fertility is; "*the capacity of a soil to supplyplant nutrients in adequate amounts to facilitate optimum growth and obtaining the yieldpotential of a crop*". Several elements take part in the growth and development of plants, andthose absorbed from the soil are generally known as plant nutrients. Besides these, the planttakes up carbon, oxygen and hydrogen, either from the air or from the water absorbed by roots.In all, 16 elements have been identified and are established to be essential for plant growth.There are carbon (C), hydrogen (H), Oxygen (O), nitrogen (N), phosphorus(P), potassium (K),calcium(Ca), magnesium (Mg), iron (Fe), sulphur(S), zinc (Zn), manganese (Mn), copper (Cu),boron (B), molybdenum (Mo), and chlorine(Cl). These elements serve as raw materials forgrowth and development of plants, and formation of fruits and seeds. Although plants absorb alarge number of elements, all of them are not essential for the growth of crops. The elements areabsorbed became they happen to be in the soil solution and those taking active part in the growthand developmental processes are called the essential ones. Some of these are required in largeamounts and some in traces. These are classified as major and micro nutrients, and are furtherclassified as follow:

Table-1: Elements of fertile soil

Major nutrients	Group I	Carbon, hydrogen and oxygen
	Group II	Nitrogen, phosphorus, potassium
		Calcium, magnesium, sulphur
Micro nutrients		Iron, manganese, boron, zinc, copper, molybdenum and chlorine

STUDY AREA :

The present study was conducted at the two places having same population approx.The first site is Gwalior which is the fourth largest city of Madhya Pradesh with a population of 20 lakhs asper the 2011 census. Gwalior is situated at 26.12°N latitude and 78.18° E longitudes in the Indo-Gangetic plains. Another site of study is Jhansi, Uttar Pradesh. Jhansi is situated 24° 11' N to 25°57' N latitude and 78° 10' E to 79° 23' E

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longitude in the semiarid region of the country (Census of India, 2011).Table-2 shows the comparative data of population of two city.

Table-2: Populative study (Census of India, 2011)

S. No.	Population	Jhansi	Gwalior
1.	Total Souls	1,998,603	2,032,036
2.	Male Souls	1,057,436	1,090,327
3.	Female Souls	941,167	941,709
4.	Urban Souls	833,484	1,273,792
5.	Rural Souls	1,165,119	758,244

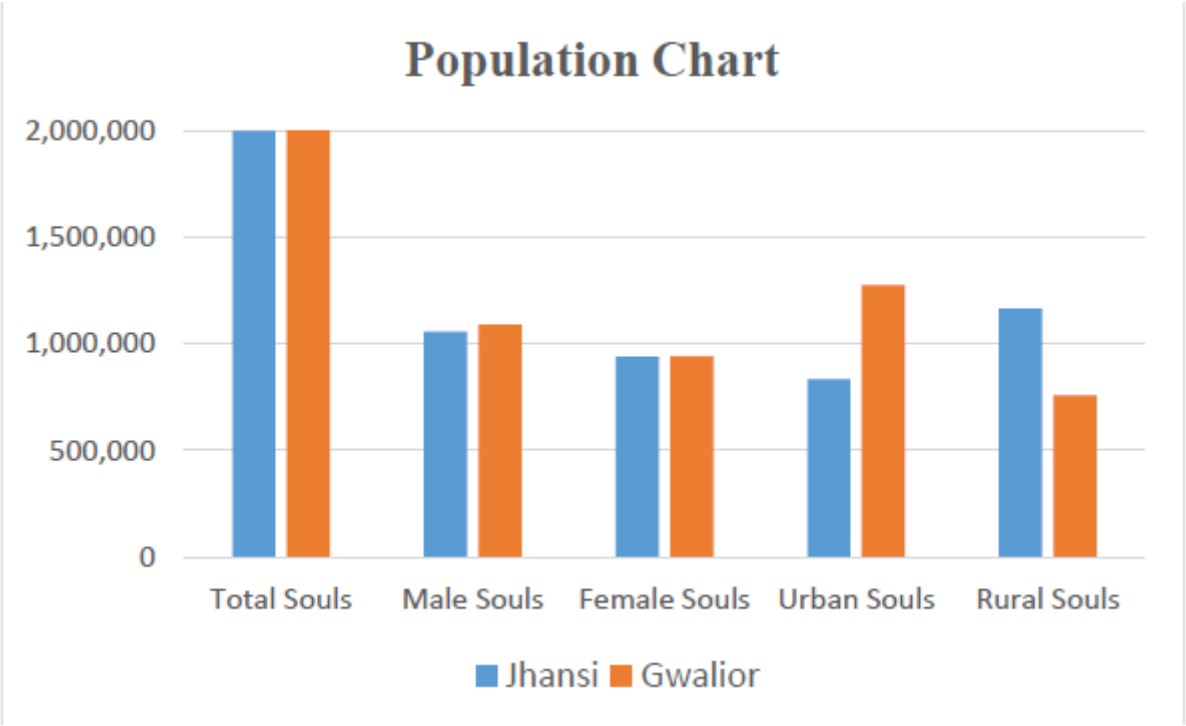

Fig-1: Populative study

The prime objective of the present study is test the fertility of soil. In this concern soil testing isnecessary. Soil testing refers to the chemical analysis of soils and is well recognized as ascientific means for quick characterization of the fertility status of soils and predicting thenutrient requirement of crops. It also includes testing of soils for other properties like texture,structure, pH, cation exchange capacity, water holding capacity, electrical conductivity etc. Oneof the objectives of soil tests is to sort out the nutrient deficient areas from non-deficient ones.This information is important for determining whether the soils could supply adequate nutrientsfor optimum crop production or not. Soil testing helps in understanding the inherent fertilitystatus of the soils. On the basis of extensive literature review the objectives of the study is asfollows:

1. Grouping of soil into classes relative to the nutrient level.
2. Predicating the probability of getting a profitable response to the fertilizers.
3. To provide the basis for fertilizer recommendation.

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For efficient soil testing and better results, the soil testing programme can be divided intodifferent phases viz.

1. Collection and preparation of soil sample.
2. Extraction of available nutrients and their determination.
3. Calibration and interpretation of results.
4. Recommendation of fertilizers based on soil testing results.

RESULT:

To test the fertility of soil and to find out the ingredient of soil which helps to improve the soilquality and fertility, tests which conducted are as follows:

1. Field texture :

S.No	Sample field	Texture
1.	Agriculture field of Jhansi (U.P)	Sand
2.	Agriculture field of Gwalior (M.P)	Loam

The soil texture of given field are sand and loam.

2. Temperature Gradient :

S.No	Sample of given area	Temperature
1.	Agriculture field of Jhansi (U.P)	300C
2.	Agriculture field of Gwalior (M.P)	270C

The temperature of given field is 300 c and 270c.

3. pH value :

The pH of taken soil sample are given -

S.No	Samples of given area	pH value
1.	Agriculture field of Jhansi (U.P)	7.5
2.	Agriculture field of Gwalior (M.P)	8.0

The pHs of taken samples are 7.5, 8.0.so they are alkaline and basic.

4. Electrical conductivity :

S.No	Sample field	Electrical conductivity
1.	Agriculture field of Jhansi (U.P)	1.227ds/m
2.	Agriculture field of Gwalior (M.P)	1.250ds/m

The conductivity of soil sample of taken area are 1.227 ds/m and 1.250ds/m.

5. Carbonate and Nitrate percentage in soil :

Sample No-1: Agriculture field of Jhansi

S.No	Experiment	Carbonate	Nitrate
1.	A pinch of soil +dilute HCL	Present	Absent
2.	A pinch of soil +sol of diphenylamine in conc. H2So4	Present	Absent
3.	A pinch of soil+ Ammonium thiocynate +H2O2	Absent	Present

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Sample No-2: Agriculture field of Gwalior

S.No	Experiment	Carbonate	Nitrate
1.	A pinch of soil +dilute HCL	Present	Absent
2.	A pinch of soil +sol of diphenylamine in conc. H2So4	Absent	Present
3.	A pinch of soil+ Ammonium thiocynate +H2O2	Present	Absent

6. Moisture Contents

Sample 1 : Agriculture field of Jhansi

1. Observation

a. Weight of empty moisture can (X) =46.48 gram
b. Weight of moisture can+ moist soil (Y) =46.48+50 (gram)=96.48 gram
c. Weight of moisture can+ oven dry soil (Z)=95.48gram

2. Calculations

a. Moisture content in soil =(Y-Z) =(96.48-95.48) =1.00gm
b. Moisture of oven dry soil = (Z-X) = (95.48-46.48)=49 gm
c. Percentage of moisture in soil =(Y-Z)/(Z-X) x100
= (1)/ (49) x100 =2.04%

The moisture of given agriculture field of Jhansi is 2.04%

Sample 2: Agriculture field of Gwalior

1. Observation

a. Weight of empty moisture can (X) =46.26 gram

b. Weight of moisture can+ moist soil (Y) =46.26 + 50 (gram) =96.26gram

c. Weight of moisture can+ oven dry soil (Z) = 94.97 gram

2. Calculations

a. Moisture content in soil =(Y-Z) =(96.26 -94.97) = 1.29 gm

b. Moisture of oven dry soil = (Z-X) = (94.97-46.26)= 48.71gm

c. Percentage moisture in soil = (Y-Z)/ (Z-X) x100

= (1.29) / (48.71) x 100 =2.64%

The moisture of given agriculture field of Gwalior is 2.64%

7. Water Holding Capacity

Sample 1 : Agriculture field of Jhansi

a. Weight of keen dish + filter paper (W1) =22.97gm
b. Weight of soil after observation of water (W2) =54.34gm
c. Weight of oven dry soil (W3) =44.25 gm
d. Weight of 5 filter paper (W4) =3.30
e. Average weight of 1 filter paper = 3.30/5 =0.66
f. Percentage of water holding capacity = W2 – W3 – (W4/W3) – W1 x 1oo
= 54.34 - 44.25- 0.66/44.25-22.97 x100
=44.31%

The water holding capacity of given field is 44.31 %.

Sample 2 : Agriculture field of Gwalior

a. Weight of keen dish + filter paper (W1) =24.15gm

b. Weight of soil after observation of water (W2) = 52.15 gm
c. Weight of oven dry soil (W3) =40.39 gm
d. Weight of 5 filter paper (W4) =3.30
e. average weight of 1 filter paper = 3.30/5 =0.66
f. Percentage of water holding capacity = W2 – W3 – (W4/W3) – W1 x 1oo
= 52.15-40.39- 0.66/ 40.39- 24.15 x100
= 68.34%

The field capacity and water holding capacity of the given area is 68.34%

DISCUSSION

The pH value of soil is an important factor for the chemical reactions. Each plant andmicroorganism has its own optimal pH range. The pH value depends on parent material, climateand is strongly affected by the use of fertilizers. The pH of a mixed soil sample is fundamental toany soil assessment but did not give the exact result. Chemical reactions occur in soil microenvironments, where the pH and other conditions may differ greatly from that of the average soilenvironment. The base saturation is the percentage of the total cation exchange capacityoccupied by the basic cations increases, the pH increases.

Electrical conductivity (EC) of soil is a measure of the concentration of ions in solution. It isgenerally used as an indicator of salinity, but where nitrate levels are high and depending on thetime of year and the climatic zone. EC can be an indicator of soil nitrate status. Organic matteranalysis the amount, type, and location of organic matter may be one of the best integratingindicators of many physical, chemical and biological processes. Measurements of organic matterfractions indicate more about soil quality than the measurement of total organic matter. Totalorganic matter is strongly affected by soil texture and climate, and requires decades to changesignificantly in response to most management changes.

The active fractions of organic matter respond much more quickly to management changes. Aswith many soil characteristics, what is being measured is not the same as what is being indicatedabout soil health. This is especially true with regard to organic matter. Analyzing organic matterrequires 23chemical tests but the results are strongly linked to the physical structure andbiological activity of the soil. Soil organic matter is critical for its nutrient and water holdingcapacity as a substrate for microorganisms and in the formation of soil structure. Organic residueon the surface mitigates the impact of rainfall and the movement of water. Soil organic matterincludes all the carbon based materials left behind by plants and animals and produced bymicroorganisms. It ranges from stems and roots from last year's crop to highly decomposedresidue to recombination of organic molecules into unique humic compounds. Some is protectedfrom degradation and persists for centuries. Some is dynamic and repeatedly reformed throughthe work of microorganisms and larger flora and fauna. Each of these materials has a differenteffect on the soil environment depending on its size, location, age, and composition. Forexample, some earthworms only eat surface residues; others eat organic matter in the soil. Largeresidue provides habitat for some organisms and Old humic compounds resist decomposition andare important in binding particles into micro aggregates, and increasing the cation exchangecapacity and water holding capacity of soil. Highly labile compounds are sources of nutrients formicroorganisms and plants.

CONCLUSION

Soil is a natural body consisting of layers of primarily mineral constituents of variablethicknesses, which differ from the parent material in their texture, structure, consistence, color,chemical, physical and biological characteristic. Soil is referred to as regolith or loose rockmaterial .soil is the depth of regolith that influenced by plant roots.

Soil is composed of particles of broken rock that have been altered by mechanical and chemicalprocesses that include weathering and erosion. Soil is altered from its parent rock due to interactions between lithosphere,

hydrosphere, atmosphere and the biosphere. It is a mixture ofmineral and organic constituents that are in solid, gaseous and aqueous states.

Soil forms a structure that is filled with pores spaces and can be thought of as mixture of solids,water, and air. The several productivity factors in the soil becomes a limiting factor. If soil pH isvery high there is no use of adding fertilizer to the crops till excess sodium is removed bygypsum to lower the pH value. Similarly excessive conductance can also lower the efficiency ofapplied fertilizers. For efficient use of nutrients in the soil to test the purity of drinking water andfor the waste water treating.

REFERENCES

1. FranzluebbersA.J., (2002), 'Soil organic matter stratification ratio as an indicator of soilquality'. *Soil & Tillage Research*, Vol 66, pp 95–106
2. Franzluebbers, A.J., Langdale, G.W., Schomberg, H.H., (1999), 'Soil carbon, nitrogen,and aggregation in response to type and frequency of tillage'. *Soil Sci. Soc. Am. J*. Vol63, pp 349–355.
3. Whitney Halstead, (1982), 'A Finding Aid to the Whitney Halstead Papers, 1920 in theArchives of American Art'. *Archives of American Art, Smithsonian Institution.*
4. Franzluebbers, A.J., F.M. Hons, and D.A. Zuberer, (1994), 'Long term changes in soilcarbon and nitrogen pools in wheat Management systems. *Soil Science Society ofAmerica Journal*. 58:1639-1645.
5. Franzluebbers, A.J., D.A. Zuberer, and F.M. Hons (1995), 'Comparison ofmicrobiological methods for evaluating quality and fertility of soil. *Biology and Fertilityof Soils*, 19:135-140.
6. Garlynd, M.J., A.V. Kurakov, D.E. Romig, and R.F. Harris. (1994), 'Descriptive andanalytical characterization of soil quality/health. In: J.W. Doran et al. (eds.) Defining SoilQuality for a Sustainable Environment. *Soil Science Society of America*, Madison, WI,Special Publication 35, pp. 159-168.
7. Granatstein, D. and D.F. Bezdicek (1992), 'The need for a soil quality index: Local andregional perspectives'. *American Journal of Alternative Agriculture*. 7:12-16.
8. Griffiths, B.S., K. Ritz, and R.E. Wheatley. 1994. Nematodes as indicators of enhancedmicrobiological activity in a Scottish organic farming system. *Soil Use and Management*.10:20-24.
9. Soil Science Society of America https://www.soils.org
10. Department of Agriculture and Cooperation http://agricoop.nic.in