Estimation of Essential Nutrients Present in the Soil Samples of Different Region of Kamptee Tahsil (M.S), India.

S. Mondal, R. G. Chaudhary and M. B. Bagade
Department of Chemistry, S. K. Porwal College Kamptee,
Dist. Nagpur-441001, M.S. (INDIA)
mbagade05@gmail.com

Abstract:

Soil nutrients are essential for crop growth. Spatial variability of nutrient can be occurred in various scales, between region, field or within field especially in variation in soil properties. Precision farming is a technology available for sustainable agriculture. This technology enables farm management is based on small-scale spatial variability of soil and crop parameters in the field. The objectives of this study are to determine and map soil content nutrient especially Nitrogen, Phosphorus and Potassium (NPK) variability in a Kamptee Tahsil region using geostatistical technique. The NPK analyzed and mapped to quantify the level of spatial nutrient available and to predict nutrient values at samples location. Nutrient map also show that the area has sufficient of NPK or not. This study reveals the potential and ability of geostatistical in determining and mapping soil nutrient content in KampteeTahasil region.

Keywords*: Soil nutrient, Nitrogen, Phosphorus and Potassium (NPK), Soil properties, geostatistical technique, Crop parameters.*

Introduction:

Soil may be defined as a thin layer of earth's crust which serves as a natural medium for the growth of plants. It is the unconsolidated mineral matter that has been subjected to, and influenced by genetic and environmental factors – parent material, climate, organisms and topography all acting over a period of time. Soil differs from the parent material in the morphological, physical, chemical and biological properties. Also, soils differ among themselves in some or all the properties, depending on the differences in the genetic and environmental factors. Thus some soils are red, some are black; some are deep and some are shallow; some are coarse-textured and some are fine-textured. They serve in varying degree as a reservoir of nutrients and water for crops, provide mechanical anchorage and favorable tilts. The components of soils are mineral material, organic matter, water and air, the proportions of which vary and which together form a system for plant growth; hence the need to study the soils in perspective. Physical properties of the soil include water holding capacity, aeration, plasticity, texture, structure, density and color etc. Chemical properties refer to the mineralogical composition and the content of the type of mineral such as Kaolinite, illite and montmorillonite, base saturation, humus and organic matter content. The biological property refers to a content of extent and types of microbes in the soil which include bacteria, fungi, worms and insects.

Furthermore NPK map used to apply fertilizer to an area, where less NPK content for efficient fertilizer management. pH of soil is increases the knowledge of what nutrients are especially available in our soil .It reduces the environmental impacts due to soil amendments. It increases the efficiency of resource inputs such as fertilizers and water .It helps to predict the nutritional values needed for crop production. It helps to evaluate the fertility status of soils of a country or a state or a district. And other parameter of soil sample that is electrical conductivity. The field-scale application of apparent soil electrical conductivity to agriculture has its origin in the measurement of soil salinity. Apparent soil electrical conductivity is influenced by a combination of physico-chemical properties including soluble salts, clay content and mineralogy soil water content, bulk density, organic matter and soil temperature. Consequently measurements of electrical conductivity use at field scales to map the spatial variation of several seraphic properties: soil salinity, clay content or depth to clay-rich layers, soil water content, the depth of flood deposited sands and organic matter. In addition, electrical conductivity use at field scales

to determine a variety of anthropogenic properties: leaching fraction, irrigation and drainage patterns, and compaction patterns due to farm machinery.

Material and Methods:

The details of the soil samples collected from different regions of Kamptee are given in table 1.

The soil is digested with sulfuric acid in the presence of Hibbardi's mixture (A catalyst mixture containing K_2SO_4, $FeSO_4$ and $CuSO_4$ in the ratio of 10:1:5) salicylic acid and sodium thiosulfate. Kjeldahl method is used to estimate the amount of nitrogen present into the sample. Extraction with sodium bicarbonate is being followed in soil testing to determine the available phosphorus in soils. UV spectrophotometric method was used for phosphors estimation, while flame photometric method used for the potassium estimation in the studied soil samples. The digital conductometer and pH meter were used for the measurement of conductance and pH.

Result and Discussion:

Nitrogen is an important major nutrients required for growth and cell division of Plants. It is an important constituent of certain proteins, amino acids, certain Enzymes and nucleic acids.

Therefore, it should presents in a sufficient amount in the soils. Nitrogen rich soil shows better growth of plants and plants provide better yield of product with respect to quality & quantity. Low rating of nitrogen causes deficiencies to plant and plants does not grow normally while high rating cause's toxicity to plant and plants shows inhibit growth therefore it should be in a medium rating. Soils containing nitrogen below 272 kg/ha shows nitrogen deficiency, while above 544 kg/ha nitrogen causes toxicity so it is necessary that it should present in a moderate levels.Phosphorous is involved in several key plant functions, including energy transfer and photosynthesis transformations of sugars and starches, nutrient movement within the plant and transfer of genetic characteristics from one generation to the next. It is also involved in energy transfer process like adenosine diphosphate (ADP) and adenosine triphosphates (ATP). The low rating phosphorous contains 12.4 kg/ha while high rating phosphorous contains 22.4 kg/ha phosphorus in soil.Potassium is also an essential major element proper functioning of stomata's is essential for photo synthesis, water and nutrient transport, and plant cooling it helps to carry out these functions and it required for opening & closing of stomata in the leaves of plants. It also increases root growth and improves drought resistance & activates many enzymes. It helps to retard crop diseases proteins and responsible for synthesis of starch. The standard range of potassium in soil is 114 kg/ha for low rating and 277 kg/ha for high rating soil and between that is middle range soil. In our present study the soil sample A is rich of all the essential nutrients as it belongs to field area of Kamptee.

The fertilizers used in the harvesting of plants increase the nutrients in the soil. Soil sample E is most potassium deficient and soil sample B is phosphorus deficient. On the other hand soil sample D is most potassium rich and soil sample C is most phosphorous rich. Electrical conductivity of a soil may increase or decreased which is depending upon the concentration of salt present in the soil. It is also depend upon the amount of metal ions present in the soil. It directly influence on the crop production the interpretation of electrical conductivity are as follows. The nature of soil sample depending upon pH can be interpreted (Table 4). Keeping the above facts in mind it can be said that soil sample A and soil sample B are nutrient rich, whereas soil sample D and soil sample E are nutrient deficient. The conductivity measurement data also supports the result. From the pH measurement result it can be conclude that soil sample A, B and C are acidic in nature, while soil sample D and E are most favorable for plant production.

Table. 1- The physical properties of soil samples.

Soil Sample	Color	Origin
A	Dark black	Field area at Gada, Kamptee
B	Light yellow	Field area at Mahadevghat, Kamptee
C	Light black	Field Area at Yashodhara Nagar Kamptee
D	Dark black	Area beside Kanhan river
E	Light Brown	Field area at Kamptee rural area

Table. 2- The amount of different parameters in the studied soil sample.

Soil Sample	Nitrogen	Phosphorous	Potassium content	Conductance	pH
Sample (A)	505	12	115	0.306	5.99
Sample (B)	340	06	184	0.212	5.94
Sample (C)	392	15	90	0.194	6.24
Sample (D)	135	11	220	0.082	6.00
Sample (E)	105	08	85	0.042	7.00

Table 3. Standard conductivity study of soils.

Sr. No	Conductivity (mS)	Relative level of salt	Plant response
1	0.0– 0.2	Low	No injury to any plant. May indicate lack of nutrients
2	0.2 - 0.8	Medium	Optimum level for most plants. Usually indicates well fertilized soils. Very sensitive plant may be injured.
3	0.8 - 1.5	High	Injury to salt sensitive plants. Germination seeds or seedling likely to be injured.
4	1.5 - 5.0	Excessive	Definitely injurious to most plant of any age.

Table 4. Standard pH scale of soils.

Sr. No.	pH	Interpretation
1	Below 6.5	Acidic- requires liming
2	6.5 - 8.5	Normal – no treatment optimum for most of the crops
3	Above 8.7	Alkaline–requires reclamation with gypsum and by growing the salt toleration crops.

Conclusion:

During present study five soil samples of different region of Kamptee Tahsil, district Nagpu were examined and their NPK values investigated and compared with standard values. Nitrogen rich soil shows better growth of plants and plants provide better yield of product with respect to quality & quantity. On the basis of NPK data, sample 'A' is rich of all the essential nutrients as it belongs to field area of Kamptee, while the soil sample 'E' is most potassium deficient and 'B' is phosphorus deficient. However, the conductivities and pH measurements of soil samples were examined and noteworthy reveals soil sample 'D' and 'E' are most favorable for plant production.

Acknowledgement:

Authors are deeply thankful to the Principal, Seth KesarimalPorwal College Kamptee; RTM Nagpur University Nagpur for providing necessary laboratory and instrumental facilities.

References:

Corwin D.L., Lesch S.M., 2005 Apparent soil electrical conductivity Measurements in agriculture, Computers and Electronics in Agriculture 46, 11.

MacLarenand D.C., White M.A 2003 Soil: Its Chemistry and Properties. Journal of Chemical Education, 8, 623.

MohdHasmadi Ismail 2009 Determining and Mapping Soil Nutrient Content Using Geostatistical Technique in a Durian Orchard in Malaysia, Agriculcatural Science, 01, 12.

Pal D.K., Srivastava P., Durgeand S.L., Bhattacharyya T., 2003 Role of micro-topography in the formation of sonic soils in the semi-arid part of the Indo-Gangetic Plains, India.Catena , 51, 3–31.

Xing Y., Bubier J., Moor T.R., Murphy M., Basiliko N., Wendel S., and Blodau C., 2011 The fate of ^{15}N-nitrate in a northern peat land impacted by long term experimental nitrogen, phosphorus and potassium fertilization, Biogeochemistry, 45, 68.

Hussain Z., R.A. Khattak, M. Irshadand A.E. Eneji, 2013, Ameliorative effect of potassiumsulphate on the growth andchemical composition of wheat (TriticumaestivumL.)insaltaffected soils, Journal of Soil Science and Plant Nutrition.

Hoyle F. C., M. DAntuono, T. Overhe, Murphy D. V., 2013 Capacity for increasing soil organic carbon stocksindryland agricultural systems, Soil Research.

Muhammad D., R.A. Khattak, 2009 Growth and nutrients concentrations of maize in pressmud treated saline-sodic soils. *Soil Environ.j* 28, 145-155.

Okoronkwo N.E., S.A. Odemelam, and O.A. Ano., 2006 Levels of Toxic Elements in Soils of Abandoned Waste Dumpsite, *Africa Journal of Biotechnology*,5.

Richardson A.E., Simpson R.J., 2011 Soil Microorganisms Mediating Phosphorus Availability, *Plant Physiol. J. 156,* 989–996.