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A CASE STUDY ON PHYSICO - CHEMICAL CHARACTERISTICS OF AGRICULTURAL SOIL AROUND INDUSTRIAL AREA, VISAKHAPATNAM, A. P, INDIA

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Abstract: Soil provides all the basic needs to us and is the most essential medium for growing plants. Thirteen soil samples from 0 – 15 cm depth were collected in the agricultural land near industry, Visakhapatnam, Andhra Pradesh (India). The physico – chemical parameters such as pH, EC, Organic matter, organic carbon, nitrogen, potassium and phosphorous of soil were analysed. The result reveals that soil exhibited alkaline characteristics, on an average in organic carbon and organic matter. An understanding of physical and chemical condition of any soil is essential for proper implementation of the other management practices. Therefore the physico-chemical study of soil is very important because both physical and chemical properties which affect the soil productivity. This knowledge will create awareness among the farmers about economic productivity.

Key Words: soil, Physico chemical parameters, Agricultural lands and Soil productivity

INTRODUCTION

Soil is one of the essential natural resource which provides the main mineral elements for plant development and crop production. Soil is an important part of Biosphere and it can be sustainably or even enhanced, under careful administration. Building good soil is a slow process and under best environment, good top soil accumulates at a speed of about 10 tons per ha (2.5 acres) per year enough soil to make a layer about 1mm deep when stretch over a hectare. Beneath poor conditions, it can acquire thousands of years to build that much soil. It is very critical to find out the soil uniqueness to know the soil quality. Soil quality may include capacity for water retention, carbon sequestration, plant productivity, waste remediation, and other functions, or it may be distinct more hardly.

Agriculture refers to an ability of raising plant life from the soil and is one of the most economical factors from human beings (Wagh and Sayyed 2013).But the concentrated use of agrochemicals possibly will lead to soil degradation, residues of agrochemicals in crop or ground water includes negative effects on the health of agricultural workers, mainly in serious viable horticulture, particularly in vegetable production (Fotio et.,al 2004). Soil fertility is an key factor, which determines the growth of plant. It is depends on the deliberation of N,P,K organic and inorganic materials, micronutrients and water. In common soil chemical fertility and in exacting require of nutrient inputs is a foremost factor in soil degradation (Hartemink 2010).

The insufficiency of nutrients has become main constriction to productivity, stability and sustainability of soils (Bell and Dell 2008). There are different ways of adding up and losses of nutrients as take position in soil. These nutrient cycling make the stability of organic and inorganic soil constituents. In current year's organic and inorganic fertilizers and pesticides are fatal commonly used by farmers in agriculture to increase the yield and production of cultivable plants. The yield and quality of crop depends leading the fertilizers and presence of micronutrients. The soil state is of great value because it is a universal medium for plant growth, which supplies essentials nutrients to the plants (Narkhede et.,al 2011). But due to excess use of fertilizers, the physico-chemical status in soil is being distorted (Kamble et.,al 2013). The increasing use of chemical fertilizers to the soil, it is not easy to control the by-product of the chemicals to the soil, plant animals and human beings (Narkhede et.,al 2011). Soil farming factors interface results into the properties of soil. Physico chemical characteristics of different soils differ in space and time due to variation in topography, climate, physical weathering processes, vegetation cover, microbial activities, and several other biotic and abiotic variables (Paudel and Sah 2003). The change in physico chemical properties of soil leads to infertile or barren soil that does not maintain normal increase of vegetation for years (Jha and Singh 1991).

The industrialization and progress in agriculture are necessary to meet the basic necessity of people; at the same time it is necessary to preserve the environment (Joshi and Kumar 2011). For the high crop yield the farmers used the pesticides and fertilizers in excess amount causes serious environmental problems and also reflect on their possible impact on soil health. Nitrogen, phosphorus and potassium ratio is a key pointer in crop production that identifies balanced and unbalanced fertilization. Hence, reasonable fertilizer applications are important for high crop yield (John et,al 2010). The food productivity and environmental quality is dependent on the physico-chemical properties of soil, so it is very important to know the fundamental knowledge about the physico-chemical properties of soil.

MATERIALS AND METHODS

Study area:

Visakhapatnam District one of the Northeastern Coastal districts of Andhra Pradesh, lies between 17º - 15' and 18º-32' Northern latitude and 18º - 54' and 83º - 30' in Eastern longitude. It's bounded on the North partly by the State of Orissa and partly by Vizianagaram District, on the South by East Godavari District, on the West by Orissa State and on the East by Bay of Bengal. The study sites of the present work cover the mandals of Nakkapalli, Parvada, Rambilli, Munagapaka and Atchutapuram.

Soil Sample Collection:

The soil samples were collected from agricultural fields near industry during the year 2020.The soil samples were collected in the pre monsoon period i.e., in the month of March. Each experimental soil sample (n=3) was collected from a depth of 15 cm by an Auger following standard protocol.
The soil samples were collected from 13 sampling sites and one control sample was collected far away from the agricultural sites. The samples were collected in a clean &dry polythene bags, brought to the laboratory, sun dried and ground to fine powder at room temperature. The soil samples were stored in a dry place for further physico chemical analysis. The soil sample collected from Kondakarlava constituted the control sample.

Table1.Physico chemical properties

Soil Property	Analysis Method	Unit
pH	pH meter	
Electrical conductivity	Digital portable water analyzer kit (Model 161 E)	m mhos
Organic Matter	Titrimetric method (Walkely and Black, 1934). % Soil organic matter=% Organic Carbon ×1.724	In percentage
Available Nitrogen	Micro Kjeldhal Method	Kg/ha
Available phosphorous	Spectrophotometer	Kg/ha
Available Potassium	Flame photometer	Kg/ha

% OM = % OC x 1.72

OC: Organic Carbon, OM: Organic Matter

RESULTS AND DISCUSSION

To study the undesirable consequence of pollutants, the soil samples were collected from various spots in the study area and the results of physico – chemical analysis are shown in Table 2. The pH of the soil taken from the depth of 0 –15cm at different sites ranged from 6.2 to 8.1 which indicate that the soil is slightly acidic to moderately alkaline. The high soil pH can be attributed due to the use of fertilizers in farming (Vincent K et al., 2012).

Electrical conductivity (EC) is a calculate of ions present in solution. The conductivity of a solution increases with the increased amount of ions. In the agricultural field electrical conductivity plays a vital role, because of salinity aspect. Conductivity depends upon the dilution of soil suspension. In the present study, EC of the soil was found to be higher for S4 and S12 sample containing 0.34 µs/ cm and 0.43 µs/cm respectively. Kaushik (2013) observed that soil EC ranged from 0.25 to 0.92 dS/m around the industrial area.

Soil organic carbon (SOC) is the most important factor in maintaining soil quality because of its role in improving physical, chemical and biological properties of the soil. Changes in agricultural practices often control both the quantity and quality of SOC. In the present study, SOC of the soil was found to be higher for S12 sample containing 1.02% respectively. These observations were in accordance with the findings of Taywade and Prasad (2008).
Soil organic matter is important material goods of soil. If the soil is poor in organic matter then it enhances the process of soil erosion. If the soil organic matter is here in soil then this soil is useful for the agricultural practices. The increase in soil organic matter is the increase of mean annual precipitation, decomposing, soil moisture, water saturation and humus in soil is the reason. In the present study, SOM of the soil was found to be higher for S12 sample containing 1.76 % respectively. These observations were in accordance with the findings of Taywade and Prasad (2008).

Nitrogen is the most important nourishment element. Plants respond quickly to appliance of nitrogen salts. This factor encourages above ground vegetative growth and gives a deep green colour to the leaves. Plant roots take up nitrogen in the form of NO3 and NH4 (Sumithra et.,al 2013). It is the most significant major nutrient required by plant for proper growth and progress and it is a part of all living cells is a necessary part of all proteins, enzymes and metabolic processes concerned in the synthesis and transfer of energy (Singh and Rathore 2013). Nitrogen cycle plays an important role in soil system and is influenced by biological processes. It is mandatory for growth of plant and is a constituent of chlorophyll, plant protein and nucleic acid (Jain et.,al 2014). Soil nitrogen is also directly associated with soil organic carbon (Singh and Negi 2013). In the present study, available nitrogen of the soil was found to be higher for S11 sample containing 684 k/ha respectively. A wide variation in nitrate content (0.061 mg/g - 0.294 mg/g) was studied in agricultural soils of Vishakhapatnam (Srinavas and Kumar 2001). Similar findings of nitrate (0.180 - 0.450 mg/g) were reported in field soils of Amritsar (Katnoria et al., 2008).

Phosphorus is a component of every living cell in plant. Phosphorus is a fundamental element because of the large amount of phosphorus necessary by plants growth. It is also an essential part of the process of photosynthesis, involved in the structure of all oils, sugars, starches, etc.(Singh and Rathore 2013). Phosphorus is plentiful in the fruits of plants and seeds and also plays an important role in plant processes. Wagh et al reported that phosphorus is one of the key macronutrient required for plant growth and metabolism. The most of the action of plant such as growth, respiration and reproduction depends upon phosphorus levels of the soil in which plant grows (Wagh et.,al 2013). The available phosphorus content of the soil was higher in topographic location as compared to soils occurring on lower topographic location (Singh and Rathore 2013). The soil with high organic matter content have better supplies of organic phosphate for plant uptake than have the soils with low organic content (Miller and Donahuer 2001). Sufficient phosphorus availability for plants stimulates early plant growth and hastens maturity (Solanki and Chavda 2012). The soil with minimum leaching are known to contain high amount of phosphorus as compared to the soil with maximum leaching (Ashraf et.,al 2012). Results are in accordance with the study of Khajuria (2010) who investigated the industrial area and observed that the available nitrogen content of soil varied from 31.40 to 81.51 kg/ha, irrespective of seasons.

Potassium is not an primary part of any major plant component but it plays a key role in a vast array of physiological process vital to plant growth from protein synthesis to maintenance of plant water balance (Sumithra et.,al 2013). It is occupied in many plant metabolism reactions, ranging from lignin and cellulose used for formation of cellular structural components, to regulation of photosynthesis and production of plant sugars that are used for various plant metabolic need (Jain and Jagtap 2014). Potassium is found in its mineral form and have an effect on plants division, carbohydrate formation, translocation of sugar, various enzyme action and resistance to certain plant disease (Jain and Jagtap 2014). The high content of available potassium on surface soil may be credited to the application of potassium fertilizers and manures addition (Miles and Hammer 1989). It decreases with an increase in depth of soil. Soil that have adequate potassium allow plants to develop quickly and outgrow plant disease, insect damage and protect against winter freeze damage. Kumar (2013) during a similar study observed that potassium ranges from 3.1 ppm to 14.2 ppm in monsoon season, 3.5 ppm to 16.9 ppm in post-monsoon and 4.5 ppm to 22.3 ppm in pre-monsoon season.

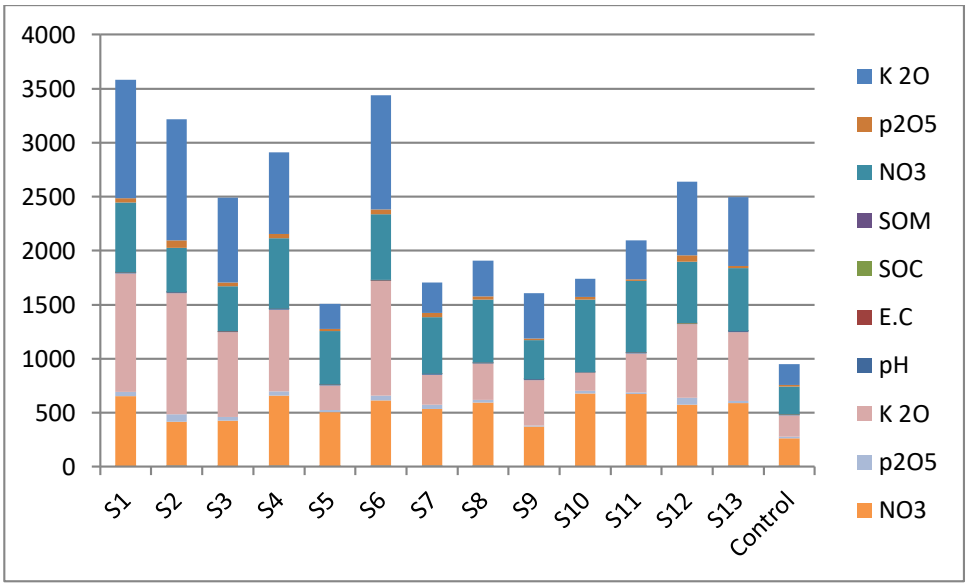
CONCLUSION:

Usually agriculture has been largely dependent on intensive chemical inputs which play an imperative role in improving food productivity to meet human demands. In recent years, most of the farmers are using the overload amount of fertilizers and pesticides. Due to overload use of chemicals soil quality decreases. Small crop also affected due to large use of fertilizers and pesticides. So it becomes important to analysis of soil parameter. The pH of the soils in the study area is mostly in alkaline nature. Electrical conductivity was high near to industry may be due to the increase of salts in the solution due to the industrial effluents. Organic carbon and Organic matter were observed on an average not that fertile. The levels of nitrogen, phosphorous and potassium were high in agricultural soil near to industry. This is mainly due to the addition of more amounts of fertilizers to crops for increasing the yield.

Table.2 Results of Physico chemical parameters for the year 2020

Station	pH	E.C m/mhos	SOC %	SOM %	NO3 kg/ha	p2o5 kg/ha	K 2O kg/ha
S1	6.9	0.10	0.88	1.52	604	52	926
S2	8.0	0.34	0.54	0.93	568	63	1120
S3	7.6	0.07	0.73	1.26	352	23	449
S4	7.0	0.31	0.86	1.48	684	74	1120
S5	7.2	0.14	0.80	1.38	605	11	291
S6	7.8	0.26	0.70	1.21	613	48	1108
S7	7.8	0.07	0.70	1.21	458	27	268
S8	7.5	0.12	0.75	1.28	582	39	396
S9	8.0	0.10	0.8	1.38	151	11	582
S10	6.7	0.03	0.94	1.62	648	34	134
S11	8.1	0.11	0.58	1.00	684	17	302
S12	6.2	0.43	1.02	1.76	450	52	1120
S13	8.0	0.15	0.54	0.93	452	14	156
Control	7.3	0.17	0.81	1.37	251	14	190
Min	6.2	0.03	0.54	0.93	151	11	134
Max	8.1	0.43	1.02	1.76	684	74	1120
Mean	7.45	0.17	0.76	1.30	527.00	35.77	613.23
Standard deviation	0.65	0.13	0.15	0.26	151.76	20.79	402.78
Standard Error	0.18	0.04	0.04	0.07	42.09	5.77	111.71

Fig.1. Graph showing the physico chemical parameters



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