

Analysis of Physico-Chemical Parameters of Soil of Sri Ganganagar, Rajasthan

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ABSTRACT: An estimation of physical-chemical parameters of soil of Sri Ganganagar district was carried out. The main objectives of this study was to carried out the survey, collection of information and analysis of physical properties of soil, for the analysis 8 sampling points were selected. Soil samples were collected at a depth of 0- 15cm and 15-30 cm and 30-45cm and the study revealed that particle density ranges from 2.40 to 2.66 gcm⁻³, bulk density ranges from 1.08 to 1.23 gcm⁻³, water retaining capacity ranges from 43.40 to 60.50%, and specific gravity ranges from 1.74 to 2.39. A soil texture was classified from sandy soil to sandy loam soil. It clearly indicated that soil has good water holding capacity and has good physical condition. Soil is suitable for almost all tropical and sub-tropical crops and oil seeds.

KEYWORDS: Sri Ganganagar, survey, physico-chemical, density, water retaining, all crops, oil seeds, Rajasthan

I.INTRODUCTION

Soil, commonly referred to as dirt, or earth, is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life of plants and soil organisms. Some scientific definitions distinguish dirt from soil by restricting the former term specifically to displaced soil. Soil consists of a solid phase of minerals and organic matter (the soil matrix), as well as a porous phase that holds gases (the soil atmosphere) and water (the soil solution).[1][2] Accordingly, soil is a three-state system of solids, liquids, and gases.[3] Soil is a product of several factors: the influence of climate, relief (elevation, orientation, and slope of terrain), organisms, and the soil's parent materials (original minerals) interacting over time.[4] It continually undergoes development by way of numerous physical, chemical and biological processes, which include weathering with associated erosion.[5] Given its complexity and strong internal connectedness, soil ecologists regard soil as an ecosystem.[6]

pH - Soil of study area were relatively alkaline with PH ranging 7.77 to 9.12 ; 7.52 to 8.94 ; and 8.10 to 8.51 of the layer depth 0 - 60 cm

EC – The mean EC of were found 1.43,1.31 and 1.36 ; 0.78 ,0.71 and 0.65 ; 0.62 ,0.57 and 0.52 dSm⁻¹ respectively .It has a declining trends from upper layer to lower layer of soil.

Organic carbon- The mean organic carbon content of upper 0 – 15cm soil layer contain 0.24,0.25 and 0.17 percent. It has a declining trends from upper layer to lower layer of soil. The source of organic carbon is plant debris and root system of the crops.[7,8]

Available Phosphorus – phosphorus in the soil was in low and medium range. The soluble inorganic salts that occurs in soils consist mostly of various proportion of the cations Na⁺,Ca⁺² and Mg⁺² which affect the soil fertility and productivity.

The N ranges from 180.35 to 275.63.The highest mean value is recorded 232.57 in (V3) and the lowest mean value 209.47

Accumulation on potassium (kg ha⁻¹) of various farmers field and depths which was found to significant. The K ranges from 270.39 to 340.40 The highest mean value is recorded 329.03 in and the lowest mean value 303.70 in[9,10]

One of the planet's most dynamic and intricate natural processes is referred to as "soil." It provides a medium for plant growth and satisfies the bulk of organisms' nutritional needs, making it essential for the existence of many sorts of life. Parent material undergoes biochemical weathering to generate soil, which is impacted by factors like climate, organisms, parent material, relief, and time. The most significant and priceless natural resource for supporting life on



Earth is soil. It takes around 1000 years for an inch of topsoil to grow (Chandra and Singh, 2009) [4]. The development and implementation of soil, plant and nutrient management techniques that enhance plant production and soil, water, and air quality is one of the most urgent issues of the day. [11,12] Without increasing the productive capacity of our vulnerable soils, humans would not be able to satisfy the needs for food and fibre from our expanding population. Soil health is defined as "the state of a soil at a specific time, equivalent to dynamic soil attributes that fluctuate over time, whereas soil quality is defined as soil usefulness for a specific purpose across time, equivalent to inherent or stable soil quality". According to the USDA, there are four types of soil quality indicators: visual, physical, chemical, and biological indicators. Physical indicators for root growth, plant emergence speed, and water infiltration include depth, bulk density, aggregate stability, porosity, texture, and compaction (Das, 2004) [10].

Sri Ganganagar has Sandal, saline, alkaline, and chalky (calcareous) soils are the most prevalent types. There are also clay, loamy, black lava soil, and nitrogenous soils. Because to over-exploitation and intermittent rainfall of 360 mm per year, the ground water level is extremely low. Agriculture remains the backbone of economy, with agriculture and related sectors accounting for 25.56 percent of the state's total GSDP in 2019-20. The collected soil samples were analysed in laboratory for various physical properties. Physical parameters included soil texture, colour, bulk density, particle density, porosity, water retaining capacity and specific gravity. The data recorded during the course of investigation was subjected to statistical analysis by the method of analysis of variance (ANOVA) technique. The type adopted for the experiment was twofactor analysis without replication.[13,14]

II.DISCUSSION

Physical properties- Physical properties of soil include soil texture, colour, porosity, water retaining capacity, specific gravity along with bulk density and particle density. These properties depend on the amount, size, shape, arrangement and mineral composition of its particles. These properties also depend on organic matter content and pore spaces. These properties affect processes such as infiltration, erosion, nutrient cycling, and biologic activity and the suitability of soil for different uses.

Soil colour-The colour varied from brown (7.5YR 4/4) to brownish yellow (10YR 6/6) in 0-15 cm depth; from dark brown (7.5YR 3/2) to brownish yellow (10YR 6/8) in 15-30 cm depth and from brownish yellow (10YR 6/8) to very dark grayish brown (10YR 3/2) in 30-45cm depth of soil profile. Surface soil showed darker colour than the subsurface soil due to presence of more organic matter. Yellow colour of soil was pertaining to presence hydrated iron oxides. The brown colour indicated that the soil contains a relatively large amount of iron oxides in addition to organic matter.

Porosity- Porosity of the soils varied from 44.804% to 51.114% with a mean value of 48.496%. The maximum mean pore space was recorded with a value of 51.114% which is due to low bulk density i.e. 1.098 Mg m⁻³. The minimum mean pore space was recorded with a value of 44.804% which is due to high bulk density i.e. 1.503 Mg m⁻³. The porosity in depths varied from 61.795% to 35.611%. The result showed that soil porosity is very much influenced by bulk density, more the soil compacted, less will be the pore space. Also, pore space was found to decrease with increase in depth attributed to increase in compaction in the subsurface

The dominant texture of soils was loamy sand and the water holding capacity of the soils were low because of which drip irrigation systems should be preferred. The soils were mostly of light colored indicating low organic carbon and organic matter thus pointing to the need of incorporating organic farming practices which eventually would also help in improving the bulk density of the soils. Porosity was found moderate and decreased with increase in depth due to compaction in sub-surface layers. The water holding capacity of the soils were low because of which drip irrigation systems should be preferred in order to improve the quality of produce and increase the percentage yield of crops thereby adapting to sustainable fashion of farming.[15,16]

III.RESULTS

Available sulphur in these soils exhibits a non-significant adverse connection with pH ($r=-0.125$) and porosity ($r=-0.053$). Sulphur in these soils exhibits a non-significant positive correlation with organic carbon ($r=0.052$), bulk density ($r=0.080$), particle density ($r=0.024$) and EC ($r=0.049$). These findings were found similar that organic carbon and accessible sulphur have a favorable correlation ($r=0.051$). This connection existed due to the association of most of the sulphur status with organic matter. Soil is a component of the lithosphere and biosphere system. It is a vast natural resource on which the life supporting systems and socio-economic development depends. Organic matter is one of the most important constituents of soil, a good amount of organic carbon / matter in soil increase soil fertility. The core

constraints in relation to land use include depletion of organic carbon, soil micronutrients and macronutrients, removal of top soil by erosion, change of physical properties and increased soil salinity. Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to poisoning. Heavy metals are dangerous because they tend to bioaccumulate in soils. In soil the heavy metal content was noticed:-

The concentration of Lead was found 198-185 $\mu\text{g/l}$. In humans exposure to lead can result in a wide range of biological effects depending on the level and duration of exposure. Various effects occur over a broad range of doses, with the developing foetus and infant being more sensitive than the adult. High levels of exposure may result in toxic biochemical effects in humans which in turn cause problems in the synthesis of haemoglobin, effects on the kidneys, gastrointestinal tract, joints and reproductive system, and acute or chronic damage to the nervous system.

The concentration of Chromium was found 177-160 $\mu\text{g/l}$. It is used in metal alloys and pigments for paints, cement, paper, rubber, and other materials. Low-level exposure can irritate the skin and cause ulceration. Long-term exposure can cause kidney and liver damage, and damage to circulatory and nerve tissue. Chromium often accumulates in aquatic life, adding to the danger of eating fish that may have been exposed to high levels of chromium.[17,18]

The concentration of Nickel was found 99-91 $\mu\text{g/l}$. Small amounts of Nickel are needed by the human body to produce red blood cells, however, in excessive amounts, can become mildly toxic. Short-term overexposure to nickel is not known to cause any health problems, but long-term exposure can cause decreased body weight, heart and liver damage, and skin irritation

The concentration of Copper was found 89-88 $\mu\text{g/l}$. Copper is an essential substance to human life, but in high doses it can cause anemia, liver and kidney damage, and stomach and intestinal irritation. People with Wilson's disease are at greater risk for health effects from overexposure to copper. Copper normally occurs in drinking water from copper pipes, as well as from additives designed to control algal growth[23,24]

The concentration of Arsenic was found 75-70 $\mu\text{g/l}$. Arsenic is one of the most toxic elements that can be found. Despite their toxic effect, inorganic arsenic bonds occur on earth naturally in small amounts. Humans may be exposed to arsenic through food, water and air. Exposure may also occur through skin contact with soil or water that contains arsenic. Exposure to inorganic arsenic can cause various health effects, such as irritation of the stomach and intestines, decreased production of red and white blood cells, skin changes and lung irritation. A very high exposure to inorganic arsenic can cause infertility and miscarriages with women, and it can cause skin disturbances, declined resistance to infections, heart disruptions and brain damage with both men and women. Finally, inorganic arsenic can damage DNA.[19,20]

IV.CONCLUSIONS

Conservation of soil is one among a few of the techniques which have been undertaken to prevent soil erosion which removes the top layer of the soil thus removing all necessary organic matters and nutrients which are very necessary for plants to grow and produce fruits. By conserving soil we can also preserve the fertility of the soil. [21,22] Conservation of soil can be done by different methods. A few of the common methods are as follows:

- Keyline design
- Contour ploughing
- Windbreakers
- Terrace farming
- Salinity management
- Perimeter runoff control
- Soil-conservation farming
- Cover crops/crop rotation



- Use of Green Manures
- Stream Bank Protections[25]

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