International Journal of Research and Review
www.ijrrjournal.com E-ISSN: 2349-9788; P-ISSN: 2454-2237

Research Paper

Chemical Analysis of Soil of Pandoga Sub Watershed with the Seasons in Una (H.P), India

Bindu Sharma

School of Biological and Environmental Sciences, Shoolini University, Post Box No.9, Head Post Office, Solan (H.P) - 173212, India

ABSTRACT

Watershed is hydrological unit to manage diverse natural resources (soil, water, biodiversity) that are unevenly distributed within a given geographical area. It is implemented in India to enhance the livelihood security of the rural poor people by soil and water conservation. Present study area too falls in sub watershed catchment area. Present study was conducted to determine the soil status by chemical parameters of soil in Pandoga sub watershed catchment area for two seasons. Three–stage systematic soil sampling design was followed. Soil samples were analyzed using standard methodology for chemical parameters. pH value of all samples show alkaline nature for both seasons except for ward 4 of site 7 that had slightly acidic nature in pre monsoon season while electrical conductivity (EC) results shows that all soil samples are not saline in nature. Organic carbon, organic carbon matter, available nitrogen, available phosphorus and available potassium had high mean value in post monsoon season as compared to pre monsoon season.

Key words: Biological oxygen demand, chemical oxygen demand, electrical conductivity

I. INTRODUCTION

Watershed development was nothing but a risk management strategy to combat environmental degradation and deplorable ecosystems of rural India from acute distress caused by recurring droughts and intensity of floods or a course of action in a right perspective to exploit full potential of natural resources. Watershed projects play important role in managing soil and water resources throughout the world (Kerr and Chung, 2001). In 1990s the government of India too adopted watershed management to conserve rainwater and soil of rain fed ecosystem (Wani and Ramakrishna, 2005; Wani *et al.*, 2008).

Soil is a vital natural and non-renewable resource which performs environmental, economic and social functions. Soil quality is related to the soil capability which is old human civilization itself (Carter *et al.*, 2004). Soil quality has-been defined as the capacity of the soil to sustain biological productivity, environmental quality and enhance plant, animal and human health (Doran and Parkin, 1994). High quality soils not only produce better food and fiber but also help to maintain natural ecosystems (Griffiths *et al.*, 2010).

According to the IPCC, 2007 (Inter governmental Panel on Climate Change), global temperatures are expected to increase between 1.1 to 6.4°C during the 21st century and precipitation patterns will be altered. This altered climate will had a potential to threaten food security through its effects on soil properties and processes Brevik (2013). In order to mitigate losses in agricultural productivity due to seasonal climatic changes (heavy rainfall, drought etc.,) there is a need to monitor physical-chemical properties of soil as it has a direct impact on soil health and subsequent crop yields.

Research on soil quality was initiated to address the issues of environment protection, agriculture productivity to tackle food security problem and to reduce land degradation in Pandoga sub watershed catchment area which is located in rainfed agricultural area of Shivalik foot hills. Soil erosion or degradation was the main challenge in this rainfed agriculture area.

II. MATERIALS AND METHODS

Study area

Pandoga sub watershed was implemented by SRIWMP (Swan River Integrated Watershed Management Project) to convert flood hazards region of rainfed agricultural area into natural gift. The Pandoga sub watershed was located at 31^0 30'25.30"N Latitude and 76^0 82' 02.24" E longitudes. Elevation of area is 350 to 600 m above mean sea level. Topography of the area is gentle to moderately sloping. Mean annual rainfall is approximately 1155 mm with extreme variation in rainy and post rainy season. Temperatures also vary from high in summer season to low in winter season. Agro climatic zone is Shivalik foot hills of Western Himalayan zone.

Methods

Three–stage systematic sampling design was followed as first one was division watershed's catchment area into three sites; second one was division of each site into three wards; third is triplicate soil sampling from each ward for two seasons (post monsoon and pre monsoon season) from a depth of 0-20 cm. Soil sample samples was analyzed by following standard methodology; pH and EC (pH and Electrical conductivity meter); organic carbon (Walkley and Black, 1934); soil organic carbon (OC value × 1.72) . NPK [(Micro - Kjeidhal procedure of Chapmann and Pratt, 1961; Olsen's et al., 1954; Flame photometerically (Piper, 1966)]. The data was statistically analyzed with the help of software Graph Pad Prism version 5.0 for standard error of mean values.

III. RESULT AND DISCUSSION

Chemical analysis

Soil pH of an area is controlled by the nature of the parent material, climate of the region, organic matter and topographic situation (Tamirat, 1992). Maximum mean pH was 7.60 in ward 9 of site 1 and minimum mean pH was 6.47 in ward 8 of site 1 during post monsoon season. Fluctuations in pH in same site may be due to differential application of fertilizers and manure in field by farmers. Soil pH raised by 2-3 units in the immediate vicinity of granule of urea (Tisdale *et al*., 1985). However, during pre monsoon season maximum mean was 7.34 in ward 10 of site 2 and minimum mean 5.88 was in ward 4 of site 3. High pH in post monsoon may be due to addition of rain water in soil (Solanki, 2001). Soil pH was moderately alkaline in all sites in post monsoon season, while it was moderately alkaline to slightly acidic in nature in pre monsoon season. Soil alkalinity in arid soil was caused by naturally existing limestone in the soil (Solanki and Chavda, 2012). The decline in soil pH was due to the action of plants and soil microbes that help to degrade plant litter and convert it into humic acid (or later into humus) hence slowly decline the soil pH (Fauzie *et al*., 2015).

Soil electrical conductivity was a measure of soluble salt ions and metals which allow the current to pass through them at any particular temperature. The results of electrical conductivity revealed that in post monsoon season maximum mean electrical conductivity was 0.38 milli mohs/cm in ward 7 of site 3 and the minimum mean electrical conductivity was 0.093 milli mohs/cm in ward 3 of site 3. However in pre monsoon season maximum mean electrical conductivity was 0.22 milli mohs/cm in ward 4 of site 3 and the minimum mean electrical conductivity recorded 0.08 milli mohs/cm in the ward 8 of site 1. Electrical conductivity results varied within the wards of sites as EC of soil varied with the moisture held in soil (Solanki and Chavda, 2012). Increase in electrical conductivity in post monsoon season attribute to high deposition of salt after monsoon season (Paine, 2005).

Soil organic carbon (SOC) was an important parameter affecting soil quality and agriculture sustainability (Guangyu *et al.,* 2010). It was evident that during post monsoon season maximum mean organic carbon was 0.830% in ward 8 of site 1 and minimum mean was 0.256% in ward 1 of site 2. However during pre monsoon season maximum mean organic carbon was 0.546% in ward 10 of site 2 and minimum was 0.190% in ward 1 of site 2. Organic carbon of study area varied with the wards and seasons. Low organic carbon was observed in pre monsoon but in ward 9 and ward 11 of site 1; ward 4 of site 2 had higher organic carbon in post monsoon season. High organic carbon in these wards might be high use of local fertilizers like animal manure and dung. Presence of soil microorganism in post monsoon season increased the decomposition of organic matter (Ingavale *et al*., 2012). Decline of SOM generally resulted in the decline in soil fertility status and globally crop productivity (Bot and Benites, 2005). Hot humid and per humid climates are deficient in organic carbon due to intensive agricultural practices (Bhattacharya *et al*., 2000).

Nitrogen was important nutrients required for plant growth because it was the major constituent of all proteins, chlorophyll and nucleic acids while deficiency of it might cause stunted growth and yellowish leaves. Maximum available nitrogen was 359.12Kg/ha and 321.96kg/ha in ward 7 of site 3 and minimum was112.85kg/ha and 108.48kg/ha in ward 2 of site 2 in post and pre monsoon season respectively. The major proportion of nitrogen in the soil was influenced by organic matter present in the soil (Borkar, 2015). Higher available nitrogen was observed in post monsoon season which might be due to luxuriant growth of nitrogen fixing bacteria (blue green soil algae) as soil had sufficient water, favourable temperature and humidity. In contrast nitrogen lost from soil by leaching as it moves with soil water below the root zone (Solanki and Chavda, 2012). Nitrogen mean value fluctuate within wards of selected sites. Reason behind these results might be mineralization of organic that released large amount of nitrogen in soil (Prasad *et al*., 2008).

Phosphorus available in adequate amount stimulates and hastens plant growth (Solanki and Chavda, 2012). It was evident that maximum mean available phosphorus was 49.28kg/ha and 37.71kg/ha in ward 7 of site 3 during post and pre monsoon season respectively. Minimum mean was 26.88kg/ha in ward 9 of site 1 during post monsoon season and minimum mean phosphorus 4.67 kg/ha was in ward 1 of site 2 during pre monsoon season. High amount of mean available phosphorus in site 3 might be due to run-off of fertilizer from its neighboring high- land area or washed away during precipitations. Higher available phosphorus was observed in post monsoon season as it might be due to adsorption of phosphate ions on suspended particles and might be assimilation of phosphate ions by phytoplankton (Solanki and Chavda, 2012).It was evident that during post monsoon season was 537.33 kg/ha and 351.19 kg/ha during pre monsoon in ward 7 of site 3 whereas minimum mean was 100.80 kg/ha and 92.77 kg/ha in ward 2 of site 2 during post and pre monsoon season respectively. Higher available potassium was observed in post monsoon season. However, reverse results were observed by (Kumar and Srikantaswami, 2012) as potassium present in soil dissolved in water and eroded off.

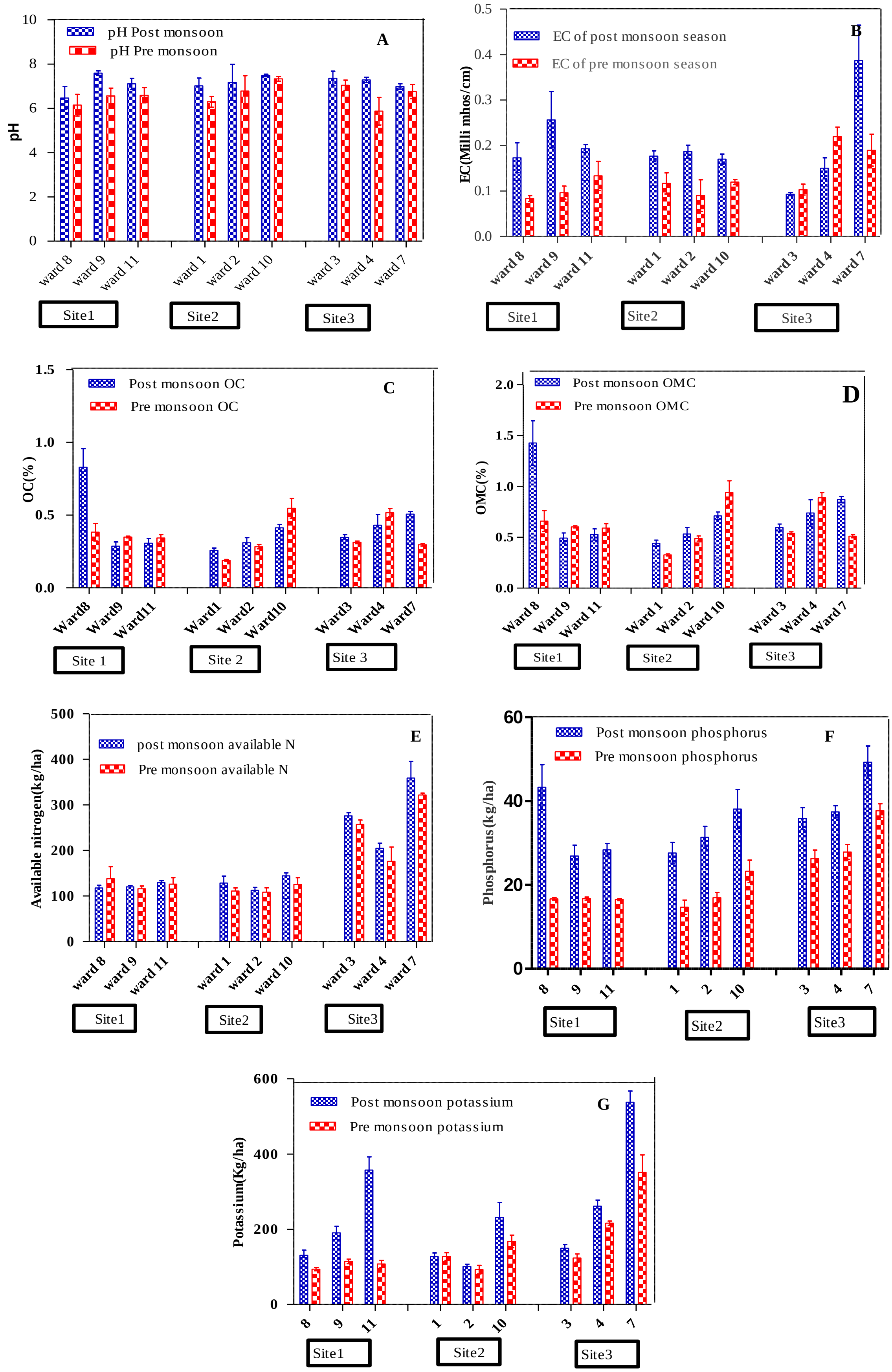

Fig.1: Variation in physical parameters of soil at Pandoga sub watershed catchment area at different sites (nine wards) during two different seasons. Values are mean ± S. E. n=3. [A: pH; B: EC; C: OC; D: OMC; E: Avail.N; F: Avail. P; G: Avail. K]

IV. CONCLUSION

Research study site had influence on the soil chemical parameter as it experienced changed ecology due to soil conservation measures (wire check dams, crate wire check dams, vegetation) adopted. These affect the rate of erosion and level of ground water in study sites. Availability of water in study sites had changed cropping pattern. Chemical analysis of soil indicated variation of parameters with the season as season wise as well as with the site as differential application of manure, fertilizers and pesticides.

V. ACKNOWLEDGMENT

Author is grateful to Dr. Sujata Bhattacharya who designed and guides my research study. Authors are also thankful for their kind co-operation and for her consent to publish paper.

VI. REFERENCES

- Bhattacharyya T, Pal DK, Mandal C, Velayutham M.. Organic carbon stock in Indian soils and their geographical distribution, Current Science. 2000; 79(5), 655-660.
- Borkar AD. Studies on Some Physico chemical Parameters of Soil Samples in Katol Taluka District Nagpur (MS), India. Research Journal of Agriculture and Forestry Sciences. 2015; 3(1): 16-18.
- Bot A and Benites J.The importance of soil organic matter Key to drought-resistant soil and sustained food production. Food and Agriculture Organization of the United Nations, Rome. 2005
- Brevik EC. The potential impact of climate change on soil properties and processes and corresponding influence on food security, Departments of Natural Sciences and Agriculture and Technical Studies, Dickinson State University, Dickinson, ND. 2013
- Chapman HD and Pratt PF. Methods of analysis for soils, plants and waters. Division of Agricultural Sciences, University of California. 1961
- Carter M R, Andrews SS. Drinkwater L E. Systems approaches for improving soil quality. In 'Managing soil quality: challenges' (Eds. P Scjonning,S elmholt, BT Christensen. 2004;261-281.
- Doran JW, Parkin TB. Defining and Assessing Soil Quality. In JW Doran, DC. Coleman, Bezdicek DF and Stewart B A (Eds.). Defining Soil Quality for a Sustainable Environment. SSSA Special Publication. 1994; 3-23.
- Fauzie AK, Khudsar F A, Sreenivasa. Analysis of Soil Physico-Chemical Properties in Various Sites at Yamuna Biodiversity Park, Delhi (India). International Journal of Innovative Research in Science, Engineering and Technology. 2015; 4(8);7220-28.
- Griffiths BS, Ball BC, Bohanec M. Integrating soil quality changes to arable agricultural systems following organic matter addition, or adoption of a ley-arable rotation. Applied Soil Ecology. 2010; 46(1):43-5.
- Guangyu C, Xin C and Yi S. Profile distribution of soil organic carbon under different land use type in Sanjing Plain. World Congress of Soil Science, Soil Solutions for a Changing World. 2010; 183-185.
- Ingavale RR, Mohite SA, Shinde TV, Jadhav AS and Raut PD. Studies on physico-chemical characteristics of soil of Bhogawati River bank in Kolhapur District. Proceeding of International Conference, SWRDM. 2012
- IPCC (Intergovernmental Panel on Climate Change). Climate change 2007. Fourth Assessment Report. Cambridge University Press, Cambridge, U.K. 2007.
- Kerr J, Chung K. Evaluating Watershed Management Projects, CAPRI Working Paper NO.17, IFPRI, and Washington, DC. 2001.
- Kumar SD, Srikantaswamy S. Study of physico chemical characteristics of industrial zone soil of mysore city, Karnataka, India. International Journal of Environmental Science. 2012; 3(1): 224-232.
- Olsen SR, CV Cole, Watanbe FS, Dean LA. Estimation of available phosphorus in the soil by extraction with sodium bicarbonate. U.S. Department of Agriculture Circular. 1954; 939.
- Paine JG. Determining Salinization Extent, Identifying Salinity Sources, and Estimating chloride mass using surface, borehole, and airborne electromagnetic Induction

methods, Water Resource Research. 2015; 39 (3): 1059.

- Solanki HA. Study on pollution of soils and water reservoir near industrial areas of Baroda. PhD thesis submitted to Bhavnagar University, Bhavnagar. 2001.
- Solanki HA and Chavda NH. Physico – chemical analysis with reference seasonal to changes in soils of Victoria park reserve forest, Bhavnagar (Gujarat).Life sciences leaflets. 2012; 8, 62-68.
- Tamirat T. Vertisol of Central Highlands of Ethiopia: Characterization and Evaluation of Phosphorus Statues. Master's Thesis, Alemaya University, Dire Dawa. 1992
- Tisdale ST, Nelson WL and Beaton JD. Soil fertility and fertilizers. 4th ed. Macmillan publishing company, New York. 1985
- Walkley A and Black IA. An examination of the Degtjareff method for Determining soil organic matter, and proposed a modification of the chromic acid titration method. Soil Science.1934; 37:29-38.
- Wani SP, Ramkrishna YS. Sustainable management of rainwater through integrated watershed approach for improved for livelihoods. In; "Watershed Management Challenges; Improved Productivity, Resources Livelihoods", (eds.Bharat R Sharma, J S Samra, CA Scot and Suhas P Wani), IMMI Sri lanka. 2005; 39-60.
- Wani SP, Sreedevi TK, Reddy TSV, Venkateshvaralu B and Prasad CS. Community watersheds for improved livelihoods through consortium approach in drought prone rain fed areas. Journal of hydrological Research and Development. 2008; 23: 55-77.

How to cite this article: Sharma B. Chemical analysis of soil of Pandoga sub watershed with the seasons in Una (H.P), India. International Journal of Research and Review. 2018; 5(10):22-27.

******