ASSESSMENT OF PH AND MOISTURE CONTENT IN AGRICULTURAL SOILS OF FARIDABAD, HARYANA

Jyoti Rani, Sudesh Chaudhary
Deenbandhu Chhotu Ram University of Science and Technology, Murthal, Sonepat, India.
Tripti Agarwal
National Institute of Food Technology Entrepreneurship and Management, Sonepat, India.

ABSTRACT-The soil is one of the most important and complex natural resource which fulfill the basic need of all livings on this earth, as it supplies nutrients to plants and then to animals through the food chain. The mere presence of nutrients in the soil does not ensure their availability to the plants growing in the soil. The availability of nutrients to plants through the soil is a function of various physical and chemical parameters of the soil such as pH, EC, moisture, Organic carbon, CEC etc. Out of these parameters pH is one of the most important parameter as it is a logarithmic factor and small variation in the pH value of soil has a great impact on the nutrients and heavy metals availability in plants. So in the present study soil samples collected from Faridabad city national capital region, Haryana has been analyzed for pH and moisture content during summer and winter. Here an attempt has been made to understand the effects of pH and moisture content on nutrients availability to plant.

***KEYWORDS*: Soil, Physico-chemical parameters, Nutrient, pH and Moisture content.**

INTRODUCTION

The soil is a most precious and variable natural resource found on the earth. It is a thin outermost layer of our earth crust having macro and micronutrients essential for plant growth (Kaur et al., 2014), (Borkar AD, 2015). The composition of soil is 50-60% mineral matter, 25-35% water, 15-25% air and organic matter (Asema et al., 2015) .

Rapid industrialization has increased the soil pollution at an alarming rate. The industries are discharging their untreated solid waste and effluent on the soil either directly or indirectly (Gabarrón et al., 2017). The use of effluents and sewage is also very common now a day by the farmer for irrigation of their fields (Daulta et al., 2014) (Khan et al., 2017). The effluents and sewage are the two important source of heavy metals contamination of soil (Gupta et al., 2008) (Pathak et al., 2009). Use of domestic sludge changes the cations exchange capacity of soil and hence affect the availability of nutrients to plants (Van Herk, 2012) . Air pollutants dispersed in the atmosphere also get settle down on the soil under the effect of gravity and leads to soil pollution (Kaur et al., 2014). Disposal of acidic or basic effluent as well as acidic rain changes the pH of soil. So it is very important to identify the source of pollution to the soil in order to carry out proper farming.

STUDY AREA

Faridabad is located in southeastern part of Haryana between 27^0 39’, 28^0 31’ North and 76^0 40’, 77^0 32’ east longitude with a total geographical area of 2151 kilometers square. The district has been divided into Faridabad and Ballabhgarh blocks. The climate of the region is mostly tropical, semi-arid and hot during summer. Average annual rainfall occurs in the district is 542mm. Winter season prevails from January to the beginning of March. The soil of Faridabad is classified as tropical and brown soil with organic matter content varying from 0.2 to 0.75.

20 Soil sample was collected during the month of June-2017 to January 2018 from different locations shown in Table 1 and figure 1a and 1b. For soil sample collection, the field was dogged from the four corners and the center up to 20 cm and one composite sample was made by mixing the soil. The soil was collected in clean plastic bags and brought to the laboratory. In the laboratory the soil has been divided into two parts, one was kept for moisture content analysis and another was air dried for pH analysis. The air dried samples were filtered through a 2mm sieve for further analysis (Khan et al., 2008).

Table 1. Locations of sampling sites

S.No.	Sampling sites (Summer Sampling)	Coding	Sampling sites (winter sampling)	Coding
1	Fathepur	Sm1	Fathepur	Sw1
2	Fathepur	Sm2	Fathepur	Sw2
3	Sunped 1	Sm3	Fathepur	Sw3
4	Sunped 2	Sm4	Fathepur	Sw4
5	Sunped 3	Sm5	Fathepur	Sw5
6	Sect-63	Sm6	Kheri pul	Sw6
7	Unchha Gaon	Sm7	Kheri pul	Sw7
8	Kheri pul	Sm8	Pali Village	Sw8
9	Kheri pul	Sm9	Pali Village	Sw9
10	Faridabad industrial area	Sm10	Pali Village	Sw10

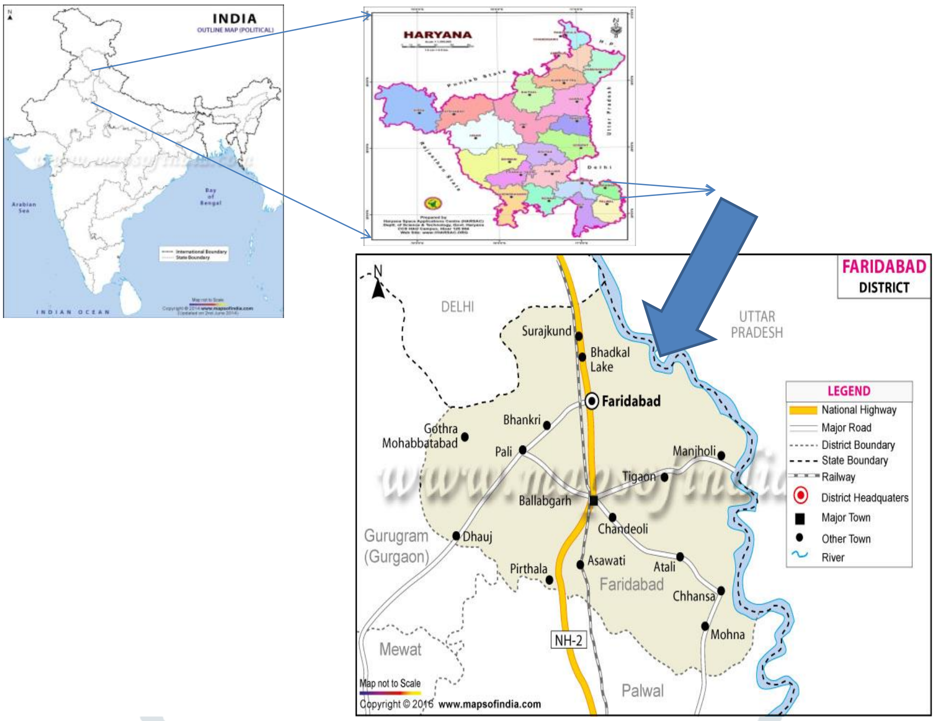

Figure 1 a. Soil sampling site map

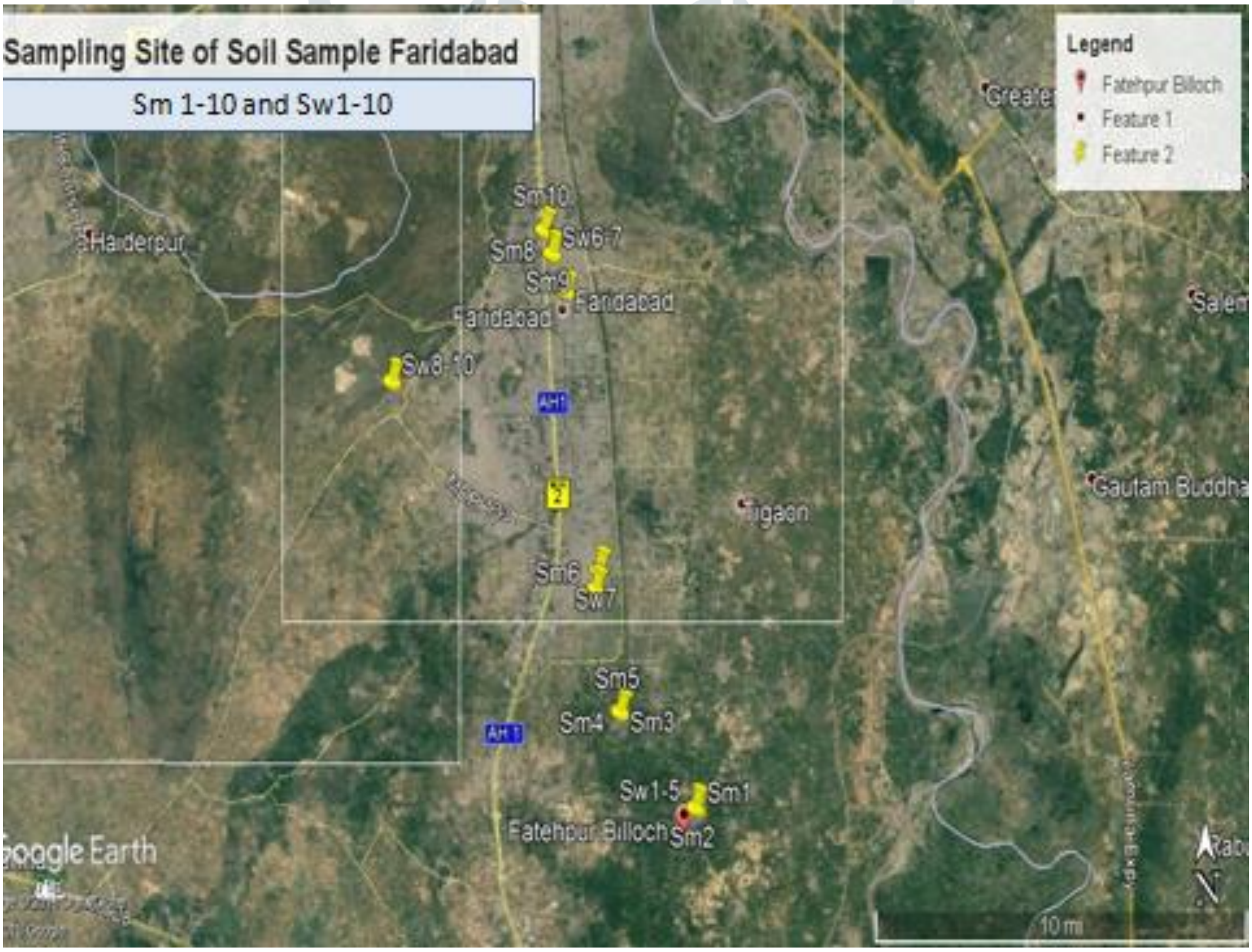

Figure 1 b. Soil sampling sites

MATERIALS AND METHODS

The determination of pH in soil is important as it plays a great role in the availability of nutrients to plants. The electrometric determination of pH by a pH meter is based on measuring the e.m.f. (millivolts) of a pH cell both a reference buffer and then with a test solution. The change in the potential difference at 25^0C for 1 pH unit is 59.1 mV. The pH of a soil is a measure of the hydrogen or hydroxyl ion activity of the soil – water system. It indicates that whether the soil is acidic, neutral or alkaline in reaction. By shaking a certain amount of soil with a certain amount of liquid, soil suspension is brought in equilibrium with a supernatant solution. In the supernatant solution the pH is measured potentiometrically on a direct reading pH meter using a glass electrode with a saturated KCl – calomel reference electrode.

The Standard buffer solutions were made by dissolving one commercially available buffer tablet each of pH 4.0, 7.0 and 9.2 freshly prepared distilled water separately and make up the volume to 100 ml. For pH analysis, 20 gm of 2.0 mm air dry soil was dissolved into 50 ml of distilled water (Addis and Abebaw, 2014) in a beaker and kept for half an hour. In the meantime turned the pH meter ON. Standardized the glass electrode using the standard buffer of pH = 7.0, 4.0, 9.2. Dipped the electrodes in the beakers containing the soil water suspension with constant stirring one by one. While recording pH, switch the pH meter to pH reading, wait for 30 seconds and record the pH value to the nearest 0.1 unit. The Electrode was washed with distilled water and blotted dry with tissue paper after taking the reading of every sample. Put the pH meter in standby mode immediately after recording. The glass electrodes was Standardized after every 10 determinations.

The second parameter analyzed is moisture content which is defined as the quantity of water contained in the soil. Absorption of nutrient largely depends on moisture content of the soil. Soil moisture content also has effect on the texture of the soil. Gravimetric Method (Direct Method) is used for soil moisture content analysis. 20 g soil samples are weighed, dried to constant weight in an oven at 105^0C and reweighed (Addis and Abebaw, 2014). From these measurements, the water content on a dry mass basis is calculated as follows:

$$\text{Moisture content (MC)(\%)} = \frac{\text{Moisture content (MC)(\%)}}{\text{100Initial sample weight (g)}} * 100$$

The corresponding moisture correction factor (mcf) for analytical results or the multiplication factor for the amount of sample to be weighted in for analysis is calculated as:

$$\text{Moisture correction factor (mcf)} = \frac{100 + \%\ \text{moisture}}{100}$$

RESULT AND DISCUSSION:

Maintenance or enhancement of soil quality is a more important criterion for analysis and sustainability of soil ecosystems. Soil pH is considered a master variable in soils as it affects many chemical processes. It specifically affects plant nutrient availability by controlling the chemical forms of the different nutrients and influencing the chemical reactions they undergo. The pH and moisture content of soils from different areas of Faridabad are shown in figure 2-5. The values of the pH were range between 7.54 to 8.96 for the soil samples collected during the summer season while the pH for winter samples was found to be 7.25 to 8.47. The standard deviation of pH samples was calculated as 0.40 and 0.50 for winter and summer samples respectively. pH in the summer was more alkaline as compared to the winter samples. The highest and lowest both pH in summer were reported from the Fathepur which may be due to differential use of fertilizers. During winter pH was found to be highest from Faridabad industrial area and lowest was in Fathepur. Vaneet Kumar et al., also reported the similar results that soil samples of summer were more alkaline as compared to winter (Kumar et al., 2016). They have also shown that pH is negatively correlated with water holding capacity, Total organic carbon, total nitrogen and total available phosphorus of soil. Wodaje Addis in 2014 reported the pH of the soil in the range of 6.53- 7.64 in Amhara Regional Estate of Ethiopia (Addis and Abebaw, 2014). Similar results were found in Yawal taluka, Jalgaon District, India (7.2-8.3) (Kiran G. Chaudhari, 2013), Bhusawal, Jalgaon District, (6.9-8.5) (Kiran G Chaudhari, 2013), Eastern Part of Pune City (7.32 to 8.52) (Wagh et al., 2013), Karnataka (7.07-7.87) (A.M.Shivanna and and G.Nagendrappa, 2014), Punjab (7.11-8.12) (Kaur et al., 2014), Aurangabad city (7.1-8.95) (Asema et al., 2015) , Katol Taluka District Nagpur (7.5 to 7.9) (Borkar AD, 2015), . Other researchers (Verma and Bhatia, 2014) reported the pH 7.6 in the soil around the area of Pariccha Thermal Power Station in Jhansi.

The microbial activity is maximum at pH 7.4. The relationship of pH with the availability of nutrients is different with different soils. In the present investigation all soils are slightly alkaline and under such conditions, the solubility of minerals decreases creating nutrient deficiencies in the soils. Plant growth is therefore limited by deficiencies in iron, manganese, zinc, copper, and boron. pH affects the solubility of metals and hence their availability to the plants. Normally pH is acidic in high rainfall areas as basic cations are forced off the soil colloids by the mass action of hydrogen ions from the rain as those attached to the colloids (OS and WA, 2017). Acidic pH increases the solubility of Al, Fe, Mn, CU and Zn up to such level which becomes toxic to plants while alkaline pH reduces the solubility of same cations and makes them deficient to the plants and reduces the growth of plants. Neutral pH results into inert oxide and hydroxides formation of these cations and hence controls the toxicity. Phosphorus level declines in strongly acidic and alkaline soils. Boron becomes less available to plants in alkaline soil while molybdenum is most often deficient in acidic soils. Acidic pH also decreases the activity of bacteria in the root of leguminous plants and restricts the availability of Ca and Mg to the plants (Allaway, 1957).

The pH of soil affects the availability of heavy metals to the plants. Heavy metals become more available to the plants at acidic pH as acidic pH release the heavy metals from their complex matrix and enhance their solubility in the soil solution. EC Directive 86/278/EEC has set heavy metals (mg/kg) guidelines in the soil for agriculture and after sewage sludge application. The guidelines for Ni at pH 5.0-5.4, 5.5-5.9, 5.5-5.9, >7.1 is 50, 60, 75 and 110 respectively. The guidelines for Cu at pH 5.0-5.4, 5.5-5.9, 5.5-5.9, >7.1 is 80, 100, 135 and 200 respectively. The guidelines for Zn at pH 5.0-5.4, 5.5-5.9, 5.5-5.9, >7.1 is 200, 250, 300 and 450 respectively. So we can clearly see that at higher pH more concentration of heavy metal is tolerable at the agricultural field by plants.

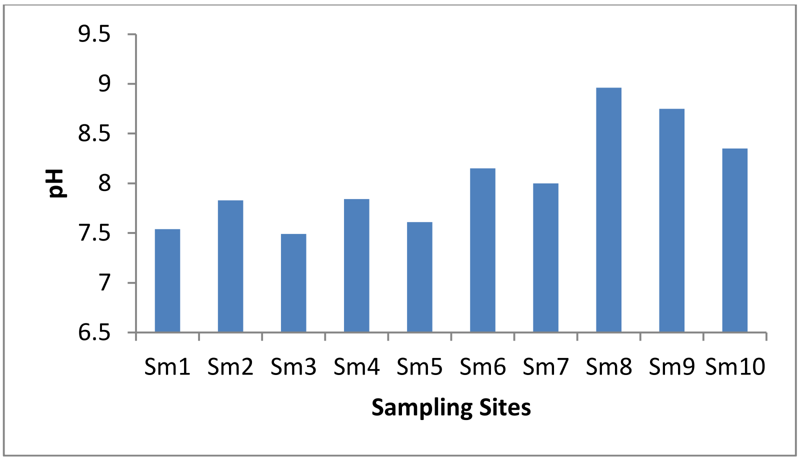

Figure: 2 pH of summer soil samples

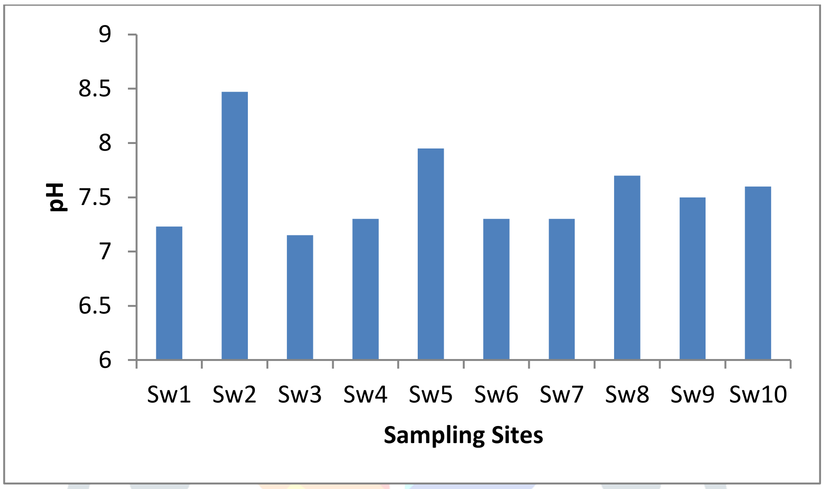

Figure: 3 pH of winter soil samples

Moisture is a most important physical property of soil and is directly dependent on the water holding capacity of soil (Addis and Abebaw, 2014). The absorption of nutrients depends on the moisture of the soil. The water content of a soil is also much related to its texture and structure. The soil moisture commonly depends on the void ratio, particle size, clay minerals, organic matter and groundwater condition (Tale and Ingole, 2016). Wetness depends largely on the porosity of a soil, and for that reason, clayey soil, which has a high porosity generally have larger water content than do sandy soils. Good water holding capacity shows the good physical condition of the soil. Singh et al., have studied the spatial and temporal variation in soil moisture content in India using IRS P4-MSMR data and concluded that maximum content varies from 16-20 % vol. during rainy season while the minimum was found to be 0-4 % vol. in April-May. Indo-Gangetic plain has significant moisture during all seasons. In the present investigation, the moisture content ranged from 8.31% to 12.54% for the soil samples collected during the summer season while the value was found to be 10.11% to 16.15%. The standard deviation for moisture content was calculated as 2.83 and 1.41 for winter and summer samples respectively. If the water becomes too low, a plant becomes stressed. Water is present in more amounts in soil; it is not available to plants due to a high degree of salinity. The other researcher has reported moisture content in soil from 7.35 -11.01%. (Addis and Abebaw, 2014), Katol Taluka District Nagpur (5.80% to 10.25%) (Borkar AD, 2015). Sandy soils retain a very little moisture content while clay holds the maximum. High moisture content result de-aeration (displacement of air) in the soil and hence reduce the oxygen content. Thus moisture content also controls the microbial activity indirectly (OS and WA, 2017).

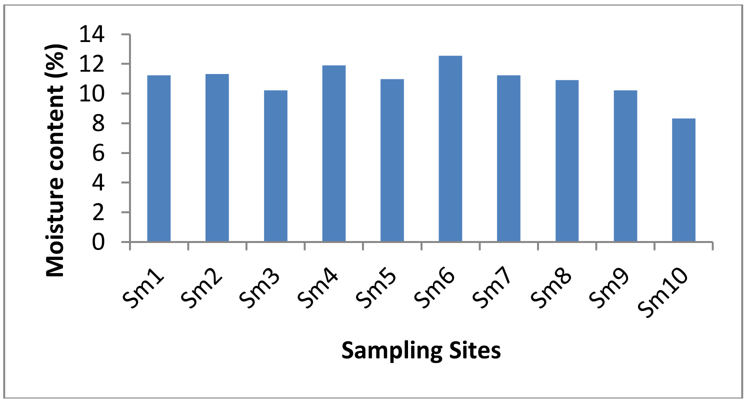

Figure: 4 Moisture content of summer soil samples

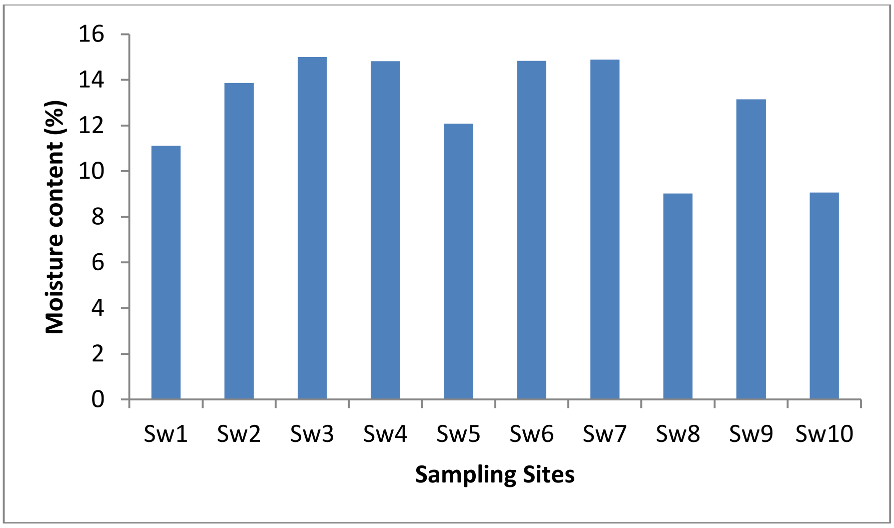

Figure: 5 Moisture content of winter soil samples

CONCLUSION

The pH and moisture content are two basic parameters which every farmer should know in order to adopt proper farming method and in selecting the type of crop which can be grown in the field. The pH range 6-8 is useful for the growth of plants. In the present study, pH of all samples is found to be in slightly to a moderately alkaline range. Growth is affected at most extreme acidic (4) and basic pH (9) if all conditions are suitable for plants, but along with pH and moisture content there are several other parameters which control the growth of plants, so there is need to monitor all the parameters properly and time to time to control the plant growth and provide this information to the farmers. In the present study, 5 samples have shown the pH value >8 out which 4 were summer samples and one was collected during winter. The moisture content ranged from 8.31% to 16.15%. It is concluded that the physicochemical analysis of soil samples under study shows the different concentration of various pH and moisture content at different sites.

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