# CORRELATION OF PH AND ORGANIC CARBON WITH AVAILABLE IRON (FE) IN RED AND YELLOW SOIL (*INSEPTISOLS*) OF OF NAVAGARH BLOCK IN JANJGIR –CHAMPA DISTRICT IN CHHATTISGARH

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*Received-05.03.2015, Revised-24.03.2015*

**Abstract:** A Study was undertaken to evaluate the fertility status of Navagarh block, Janjgir- Champa district, Chhattisgarh, covering 112 villages of Navagarh block and 78 villages under soil fertility on the basis of correlation between status of OC, pH and available Fe in red and yellow soil. The statistical description of soil characteristics indicated that the pH of the soils varied from 4.5 to 7.2 (mean- 5.73). The variation in organic carbon in these soil from 0.25 to 0.85 percent (mean-0.53%). It was observed that soil had low to medium in organic matter status. The DTPA-extractable available Fe content were ranged from 3.24 to 51.42 mg $kg^{-1}$ (mean- 26.52 mg $kg^{-1}$) respectively in soil of Navagarh block. The present study revealed that there is wide variation in soil fertility status in soils of Navagarh block, but by and large, the soils were moderately acidic to neutral in reaction, low to medium in organic carbon, available iron content showed high status. The correlation studies between available micronutrient Fe and soil properties ( pH ,OC) showed significant negative correlation with pH but significant positive correlation with OC.

**Keywords:** Correlation, Organic carbon, pH, Fe

## INTRODUCTION

Soil fertility management will ultimately consider all aspects of soil – plant relationship and pollution of the environment as well. Soil fertility may be defined as the soil system's nutrient supplying capacity. It helps in adopting appropriate measures for overcoming various limitations and at the same time ensures optimum crop production. All plant needs certain mineral elements for proper growth, development, and maintenance. micro ( Fe) nutrients are important soil elements that control its fertility. Soil fertility is one of the important factors in relation to evaluation of productivity status of the soils of an area and region. It is an important aspect in context of sustainable agriculture production. Soil fertility is an important factor, which determines the growth of plants.Soil fertility is related to the amount of available nutrients which is measured by yield capacity. There are some other factors like organic matter or even soil texture which influence the availability of nutrients and the productivity.Soil micro nutrients are an essential as primary and secondary nutrients for the development of crop growth. The addition of micro nutrients to fertilizers in the optimum amounts and in degraded soils ensures the sustainability of cropping through balanced nutrition and ultimately sustainable development of the fertilizer industry. Soil test-based fertility management is an effective tool for increasing productivity of agricultural soils that have high degree of spatial variability resulting from the combined effects of physical, chemical or biological processes (Goovaerts, 1998). However, major constraints impede wide scale adoption of soil testing in most developing countries. In India, these include the prevalence of small holding systems of farming as well as lack of infrastructural facilities for extensive soil testing (Sen *et al.* 2008).

## MATERIAL AND METHOD

Soil physicochemical characteristics of Soil pH was determined in 1:2.5 soil - water suspension after stirring for 30 minutes, by glass electrode pH meter as suggested by Piper.The sample soil used for pH determination was allowed to settle down for four hours then conductivity of supernatant liquid was determined by Solu- bridge as described by Black (1965) . Organic carbon was determined by Walkley and Black's rapid titration method (1934) . The micronutrients Fe were extracted by using 0.005M DTPA (Diethyl triamine penta acetic acid), 0.01M calcium chloride dehydrate and 0.1M triethanol amine buffered at 7.3 pH Lindsay and Novell (1978) and concentrations were analyzed by atomic absorption spectrophotometer 4129.

## RESULT AND DISCUSSION

### Physico-chemical characteristics

**Table 1.** Salient soil properties of the study area

| Soil characteristics | Range | Mean | S.D |
|---|---|---|---|
| pH (1:2.5,Soil:water) | 4.5-7.2 | 5.73 | ± 0.55 |

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| | | | |
|---|---|---|---|
| O.C. (%) | 0.25-0.83 | 0.53 | ± 0.09 |
| AvailableFe (mg $kg^{-1}$) | 3.24-51.42 | 26.52 | ±10.91 |

**Table 2.** Limits for the soil test values used for rating the soil

| **Classification for pH values** | | | | |
|---|---|---|---|---|
| **Strongly acid** | **Moderately acid** | **Slightly acid** | **Neutral** | **Slightly alkaline** |
| <5.0 | 5.0-6.0 | 6.1-6.5 | 6.6-7.5 | 7.6-8.5 |
| **Parameters** | **Low** | **Medium** | **High** | |
| O.C. (%) | <0.50 | 0.50-0.75 | >0.75 | |
| | **Micronutrients** | | | |
| | **Deficient** | **Sufficient** | **High level** | |
| Av. Fe (mg $kg^{-1}$) | <4.50 | >4.50 | >9.00 | |

**Table 3.** Category of soil samples under different pH rating of Navagarh block

| **Classes** | **Red and yellow soil** | | |
|---|---|---|---|
| | **Limit** | **No. of Samples** | **% Samples** |
| **Strongly acid** | <5.0 | 110 | 5.54 |
| **Moderately acid** | 5-6.0 | 1311 | 66.07 |
| **Slightly acid** | 6.1-6.5 | 407 | 20.52 |
| **Neutral** | 6.6-7.5 | 156 | 7.87 |
| **Slightly alkaline** | 7.6-8.5 | 0 | 0 |
| **Total** | | **1984** | **100** |

**Soil reaction (pH)**

The red and yellow soil samples of the study area were determined for pH (Table 4.1) and observed in the range of 4.5 - 7.2 with the mean value of 5.73. pH estimation from total 1984 soil samples of Navagarh block covering about 78 villages was done and it was observed under strongly acidic 5.54 %, under moderately acidic 66.07% under slightly acidic 20.52 % and only 7.87 % samples were categorized under neutral soil. (Table 4.3) Similar results were also noted by Kher and Khajuria (2005), Jena *et al*. (2008), Jatav (2010) and Shukla (2011). The lowest average pH 5.0 of the Chorgaon village was under moderately acidic in reaction as compare to highest pH i.e. 6.7 in Pachari village of the Navagarh block.

**Table 4.** Distribution and categorization of organic carbon status in soil of Navagarh block

| **Organic carbon (%)** | **Red and yellow soil** | |
|---|---|---|
| **Classes** | **No. of Samples** | **% Samples** |
| **Low**(0.25-0.50) | 387 | 19.5 |
| **Medium**(0.50-0.75) | 1577 | 79.5 |
| **High**(>0.75) | 20 | 1.0 |
| **Total** | **1984** | **100.0** |

**Organic Carbon**

The organic C analyzed in all sampled red and yellow soil exhibited in the range of 0.25 to 0.83 with a mean value of 0.53 % (Table 1). Thus, red and yellow soil is having low to medium status of organic carbon. Distribution of soil samples with respect to organic C content indicates that about 19.5 % samples had low (<0.50 %) organic C, 79.5 % in medium (0.50-0.75 %) and only 1.0 % samples had higher organic C (>0.75 %). Use of almost nil to very

low amount of organic wastes like farm yard manure and chemical fertilizers in imbalanced manner was the main reason for poor organic C resulted low productivity of the region. High temperature and good aeration in the soil increased the rate of oxidation of organic matter resulting reduction of organic carbon content. The high temperature prevailing in the area was responsible for the rapid burning of organic matter, thus resulting in medium organic carbon content of these soils. Similar results were also noted by Lathwal (2006),Sarma *et al.* (2008) in the soils of Amritsar District, jatav (2010) and shukla (2011). An average value of OC of the soil was found minimum i.e. 0.4% and maximum 0.6% of Navagarh block.

**Table 5.** Distribution of available iron status in surface soil of Navagarh block

| **Rating of available Fe (mg kg$^{-1}$)** | | **Red and yellow soil** | |
|---|---|---|---|
| | | **No. of Samples** | **% Samples** |
| **Deficient** | <4.5 | 9 | 0.45 |
| **Sufficient** | 4.5-9.0 | 111 | 5.59 |
| **High level** | >9.0 | 1864 | 93.95 |
| **Total** | | **1984** | **99.99** |

**Available iron status**

The DTPA-extractable Fe content of red and yellow soil under study ranged from 3.24 to 51.42 mg kg$^{-1}$ with mean 26.52 mg kg$^{-1}$ (Table 1). Considering 4.5 mg kg$^{-1}$ (Table 5) DTPA-extractable Fe as critical limit (Lindsay and Norvell 1978), the data reveals that 5.59% soil samples were found to be sufficient in available Fe content and 93.95% in higher level and only 0.45% soil samples were found to be deficient level (Table 5). High available Fe content in red and yellow soil of Navagarh block might be due to its topography relief and cultivation of rice, which induced an erotic prolonged submergence coupled with reducing conditions. The soil in study area was some deficient in Fe as the amount of Fe required by crops is being released by Fe bearing minerals in these soil. The pH had reverse effect on the availability of Fe content in soil. Gajbhiye *et al.* (1993) in soil of Saongi watershed of Maharashtra, Rajeswar *et al.* (2009) in soil of Garikapadu of Krishna District of Andhra Pradesh have also reported the similar trends in available Fe content. Vaisnow (2010), Jatav (2010), Shukla (2011). The highest and lowest mean values of available iron content for red and yellow soil were recorded 44.22 and 11.3 mg kg$^{-1}$ in Navagarh block.

**Table 6.** Averages of available micronutrients in different ratings of pH and organic carbon

| | **Limit** | **No. of Samples** | **Available micronutrients (mg kg$^{-1}$)** |
|---|---|---|---|
| | | | **Fe** |
| | <5.0 | 110 | 27.6 |
| **pH** | 5-6.0 | 1311 | 27.1 |
| | 6.1-6.5 | 407 | 24.9 |
| | 6.6-7.5 | 156 | 25.0 |
| **Organic carbon (%)** | <0.50 | 387 | 28.0 |
| | (0.50-0.75) | 1577 | 26.2 |
| | (>0.75) | 20 | 27.0 |

**Available Fe, content in relation to soil characteristics Soil reaction (pH) and Organic carbon**

In general the data presented in table 6 show that pH is inversely related with DTPA-extractable Fe content. The availability of DTPA- extractable Fe content show high values due to their solubility effects. No relationships were found between OC and DTPA-extractable Fe content. Since the OC statuses in the soil under study were in the range of lower values hence no definite relationship could be observed with micronutrient.

**Table 7.** Correlation coefficients (r) between physico-chemical properties and DTPA-extractable Fe in red and yellow of Navagarh block

| Soil properties | Fe |
|---|---|
| **pH** | -0.150** |
| **O.C.** | -0.153** |

*Significant at 5% level ** Significant at 1% level

**Relationship between soil characteristics and DTPA-extractable Fe in red and yellow soil Iron**

The DTPA-Fe showed a negative and significant correlation (r =-0.150**) with pH (Table 7) which confirms the basic chemistry of Fe availability in various pH level of the soil. Talukdar *et al.* (2009), Verma *et al.* (2007), Singh *et al.* (2006) and Somasundaram *et al.* (2009) Jatav (2010), Shukla (2011) also reported significant negative correlation of available Fe with pH of the soil. The correlation of Fe level showed a negative and significant result (r =-0.071*), Similar observations were also observed by Somasundaram *et al.* (2009), and Sharma *et al.* (2006). The DTPA-Fe indicated negative and significant correlation (r =-0.153**) with organic C (Table 7). No significant positive correlations of pH, and organic C with the DTPA- extractable micronutrients were observed in present study.

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