Fertility Mapping of Soils from Hingoli and Sengaon Tahsils of Hingoli District, India

S.R. Adat*, T.R. Zagade and P.B. Chalawade

Department of Soil Science and Agril.Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, India

*Corresponding author:

A B S T R A C T

Studies on “Fertility mapping of soils from Hingoli and Sengaon tahsils of Hingoli district” was carried out to investigate the nutrient status of these soils. From each village five representative soil samples were collected and from each tahsil twenty villages were selected. Hundred samples were collected from each tahsil and total 200 soil samples were collected from Hingoli and Sengaon tahsils. Available N content of Hingoli soils were ranged from 105.62 to 457.85 Kg ha\(^{-1}\) with a mean value of 183.04 Kg ha\(^{-1}\). The available phosphorus content in these soils were varied from 5.28 to 20.07 Kg ha\(^{-1}\) with a mean value of 10.09 Kg ha\(^{-1}\). The available potassium content varies from 129.70 to 1053.40 Kg ha\(^{-1}\) with an average value of 498.59 Kg ha\(^{-1}\). Soils from Sengaon tahsils varies in available N from 112.88 to 313.60 Kg ha\(^{-1}\) with an average value of 216.42 Kg ha\(^{-1}\). Available P content in these soils was ranges from 5.73 to 21.14 Kg ha\(^{-1}\) with an average value of 10.81 Kg ha\(^{-1}\). Available K content in these soils was ranges from 206.50 to 910.30 Kg ha\(^{-1}\) with an average value of 485.30 Kg ha\(^{-1}\). In secondary nutrients, exchangeable Ca content with an average value of 13.93 Cmol(P\(^{+}\)) kg\(^{-1}\) of soil. The data on exch. Mg with an average value of 1.84 Cmol(P\(^{+}\)) kg\(^{-1}\) of soil and available sulphur of these soil were ranged from 4.28 to 18.99 mg kg\(^{-1}\) with average value of (11.58 mg kg\(^{-1}\)) from Hingoli tahsils. Exch. Ca content of Sengaon tahsils soils were varied from 10.41 to 17.32 Cmol(P\(^{+}\)) kg\(^{-1}\) of soil with an average value of 13.93 Cmol(P\(^{+}\)) kg\(^{-1}\) of soil. The data on exch. Mg and their categorization in Sengaon soils showed that the exch. Mg content of these soils were varied from 0.16 to 5.12 Cmol(P\(^{+}\)) kg\(^{-1}\)of soil with an average value of 1.62 Cmol(P\(^{+}\)) kg\(^{-1}\) of soil. Available sulphur of these soil were ranged from 4.24 to 16.56 mg kg\(^{-1}\) with average value of (10.40 mg kg\(^{-1}\)).

Keywords
Nutrient, Mapping, Fertility, Hingoli district, India

Introduction

Soils are a vital natural resource whose proper use greatly determines the capabilities of life support system and socio-economic development of people. Being important component of geosphere-biosphere system, Soil provides food, fiber, fodder, and fuel wood for varieties of basic human needs and shelter demand of future. Therefore, management of soil resource on scientific principles is of prime important (Sarkar et al., 2002). Soil is a natural dynamic body containing mineral matter, organic matter and living forms considered to be store house of nutrients even though their continuous removal by intensive cropping. Among the several factors that influence crop
production potential, soil fertility is fundamental factors. It is the integral part of soil and generally defined as capacity of soil to supply nutrient needed by crop in proper form and which having both direct and indirect effect on plant growth.

Intensive cropping and increased use of fertilizers, though there is increasing production tremendously, resulted in heavy turnover of nutrients from soil. There is a continuous decline in soil fertility and productivity due to exploitation of soil resource base. Imbalanced and indiscriminate use of fertilizers and emergence of micronutrients deficiencies have been identified as most important factors for declining crop productivity (Kanwar and Randhava, 1967) and Puri et al., (2003).

To know the present status of soil and future productivity, it is essential to know the fertility status. Considerable work on physico-chemical properties of Maharashtra soils was reported (Bharambe, 2001). Thus, it is necessary to define the areas of deficiency of particular nutrients in a particular areas and crops. Soil test data would be helpful in growing such deficient areas on soil and crop basis. Thus, the details of soil resource thematic maps and using data on various soil properties, focus given on fertility status, hence, present investigation is useful in judging the deficiencies of various nutrients.

**Materials and Methods**

Available macronutrient content in soils were determined by following methods.

**Available nitrogen**

Available nitrogen was determined by alkaline potassium permanganate method as suggested by (Subbiah and Asija, 1956).

**Available phosphorus**

The Available phosphorus was determined by Olsen’s method using 0.5 M sodium bicarbonate (pH 8.5) as an extracting reagent as described by (Chopra and Kanwar,1976).

**Available potassium**

The Available potassium was determined by soil treated with neutral normal ammonium acetate and the potassium in extract was determined by emission spectroscopy by flame photometer (Jackson,1967).

**Exchangeable Ca and Mg**

Exchangeable Ca and Mg was determined by using ammonium acetate extractant of soil by EDTA Versenate Method (Jackson, 1973)

**Available Sulphur**

The available sulphur was determined by using Turbidi metric method by using 1:5 soil and extractant 0.15 % CaCl₂ solution on spectrophotometer at 340 nm wavelength (William and Seinberes, 1969).

**Results and Discussion**

**Status of Available N, P, and K in soils**

The N, P and K are the key nutrient, which are required for plant metabolism. Due to imbalance supply of faulty management practices there is decrease in availability of these nutrients. Hence wide spread deficiency or unavailability of nutrients in soils of Hingoli and Sengaon tahsils undertaking for study.

The data on status of N, P and K and their categorization in soils of Hingoli tahsil showed in above table that the available N content of these soils were ranged from
105.62 to 457.85 Kg ha\(^{-1}\) with a mean value of 183.04 Kg ha\(^{-1}\). The lowest N content (105.62 Kg ha\(^{-1}\)) was observed in soils of Sakhara village whereas the highest N content (457.85 Kg ha\(^{-1}\)) were recorded in soils of Bhankheda (Sample No. A96). Out of 20 villages the lowest range 118.15 to 187.80 Kg ha\(^{-1}\) with an average value of 153.81 Kg ha\(^{-1}\) was observed in Bhankheda. Out of 100 soil samples, 94 percent in low (<250 Kg ha\(^{-1}\)) and 6 percent medium (250 to 500 Kg ha\(^{-1}\)) in available N content.

The available phosphorus content in these soils were varied from 5.28 to 20.07 Kg ha\(^{-1}\) with a mean value of 10.09 Kg ha\(^{-1}\). The lowest P (5.28 Kg ha\(^{-1}\)) content was observed in Sakhara village (Sample No. A9), while highest P (20.07 Kg ha\(^{-1}\)) was recorded in village Pimparilinga (Sample No. A55). These results clearly showed that the soils of Hingoli tahsil were low to medium in P content. The large range may be due to variation in soil properties and their high P fixing capacity, which prevents to come into readily available form in soil solution. These results were confrimry with Patil and Sonar, (1994) and Puri, (2009).

The available potassium contents in these soils were ranged from 129.70 to 1053.40 Kg ha\(^{-1}\) with an average value of 498.59 Kg ha\(^{-1}\). The lowest value of K was recorded in soils of Ghordari while highest value of K content was recorded in Suki village. Among twenty villages the lowest range in K content were ranges from 129.70 to 493.70 Kg ha\(^{-1}\) with an average value of 311.52 Kg ha\(^{-1}\) in village Ghordari while highest range 409.10 to 989.40 Kg ha\(^{-1}\) with an average value of 678.18 Kg ha\(^{-1}\) K were observed in Sakhara village. Out of 100 samples 3, 17 and 80 percent samples were categorized in low (<150 Kg ha\(^{-1}\)), medium (150 to 300 Kg ha\(^{-1}\)) and high (> 300 Kg ha\(^{-1}\)) in K content respectively.

**Status of available N, P and K of Sengaon tahlis soils**

Available N content of these soils were varied from 112.88 to 313.60 Kg ha\(^{-1}\) with an average value of 216.42 Kg ha\(^{-1}\). The lowest available N content was recorded in village Bhankheda. While, highest content of N was observed in village Warudkazi. Further, data indicate that the lowest range of 118.15 to 187.80 Kg ha\(^{-1}\) with a mean value of 153.81 Kg ha\(^{-1}\) was observed in Chaundi village whereas, highest range 106.60 to 457.85 Kg ha\(^{-1}\) were recorded with an average value of 211.95 Kg ha\(^{-1}\) in N content of these soils. Among twenty villages all villages were low in N content. Out of 100 soil samples 93 percent samples were low and 7 percent medium in available N content.

The available P content in these soils were ranges from 5.73 to 21.14 Kg ha\(^{-1}\) with an average value of 10.81 Kg ha\(^{-1}\). The lowest P content was recorded in village Pimparilinga whereas, highest P content was recorded in village Borada. The lowest range 5.73 to 9.58 Kg ha\(^{-1}\) in available P content with a mean value of 7.66 Kg ha\(^{-1}\) were recorded in Pimparilinga village while highest range 10.57 to 21.14 Kg ha\(^{-1}\) with an average value of 15.62 Kg ha\(^{-1}\) were recorded in soils of Borada village. Among 20 villages, 10 villages were low and 10 villages which were medium in P content. Out of 100 soil samples 55 percent in low, and 45 per cent sample was categorized under medium content of available P.

The available K content in these soils were ranges from 206.50 to 910.30 Kg ha\(^{-1}\) with an average value of 485.30 Kg ha\(^{-1}\). The lowest value of K content was recorded in village
Bhankheda whereas, highest value of K content was observed in soils of Ganeshpur village. The lowest range 206.50 to 520.80 Kg ha\(^{-1}\) K with mean value of 372.86 Kg ha\(^{-1}\) was recorded in Bhankheda village, while highest range 471.80 to 910.30 Kg ha\(^{-1}\) was observed in soils of Ganeshpur village. Out of Twenty villages, 13 villages viz., Bhankheda (372.86 Kg ha\(^{-1}\)), Chaundi (469.72 Kg ha\(^{-1}\)), Goregaon (406.22 Kg ha\(^{-1}\)), Gondala (406.96 Kg ha\(^{-1}\)), Ghordari (412.56 Kg ha\(^{-1}\)), Kendre (495.74 Kg ha\(^{-1}\)), Mhalsi (430.42 Kg ha\(^{-1}\)), Veltura (448.82 Kg ha\(^{-1}\)), Pimpaldari(452.00 Kg ha\(^{-1}\)), Vadhivra (479.84 Kg ha\(^{-1}\)) Sukli (493.18 Kg ha\(^{-1}\)), Waghjali (399.50 Kg ha\(^{-1}\)) and Warudkazi (459.86 Kg ha\(^{-1}\)) were categorized in medium K content and remaining villages were categorized under high content of K.

**Status of exchangeable Ca, Mg and available Sulphur of Hingoli tahsil soils**

Exch.Ca content of these soils were varied from 11.24 to 19.60 Cmol(P\(^{+}\))kg\(^{-1}\) of soil with an average value of 13.93 Cmol(P\(^{+}\))kg\(^{-1}\) of soil. The lowest available Ca content was recorded in village Sukli (Sample no.HQ1). While, highest content of Ca was observed in village Ajegaon (Soil sample No.HB2). Further, data indicate that the lowest range of 12.08 to 13.28 Cmol (P\(^{+}\)) kg\(^{-1}\) of soil with a mean value of 12.82 Cmol(P\(^{+}\))/kg of soil observed in Hingoli village whereas, highest range 13.12 to 19.60 Cmol (P\(^{+}\)) kg\(^{-1}\) of soil recorded with an average value of 14.95 Cmol(P\(^{+}\))/kg of soil content of these soils. Out of 100 soil samples 91 per cent samples were low and 9 per cent medium in available Ca content. These value indicated that Ca content in the Hingoli soils were low to medium.

From above result, it was inferred that high calcium because of presence of CaCO\(_3\) which dominant source of calcium in soil and it liberate when mineral disintegrate and decompose. Mahapatra and Shahu (1996) reported that exchangeable Ca\(^{+}\) varied from 1.07 to 29.6 Cmol(P\(^{+}\))kg\(^{-1}\). Similar results were observed by More et al., (2002).

The data on exch. Mg and their categorization in Hingoli soils showed in revealed that the exch. Mg content of these soils were varied from 0.16 to 6.32 Cmol(P\(^{+}\))kg\(^{-1}\) of soil with an average value of 1.84 Cmol(P\(^{+}\))kg\(^{-1}\) of soil. The lowest available Mg content was recorded in village Kalkondi (sample no.HK5). While, highest content of Mg was observed in village Takli (sample no.HT3). Further, data indicate that the lowest range of 0.64 to 1.60 Cmol(P\(^{+}\))kg\(^{-1}\) of soil with a mean value of 1.28 Cmol(P\(^{+}\))kg\(^{-1}\) of soil observed in Karanjali village whereas, highest range 0.80 to 5.44 Cmol(P\(^{+}\))kg\(^{-1}\) of soil recorded with an average value of 2.92 Cmol(P\(^{+}\))kg\(^{-1}\) of soil of these soils. Out of 100 soil samples, 87 per cent samples were low, 10 percent medium and 3 per cent were low in available Mg content (Fig 5). Mahapatra and shahu,(1996) reported that exch. Mg\(^{+}\) varied from 0.66 to 30.1 Cmol(P\(^{+}\))kg\(^{-1}\). Similar results quoted by More et al., (2002).

Available Sulphur of these soil were ranged from 4.28 to 18.99 mg kg\(^{-1}\) with average value of (11.58 mg kg\(^{-1}\)). The lowest value (4.28 mg kg\(^{-1}\)) of S content was recorded in village Mauja, (sample no. A68) where as highest value of S was recorded in soils of Digraj village. The lowest range 4.72 to 12.81 mg kg\(^{-1}\) with mean value of 9.03 mg kg\(^{-1}\) were recorded in Boralwadi village while highest range 11.31 to 17.50 mg kg\(^{-1}\) with an average value of 14.44 mg kg\(^{-1}\) were observed in Ghota village in available S content in these soils of Hingoli tahsil.

**Status of exch. Ca, Mg and available S of Sengaon tahsil soils**

Exch. Ca content of these soils were varied from 10.41 to 17.32 Cmol(P\(^{+}\))kg\(^{-1}\) of soil with
an average value of 14.16 Cmol(P⁺) kg⁻¹ of soil. The lowest exch.Ca content was recorded in village Goregaon (sample no.SI2). While, highest content of Ca was observed in village Ajegaon (sample no.SB1). Further, data indicated that the lowest range of 10.41 to 15.12 Cmol(P⁺) kg⁻¹ of soil with a mean value of 13.29 Cmol(P⁺) kg⁻¹ of soil observed in Bhankheda village whereas, highest range 12.80 to 17.32 Cmol(P⁺) kg⁻¹ of soil recorded with an average value of 14.85 Cmol(P⁺) kg⁻¹ of soil content of these soils. Among twenty villages, maximum villages were low in Ca content. Out of 100 soil samples indicated that Ca content in the Sengaon soils were low to medium. From above result, it was inferred that high calcium because of presence of CaCO₃ which dominant source of calcium in soil and it liberate when mineral disintegrate and decompose. The data on exch. Mg and their categorization in Sengaon soils showed in table 15 revealed that the exch. Mg content of these soils were varied from 0.16 to 5.12 Cmol(P⁺) kg⁻¹ of soil with an average value of 1.62 Cmol(P⁺) kg⁻¹ of soil. The lowest available Mg content was recorded in village Mhalshi (Sample no.SK1). While, highest content of Mg was observed in village Ghordari (sample no.SG4). Among twenty villages, maximum villages were low in Mg content.

Table.1 Status of available N,P and K in soils of Hingoli tahsil from Hingoli district

| Sr. No. | Sample No. | N (Kg ha⁻¹) | P (Kg ha⁻¹) | K (Kg ha⁻¹) |
|---------|------------|-------------|-------------|-------------|
| 1       | HA1        | 185.45      | 12.00       | 311.10      |
| 2       | HA2        | 126.78      | 9.84        | 381.20      |
| 3       | HA3        | 180.45      | 15.90       | 237.40      |
| 4       | HA4        | 194.43      | 11.91       | 403.70      |
| 5       | HA5        | 240.60      | 10.03       | 341.50      |
| 6       | HB1        | 214.24      | 8.96        | 139.00      |
| 7       | HB2        | 244.60      | 11.51       | 493.40      |
| 8       | HB3        | 195.22      | 7.43        | 894.30      |
| 9       | HB4        | 165.20      | 11.91       | 367.80      |
| 10      | HB5        | 147.34      | 8.06        | 797.90      |
| 11      | HC1        | 158.45      | 10.43       | 471.80      |
| 12      | HC2        | 457.85      | 9.58        | 424.90      |
| 13      | HC3        | 210.10      | 8.96        | 335.80      |
| 14      | HC4        | 126.78      | 6.98        | 813.60      |
| 15      | HC5        | 106.60      | 6.76        | 308.20      |
| 16      | HD1        | 187.80      | 9.40        | 385.40      |
| 17      | HD2        | 154.66      | 10.57       | 287.50      |
| 18      | HD3        | 142.28      | 9.77        | 645.00      |
| 19      | HD4        | 166.20      | 12.00       | 367.80      |
| 20      | HD5        | 118.15      | 6.09        | 273.60      |
| 21      | HE1        | 380.40      | 19.26       | 368.90      |
| 22      | HE2        | 125.40      | 7.51        | 558.00      |
| 23      | HE3        | 185.72      | 6.63        | 242.30      |
| 24      | HE4        | 106.68      | 7.17        | 526.10      |
| 25      | HE5        | 188.42      | 17.20       | 669.30      |
| 26      | HF1        | 179.90      | 8.51        | 652.70      |
| 27      | HF2        | 178.75      | 9.04        | 337.00      |
|   |   |   |   |
|---|---|---|---|
| 28 | HF3 | 191.20 | 6.89 | 486.40 |
| 29 | HF4 | 174.39 | 17.90 | 451.60 |
| 30 | HF5 | 142.12 | 9.98 | 571.20 |
| 31 | HG1 | 129.64 | 5.82 | 296.50 |
| 32 | HG2 | 196.42 | 14.51 | 1076.20 |
| 33 | HG3 | 212.24 | 11.52 | 543.90 |
| 34 | HG4 | 208.12 | 10.03 | 343.70 |
| 35 | HG5 | 190.45 | 12.18 | 1486.90 |
| 36 | HH1 | 219.42 | 8.96 | 316.20 |
| 37 | HH2 | 176.38 | 6.23 | 129.70 |
| 38 | HH3 | 144.28 | 7.57 | 493.70 |
| 39 | HH4 | 195.56 | 10.00 | 168.80 |
| 40 | HH5 | 212.44 | 7.97 | 449.20 |
| 41 | HI1 | 210.79 | 11.24 | 506.80 |
| 42 | HI2 | 238.33 | 14.24 | 349.80 |
| 43 | HI3 | 181.88 | 11.64 | 446.60 |
| 44 | HI4 | 150.98 | 8.24 | 282.70 |
| 45 | HI5 | 225.78 | 16.93 | 588.50 |
| 46 | HJ1 | 215.24 | 12.45 | 589.40 |
| 47 | HJ2 | 175.32 | 10.57 | 438.30 |
| 48 | HJ3 | 112.89 | 6.89 | 496.60 |
| 49 | HJ4 | 210.11 | 9.22 | 416.00 |
| 50 | HJ5 | 210.43 | 9.13 | 296.30 |
| 51 | HK1 | 241.47 | 13.97 | 494.30 |
| 52 | HK2 | 156.18 | 7.97 | 288.60 |
| 53 | HK3 | 144.26 | 6.06 | 349.8 |
| 54 | HK4 | 215.12 | 6.89 | 626.70 |
| 55 | HK5 | 133.76 | 7.43 | 756.60 |
| 57 | HL2 | 135.68 | 8.24 | 651.50 |
|    |   |    |    |
|----|---|----|----|
| 58 | HL3 | 173.38 | 7.70 | 281.00 |
| 59 | HL4 | 192.14 | 13.44 | 253.10 |
| 60 | HL5 | 150.52 | 8.24 | 423.10 |
| 61 | HM1 | 144.32 | 7.43 | 401.80 |
| 62 | HM2 | 187.85 | 6.63 | 609.10 |
| 63 | HM3 | 128.08 | 10.03 | 200.50 |
| 64 | HM4 | 180.42 | 9.63 | 304.80 |
| 65 | HM5 | 166.25 | 10.30 | 694.40 |
| 66 | HN1 | 238.33 | 5.28 | 512.10 |
| 67 | HN2 | 105.62 | 7.16 | 409.10 |
| 68 | HN3 | 290.51 | 15.59 | 864.50 |
| 69 | HN4 | 140.82 | 11.91 | 615.80 |
| 70 | HN5 | 195.88 | 17.90 | 989.40 |
| 71 | HO1 | 168.75 | 11.37 | 210.30 |
| 72 | HO2 | 270.52 | 12.27 | 329.60 |
| 73 | HO3 | 174.5 | 6.90 | 636.20 |
| 74 | HO4 | 158.24 | 9.67 | 485.10 |
| 75 | HO5 | 172.48 | 10.43 | 388.30 |
| 76 | HP1 | 177.52 | 10.04 | 283.30 |
| 77 | HP2 | 128.30 | 6.89 | 228.70 |
| 78 | HP3 | 180.32 | 11.46 | 494.70 |
| 79 | HP4 | 195.84 | 11.91 | 396.50 |
| 80 | HP5 | 182.45 | 11.10 | 456.40 |
| 81 | HQ1 | 213.24 | 11.82 | 261.50 |
| 82 | HQ2 | 125.78 | 7.30 | 510.50 |
| 83 | HQ3 | 235.20 | 12.72 | 445.80 |
| 84 | HQ4 | 260.28 | 15.85 | 390.80 |
| 85 | HQ5 | 213.24 | 5.56 | 1053.40 |
| 86 | HR1 | 166.20 | 8.37 | 250.30 |
**Table 2** N, P, and K status of Sengaon tahsil soils

| Sr.No. | Sample No. | N (Kg ha⁻¹) | P (Kg ha⁻¹) | K (Kg ha⁻¹) |
|--------|------------|-------------|------------|-------------|
| 1      | SA1        | 188.10      | 14.11      | 629.80      |
| 2      | SA2        | 132.68      | 8.51       | 787.60      |
| 3      | SA3        | 165.80      | 6.89       | 424.10      |
| 4      | SA4        | 154.18      | 8.24       | 445.20      |
| 5      | SA5        | 140.02      | 7.88       | 256.90      |
| 6      | SB1        | 216.38      | 7.97       | 906.80      |
| 7      | SB2        | 205.16      | 7.61       | 550.80      |
| 8      | SB3        | 185.02      | 9.22       | 446.80      |
| 9      | SB4        | 222.65      | 11.37      | 270.70      |
| 10     | SB5        | 310.40      | 7.52       | 550.50      |
| 11     | SC1        | 150.54      | 8.15       | 450.80      |
| 12     | SC2        | 256.60      | 14.15      | 253.40      |
| 13     | SC3        | 112.88      | 10.57      | 520.80      |
| 14     | SC4        | 182.75      | 7.62       | 432.80      |
| 15     | SC5        | 191.83      | 6.09       | 206.50      |
| 16     | SD1        | 206.97      | 16.93      | 337.60      |
| 17     | SD2        | 197.00      | 9.36       | 605.20      |
| 18     | SD3        | 219.52      | 14.78      | 507.60      |
| 19     | SD4        | 191.29      | 18.45      | 426.40      |
|   |   |   |   |   |
|---|---|---|---|---|
| 20 | SD5 | 142.62 | 10.12 | 471.80 |
| 21 | SE1 | 263.42 | 12.45 | 366.50 |
| 22 | SE2 | 205.10 | 10.93 | 509.20 |
| 23 | SE3 | 194.48 | 12.18 | 325.80 |
| 24 | SE4 | 200.70 | 7.17 | 233.00 |
| 25 | SE5 | 184.65 | 11.64 | 596.60 |
| 26 | SF1 | 238.18 | 16.57 | 277.20 |
| 27 | SF2 | 206.10 | 6.98 | 375.80 |
| 28 | SF3 | 200.70 | 10.03 | 635.80 |
| 29 | SF4 | 156.75 | 13.97 | 328.50 |
| 30 | SF5 | 242.80 | 12.85 | 420.20 |
| 31 | SG1 | 163.20 | 9.04 | 910.30 |
| 32 | SG2 | 170.85 | 15.05 | 650.30 |
| 33 | SG3 | 144.25 | 7.52 | 475.20 |
| 34 | SG4 | 159.93 | 8.96 | 628.50 |
| 35 | SG5 | 181.88 | 6.45 | 171.80 |
| 36 | SH1 | 124.30 | 9.14 | 378.50 |
| 37 | SH2 | 176.15 | 9.58 | 268.30 |
| 38 | SH3 | 163.84 | 15.41 | 562.40 |
| 39 | SH4 | 198.65 | 13.96 | 327.80 |
| 40 | SH5 | 172.82 | 16.53 | 430.20 |
| 41 | SI1 | 188.16 | 13.88 | 420.00 |
| 42 | SI2 | 175.88 | 9.67 | 270.40 |
| 43 | SI3 | 192.12 | 7.16 | 734.00 |
| 44 | SI4 | 191.29 | 9.76 | 737.20 |
| 45 | SI5 | 169.52 | 6.45 | 317.10 |
| 46 | SJ1 | 232.40 | 13.44 | 275.30 |
| 47 | SJ2 | 185.02 | 10.57 | 737.20 |
| 48 | SJ3 | 238.33 | 14.78 | 430.20 |
| 49 | SJ4 | 313.60 | 21.14 | 712.90 |
| 50 | SJ5 | 181.88 | 18.18 | 509.60 |
| 51 | SK1 | 193.50 | 8.37 | 475.20 |
| 52 | SK2 | 203.84 | 18.90 | 320.70 |
| 53 | SK3 | 210.11 | 14.24 | 596.40 |
| 54 | SK4 | 191.29 | 12.81 | 350.70 |
| 55 | SK5 | 178.20 | 11.91 | 409.10 |
| 56 | SL1 | 190.22 | 9.58 | 328.60 |
| 57 | SL2 | 185.30 | 5.73 | 224.10 |
| 58 | SL3 | 178.75 | 6.36 | 409.10 |
| 59 | SL4 | 194.43 | 7.70 | 705.30 |
| 60 | SL5 | 198.60 | 8.96 | 592.90 |
|   |   |   |   |   |
|---|---|---|---|---|
| 61 | SM1 | 222.65 | 19.89 | 460.50 |
| 62 | SM2 | 200.70 | 8.10 | 305.90 |
| 63 | SM3 | 166.20 | 7.97 | 457.90 |
| 64 | SM4 | 168.20 | 10.16 | 534.40 |
| 65 | SM5 | 263.42 | 11.71 | 485.40 |
| 66 | SN1 | 203.84 | 8.96 | 627.20 |
| 67 | SN2 | 242.75 | 7.88 | 817.80 |
| 68 | SN3 | 240.20 | 8.37 | 575.80 |
| 69 | SN4 | 238.33 | 16.12 | 214.80 |
| 70 | SN5 | 194.43 | 6.90 | 385.00 |
| 71 | SO1 | 202.10 | 12.32 | 345.80 |
| 72 | SO2 | 199.42 | 9.76 | 662.30 |
| 73 | SO3 | 263.42 | 6.36 | 611.80 |
| 74 | SO4 | 182.30 | 7.52 | 394.30 |
| 75 | SO5 | 194.43 | 6.90 | 385.00 |
| 76 | SP1 | 208.90 | 9.67 | 437.30 |
| 77 | SP2 | 141.12 | 9.40 | 644.30 |
| 78 | SP3 | 188.22 | 14.87 | 717.80 |
| 79 | SP4 | 194.43 | 6.99 | 817.80 |
| 80 | SP5 | 175.70 | 16.48 | 391.90 |
| 81 | SQ1 | 182.48 | 9.31 | 510.20 |
| 82 | SQ2 | 191.29 | 11.64 | 605.70 |
| 83 | SQ3 | 165.60 | 14.69 | 220.60 |
| 84 | SQ4 | 216.45 | 13.52 | 757.00 |
| 85 | SQ5 | 170.24 | 10.93 | 372.40 |
| 86 | SR1 | 241.47 | 8.37 | 415.30 |
| 87 | SR2 | 197.56 | 7.16 | 220.30 |
| 88 | SR3 | 214.38 | 11.12 | 637.80 |
| 89 | SR4 | 188.72 | 7.61 | 315.40 |
| 90 | SR5 | 435.90 | 12.09 | 408.70 |
| 91 | SS1 | 222.65 | 10.03 | 509.60 |
| 92 | SS2 | 248.40 | 7.03 | 306.30 |
| 93 | SS3 | 172.10 | 8.96 | 366.20 |
| 94 | SS4 | 185.30 | 7.70 | 720.80 |
| 95 | SS5 | 291.52 | 12.00 | 528.80 |
| 96 | ST1 | 178.75 | 13.61 | 625.60 |
| 97 | ST2 | 275.96 | 12.36 | 437.40 |
| 98 | ST3 | 140.34 | 6.45 | 602.40 |
| 99 | ST4 | 205.10 | 6.98 | 395.20 |
| 100 | ST5 | 313.60 | 21.13 | 238.70 |
| **Mean** | **216.42** | **10.81** | **485.3** |
### Table 3: Exchangable Ca, Mg and available S status of soils

| Sr. No. | Sample No. | Ca Cmol (P⁺) kg⁻¹ | Mg Cmol (P⁺) kg⁻¹ | S mg kg⁻¹ |
|---------|------------|--------------------|--------------------|-----------|
| 1       | HA1        | 12.88              | 2.40               | 08.80     |
| 2       | HA2        | 13.60              | 0.80               | 5.74      |
| 3       | HA3        | 14.00              | 5.44               | 12.84     |
| 4       | HA4        | 13.04              | 1.28               | 13.99     |
| 5       | HA5        | 13.36              | 4.72               | 9.20      |
| 6       | HB1        | 14.00              | 1.76               | 11.73     |
| 7       | HB2        | 19.60              | 5.12               | 8.50      |
| 8       | HB3        | 14.08              | 2.00               | 4.72      |
| 9       | HB4        | 13.96              | 1.32               | 7.42      |
| 10      | HB5        | 13.12              | 1.76               | 12.81     |
| 11      | HC1        | 14.24              | 1.12               | 7.36      |
| 12      | HC2        | 16.00              | 0.88               | 13.61     |
| 13      | HC3        | 13.84              | 4.80               | 11.63     |
| 14      | HC4        | 14.08              | 1.60               | 8.07      |
| 15      | HC5        | 13.76              | 1.76               | 11.97     |
| 16      | HD1        | 11.24              | 6.32               | 6.70      |
| 17      | HD2        | 15.36              | 1.44               | 12.88     |
| 18      | HD3        | 14.72              | 2.16               | 9.38      |
| 19      | HD4        | 14.24              | 1.48               | 7.05      |
| 20      | HD5        | 14.72              | 1.20               | 10.55     |
| 21      | HE1        | 14.32              | 1.68               | 11.31     |
| 22      | HE2        | 17.20              | 1.24               | 17.22     |
| 23      | HE3        | 16.24              | 0.56               | 14.09     |
| 24      | HE4        | 12.80              | 1.28               | 12.08     |
| 25      | HE5        | 14.00              | 2.48               | 17.50     |
| 26      | HF1        | 12.08              | 1.36               | 14.965    |
|   |     |    |    |    |
|---|-----|----|----|----|
| 27| HF2 | 13.76 | 2.88 | 12.631 |
| 28| HF3 | 13.52 | 0.88 | 14.930 |
| 29| HF4 | 14.32 | 0.88 | 4.28  |
| 30| HF5 | 13.60 | 2.00 | 7.81  |
| 31| HG1 | 12.40 | 2.72 | 11.97 |
| 32| HG2 | 14.60 | 1.20 | 9.12  |
| 33| HG3 | 18.00 | 0.89 | 7.26  |
| 34| HG4 | 13.64 | 1.48 | 14.06 |
| 35| HG5 | 10.28 | 2.24 | 16.21 |
| 36| HH1 | 12.92 | 1.56 | 12.56 |
| 37| HH2 | 13.28 | 0.80 | 15.97 |
| 38| HH3 | 12.80 | 2.56 | 12.46 |
| 39| HH4 | 12.08 | 0.87 | 11.45 |
| 40| HH5 | 15.04 | 1.00 | 11.18 |
| 41| HI1 | 12.48 | 1.28 | 14.79 |
| 42| HI2 | 11.36 | 1.44 | 8.65  |
| 43| HI3 | 14.56 | 1.12 | 11.73 |
| 44| HI4 | 17.48 | 1.24 | 6.84  |
| 45| HI5 | 13.64 | 1.88 | 9.02  |
| 46| HJ1 | 12.00 | 0.96 | 9.32  |
| 47| HJ2 | 13.92 | 2.24 | 7.63  |
| 48| HJ3 | 14.88 | 1.28 | 11.80 |
| 49| HJ4 | 12.04 | 2.96 | 12.67 |
| 50| HJ5 | 15.12 | 0.56 | 15.83 |
| 51| HK1 | 14.16 | 1.76 | 11.94 |
| 52| HK2 | 14.24 | 1.68 | 10.06 |
| 53| HK3 | 13.52 | 1.50 | 11.11 |
| 54| HK4 | 16.16 | 1.60 | 16.31 |
| 55| HK5 | 13.76 | 0.16 | 5.92  |
|   |   |   |   |   |
|---|---|---|---|---|
| 56 | HL1 | 14.56 | 3.12 | 12.40 |
| 57 | HL2 | 14.88 | 1.60 | 14.72 |
| 58 | HL3 | 13.36 | 2.72 | 8.70  |
| 59 | HL4 | 15.60 | 1.76 | 10.22 |
| 60 | HL5 | 12.96 | 1.60 | 11.25 |
| 61 | HM1 | 18.40 | 1.76 | 14.40 |
| 62 | HM2 | 13.76 | 1.76 | 9.65  |
| 63 | HM3 | 15.12 | 1.84 | 13.12 |
| 64 | HM4 | 13.36 | 2.48 | 11.11 |
| 65 | HM5 | 10.76 | 1.12 | 14.40 |
| 66 | HN1 | 14.48 | 1.44 | 7.10  |
| 67 | HN2 | 14.64 | 2.88 | 11.49 |
| 68 | HN3 | 13.68 | 1.76 | 11.97 |
| 69 | HN4 | 17.08 | 1.60 | 7.46  |
| 70 | HN5 | 13.44 | 1.84 | 14.65 |
| 71 | HO1 | 14.08 | 1.36 | 9.79  |
| 72 | HO2 | 12.24 | 2.32 | 12.50 |
| 73 | HO3 | 13.48 | 1.72 | 7.84  |
| 74 | HO4 | 14.96 | 0.88 | 13.26 |
| 75 | HO5 | 12.32 | 2.64 | 12.36 |
| 76 | HP1 | 13.00 | 2.64 | 4.88  |
| 77 | HP2 | 12.84 | 1.60 | 11.11 |
| 78 | HP3 | 15.52 | 0.72 | 6.00  |
| 79 | HP4 | 13.60 | 1.48 | 11.00 |
| 80 | HP5 | 12.92 | 1.24 | 12.29 |
| 81 | HQ1 | 11.24 | 2.16 | 10.72 |
| 82 | HQ2 | 13.76 | 1.84 | 14.06 |
| 83 | HQ3 | 14.82 | 2.70 | 18.99 |
| 84 | HQ4 | 15.28 | 3.20 | 13.78 |
### Table 4: Exchangable Ca, Mg, and available S status of soils

| Sr.No. | Sample No. | Ca Cmol(P⁺)kg⁻¹ | Mg Cmol(P⁺)kg⁻¹ | Avail. S (mg kg⁻¹) |
|--------|------------|-----------------|-----------------|-------------------|
| 1      | SA1        | 12.50           | 1.00            | 12.43             |
| 2      | SA2        | 13.92           | 1.44            | 10.83             |
| 3      | SA3        | 15.00           | 1.92            | 6.87              |
| 4      | SA4        | 14.80           | 1.12            | 10.65             |
| 5      | SA5        | 15.04           | 0.88            | 13.95             |
| 6      | SB1        | 17.32           | 1.04            | 9.38              |
| 7      | SB2        | 12.80           | 1.92            | 9.61              |
| 8      | SB3        | 14.96           | 1.92            | 12.84             |
| 9      | SB4        | 14.80           | 1.28            | 15.90             |
|   |   |   |   |   |
|---|---|---|---|---|
| 10| SB5| 14.40| 2.72| 12.59|
| 11| SC1| 13.00| 2.68| 9.44 |
| 12| SC2| 14.72| 1.48| 12.04|
| 13| SC3| 13.80| 2.00| 8.50 |
| 14| SC4| 15.60| 1.68| 11.97|
| 15| SC5| 14.44| 1.48| 12.91|
| 16| SD1| 15.12| 1.68| 7.60 |
| 17| SD2| 13.68| 1.92| 11.00|
| 18| SD3| 14.40| 2.16| 9.75 |
| 19| SD4| 10.41| 1.52| 13.12|
| 20| SD5| 12.88| 2.24| 9.86 |
| 21| SE1| 13.12| 2.32| 5.74 |
| 22| SE2| 14.16| 1.28| 7.12 |
| 23| SE3| 15.00| 1.84| 11.14|
| 24| SE4| 13.28| 1.76| 6.50 |
| 25| SE5| 12.44| 1.66| 12.22|
| 26| SF1| 14.48| 2.00| 7.25 |
| 27| SF2| 12.48| 3.52| 8.10 |
| 28| SF3| 14.60| 1.88| 11.04|
| 29| SF4| 15.04| 0.92| 6.20 |
| 30| SF5| 13.96| 2.68| 12.84|
| 31| SG1| 13.12| 1.68| 8.61 |
| 32| SG2| 11.68| 0.96| 7.98 |
| 33| SG3| 14.36| 0.96| 12.11|
| 34| SG4| 13.96| 5.12| 16.56|
| 35| SG5| 14.88| 0.48| 14.16|
| 36| SH1| 16.92| 2.12| 10.93|
| 37| SH2| 14.16| 1.36| 11.18|
| 38| SH3| 12.00| 3.28| 13.71|
| 39| SH4| 14.12| 1.32| 11.80|
| 40| SH5| 16.00| 1.28| 14.46|
|   |   |   |   |   |
|---|---|---|---|---|
| 41 | SI1 | 13.04 | 2.20 | 7.35 |
| 42 | SI2 | 14.83 | 0.41 | 4.76 |
| 43 | SI3 | 12.80 | 0.20 | 8.20 |
| 44 | SI4 | 13.56 | 1.76 | 12.77 |
| 45 | SI5 | 11.72 | 1.64 | 9.58 |
| 46 | SJ1 | 14.37 | 1.37 | 7.35 |
| 47 | SJ2 | 12.88 | 2.80 | 13.61 |
| 48 | SJ3 | 15.28 | 2.32 | 8.24 |
| 49 | SJ4 | 13.92 | 1.76 | 8.90 |
| 50 | SJ5 | 14.96 | 1.92 | 7.80 |
| 51 | SK1 | 14.88 | 0.16 | 5.72 |
| 52 | SK2 | 15.64 | 1.64 | 8.68 |
| 53 | SK3 | 11.56 | 1.32 | 5.79 |
| 54 | SK4 | 13.84 | 0.52 | 4.24 |
| 55 | SK5 | 14.08 | 1.64 | 9.36 |
| 56 | SL1 | 11.36 | 2.00 | 7.40 |
| 57 | SL2 | 16.88 | 0.64 | 5.70 |
| 58 | SL3 | 13.28 | 2.00 | 11.98 |
| 59 | SL4 | 14.36 | 1.60 | 9.65 |
| 60 | SL5 | 16.16 | 3.08 | 14.53 |
| 61 | SM1 | 14.00 | 1.68 | 11.80 |
| 62 | SM2 | 14.56 | 1.84 | 10.13 |
| 63 | SM3 | 13.00 | 1.28 | 4.65 |
| 64 | SM4 | 18.36 | 1.52 | 12.53 |
| 65 | SM5 | 14.60 | 1.48 | 8.61 |
| 66 | SN1 | 13.04 | 2.40 | 13.47 |
| 67 | SN2 | 16.40 | 1.68 | 8.88 |
| 68 | SN3 | 13.36 | 1.84 | 10.06 |
| 69 | SN4 | 14.72 | 0.64 | 14.75 |
| 70 | SN5 | 19.16 | 1.72 | 9.82 |
| 71 | SO1 | 14.08 | 1.56 | 10.65 |
|   |   |   |   |
|---|---|---|---|
| 72 | SO2 | 13.48 | 1.64 | 8.60 |
| 73 | SO3 | 14.44 | 1.04 | 9.30 |
| 74 | SO4 | 11.28 | 1.44 | 11.49 |
| 75 | SO5 | 13.92 | 1.96 | 11.52 |
| 76 | SP1 | 14.92 | 1.76 | 8.40 |
| 77 | SP2 | 14.12 | 1.24 | 13.57 |
| 78 | SP3 | 12.48 | 1.96 | 4.74 |
| 79 | SP4 | 11.96 | 1.60 | 12.32 |
| 80 | SP5 | 15.04 | 1.44 | 9.47 |
| 81 | SQ1 | 14.20 | 2.28 | 11.28 |
| 82 | SQ2 | 14.64 | 0.52 | 9.30 |
| 83 | SQ3 | 12.28 | 1.92 | 12.18 |
| 84 | SQ4 | 13.84 | 1.52 | 12.63 |
| 85 | SQ5 | 15.08 | 0.40 | 7.22 |
| 86 | SR1 | 14.84 | 0.52 | 13.68 |
| 87 | SR2 | 12.48 | 1.36 | 11.66 |
| 88 | SR3 | 14.88 | 0.96 | 12.43 |
| 89 | SR4 | 15.04 | 1.28 | 9.30 |
| 90 | SR5 | 18.84 | 1.64 | 12.15 |
| 91 | SS1 | 14.88 | 1.36 | 7.77 |
| 92 | SS2 | 13.76 | 1.44 | 12.22 |
| 93 | SS3 | 10.40 | 1.48 | 9.75 |
| 94 | SS4 | 13.48 | 0.40 | 7.60 |
| 95 | SS5 | 14.08 | 1.56 | 13.85 |
| 96 | ST1 | 18.48 | 1.36 | 10.48 |
| 97 | ST2 | 12.56 | 2.16 | 7.84 |
| 98 | ST3 | 13.60 | 1.92 | 6.79 |
| 99 | ST4 | 13.90 | 1.76 | 8.88 |
|100 | ST5 | 16.50 | 1.52 | 14.13 |
| **MEAN** | | **14.10** | **1.63** | **10.40** |
Available Sulphur of these soil were ranged from 4.24 to 16.56 mg kg\(^{-1}\) with average value of (10.40 mg kg\(^{-1}\)). The lowest value (4.24 mg kg\(^{-1}\)) of S content was recorded in village Kalkondi, where as highest value of S was recorded in soils of Deulgaon village. The lowest range 4.24 to 9.36 mg kg\(^{-1}\) with mean value of 6.75 mg kg\(^{-1}\) were recorded in Kalkondi village while highest range 10.93 to 14.46 mg kg\(^{-1}\) with an average value of 12.41 mg kg\(^{-1}\) were observed in Hingoli in available S content.

In conclusion, in all, from Hingoli tahsil 94 per cent soils were low and 6 per cent were placed in medium category in available N content whereas 92 per cent were low and 8 per cent were medium in available N content from Sengaon tahsil.

The Soils from Hingoli and Sengaon tahsils were found 54 per cent low and 46 per cent medium whereas from Sengaon 52 per cent in low and 48 per cent found in medium available P content. The available K content from Hingoli tahsils, 80 per cent soils were high, 17 per cent were medium K content and from Sengaon 88 per cent soils were high in K content.

The exch. Calcium and Magnesium in soils of Hingoli and Sengaon were varied from 10.28 to 19.60 Cmol(P\(^+\)) kg\(^{-1}\) of soil and 10.19 to 19.16 Cmol(P\(^+\)) kg\(^{-1}\) of soil respectively. The soils from Hingoli and Sengaon tahsils were found high category in calcium content and low in magnesium. In case of available Sulphur, 67 per cent and 83 per cent were deficient in Hingoli and Sengaon tahsils respectively. According to concept of “soil nutrient index”, the status of available N and P are low to medium whereas K are high in soils of Hingoli and Sengaon tahsils. The exch. Ca is high and Mg is low in these soil whereas these soils are deficient in S content. Thus, it can be concluded that soils of Hingoli and Sengaon tahsils are low to medium in fertility status.

References

Aage, A.B; Magar S.M., Godhawale G.V. and Borgaonkar S.B (2007b). “Studies on available macronutrients status in Beed district of Maharashtra state.” Int. J. of Tropical Agriculture., 25 (3).pp.487-489.

Awasthi U. S.(2005). “Balanced nutrition:Need to address crucial issues”. The Hindu survey of Indian Agriculture,pp. 3-12.

Babar S., Narkhede A.H., Rathod P.K., Rathod S.D. and Kamble B.M (2007). “Studies on forms of soil Potassium and their interrelationship in central and eastern Vidarbha region of Maharashatra, India”. The Asian. J. of soil. Sci., 2 (1),pp.96-103.

Bharmbe P.R. and Ghonshikar C.P (1984). “Fertility status of soils in Jayawkwadi command.” J.maharashtra agric. Univ.,9(3), pp.326-327.

Bhattacharjee S.K., Bansal K.N. and Trivedi S.K (2003). “Studies on forms of soil Potassium and their interrelationship in central and eastern Vidarbha region of Maharashatra, India”. J. Ind. Soc. Soil Sci.,51(1),pp.74-76.

Binita N.K., Dasog G.S. and Patil P.L (2009). “Soil fertility mapping in Ghatprabha left bank canal command area of north Karnataka by geographic information system technique”. Karnataka J. Agric Sci., 22 (1),pp.81-88.

Black, C.A (1965). “Methods of soil Analysis part-II”. American society of Agronomy, In. C. Madison Wiscousin, USA.

Cate, R.B. and Nelson, L.A (1965). “Tech. Bull. Int. soil testing review”.L, North Carding, USA.

Chopra S.L. and Kanwar, J.B (1976). “Analytical Agricultural Chemistry”. Kalyani publication., New Delhi.

Dhanya, V., Mathews., Patil,P.L. and Dasog, G.S (2009). “Identification of soil
fertility constraints of a pilot site in coastal agro ecosystem of Karnataka by GIS techniques,” *Karnataka J. Agric. Sci.*, 22 (1),pp.77-80.

Dolui, A.K. and R. Bera (2001). “Soil tests for available Iron and their Relation with soil properties in some Alfisols of Orissa India”. *Int. J. of tropical agriculture.*, 19 (1-4), pp. 5-15.

Dwivedi, S.K., Sharma, V.K and Bhardwaj, Vipin (2005). “Status of available nutrients in soils of cold arid region of Ladakh”. *J. Indian Soc. Soil Sci.*, 53 (3), pp. 421-423.

Gajbe, M.V., Londe, M.G. and Varade, S.B (1976). “Soils of Marathwada”. *J. Maharashtra Agric. Univ.* 1 (2-6), pp. 55-59.

Ghonsikar, C.P (1982). “Research Review Report on soils”. *Joint Agrisco Maharashtra Agril. Univ.* held at KKV, Dapoli.

Hegde D.M. and Sudhakara Bapu S.N (2001). “Nutrient management strategies in Agriculture”, A future out look. *Fertilizer News.*, 46 (12), pp. 61-66.

Hundal, H.S., Rajkumar, Dhanwindar Singh, and Manchandra, J.S (2006). “Available nutrient and heavy metal status of soils of Punjab North West India”. *J. Indian Soc. Soil Sci.* 54 (1), pp. 50-56.

Jackson, M.L. (1967). “Soil chemical analysis”, *Prentice Hall of India pvt. Ltd, New Delhi*. 46, pp. 128-135 and 283.

Kanthaliya, P.C. and Bhatt, P.L (1991). “Relation between organic carbon and Available nutrients in some soils of sub humid zone”. *J. Indian Soc. Soil Sci.* 39, pp. 781-782.

How to cite this article:

Adat, S.R., T.R. Zagade and Chalawade, P.B. 2017. Fertility Mapping of Soils from Hingoli and Sengaon Tahsils of Hingoli District, India. *Int.J.Curr.Microbiol.App.Sci.* 6(5): 2227-2245. doi: [https://doi.org/10.20546/ijcemas.2017.605.249](https://doi.org/10.20546/ijcemas.2017.605.249)