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Soil fertility status of some villages in Boudh block of Boudh district under western central table land climatic zone of Odisha, India

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Abstract
A soil fertility status inventory work was carried out in twenty villages of boudh in Boudh district located in Western Central Table Land central Odisha. Results shown that Soil Available Nitrogen varied between 56 to 459.2 kg ha^{-1}. Available Bray's Phosphorus varied between 0.38 to 60.99 kg ha^{-1}. Available Potassium varied 25.6 to 1597 kg ha^{-1}. Soil reaction was in acidic to neutral location and micronutrient are in high range. In most of the villages major and secondary nutrients are in medium to low range.

Keywords: Soil fertility, SOC, Boudh

1. Introduction
Twenty villages of Boudh block in Boudh district namely Ereda, Bandharathar, Hamtapada, Rampur, Maaajishani, Baghiapada, Nuapali, Kanakpur, Bondaparatra, Pankimal, Boudh, Bhuktapada, Khuntiapada, Badhigaon, Paljhar, Mundapada, Bijapadar, Kasalpur, Lambakani and Olanda were in selected in the present investigation for studying the soil fertility status in order to identify the major soil fertility related crop production constrains. Boudh district is, in central Odisha towards the south of the Mahanadi River, which forms the western and northern boundary of the district. Across the Mahanadi lay the districts of Bolangir to the west, Subarnapur to the northwest, and Angul to the northeast. Nayagarh District lies to the southeast, Phulbani District to the south, and Kalahandi district to the southwest. Geographically the Boudh district extends from Latitudes 20°.22' to 20°.50'N and Longitudes 83°.34' to 84°.49'E. It is bounded by River Mahanadi and Anugul District to the north, Kandhamal District to the south, Nayagarh District to the east and Tel River and Subarnapur District to the west. (Nanda *et al*., 2008) [16]. Determination of soil available nutrient status of an area using Global Positioning System (GPS) helps in formulating site specific balanced fertilizer recommendations along with making critical decisions on nutrient management (Patil *et al*., 2017) [19]. GPS based soil fertility evaluation not only gives ideas about fertility status of the soil but also helps in monitoring the soil health from time to time (Mishra *et al*., 2016) [2]. Although soil fertility status and maps have been prepared for different areas of Odisha, but no such intensive work had been done for Boudh block of Boudh district. Therefore, an attempt has been made in the present investigation to prepare soil fertility status of twenty selected villages of Boudh Block of Boudh district. As nitrogen, phosphorus and potassium are the three major primary macro nutrients; that of Sulphur, calcium and magnesium are of the most important secondary macronutrients and all important micronutrients, soil fertility status is evaluated focusing on these nutrients. Along with these parameters some of the basic soil chemical properties are also determined which includes soil pH, EC and SOC. This study will help in finding out soil fertility related crop production constraints along with suggesting remedial measures for higher crop production.

2. Materials and Methods
2.1 Experimental site
All twenty villages are situated in the Boudh block. Total 200 surface samples are collected from all twenty villages with random sampling method.

Major Irrigation sources of this villages are Salki Irrigation Project, Bagh Barrage Irrigation Project, Pillasalki Irrigation Project. One of the villages Kanakpur located nearby salki river (the odia name was Salunki). This district was located under southern portion of the Mahanadi River, The mean annual precipitation is 920.5 mm. The mean maximum summer temperature is 31 °C and the climate is hot and moist sub-humid. The soils of this Agro climatic zones are mostly Black (Chromusterts, Us-torthents) (Sahu & Mishra, 2005) [22].

2.2 Soil sampling and analysis

Total 200 composite surface samples are collected from form twenty villages randomly. Soil were analyzed for its Avaliable Nitrogen (Subbiah and Asija, 1956) [24], Phosphorus (Bray and Kurtz, 1945) [4], Potassium (Hanway and Heidel, 1952) [7], Sulfur (Chesnin and Yien, 1950) [5], hot water extractable boron (John *et al*., 1975) [9], organic carbon (Walkley and Black, 1934) [25], pH(1:2) (Jackson, 1973) [8], EC(1:2) (Jackson, 1973) [8] and Available Fe, Zn, Mn, and Cu (DTPA Extractant Method Using Atomic Absorption Spectrophotometer).

3. Results and Discussion

3.1 Available Nitrogen

The overall available nitrogen content of twenty villages were found to be to between 56 to 459.2 kg ha^{-1} with mean value of 170.68 kg ha^{-1}; the available nitrogen status of the respective villages are as followed; soils of Ereda found to be between 100.8 -268.8 kg ha^{-1} with mean value of 187.2 kg ha^{-1}; soils of Bandharathar found to be between 56 -291.2 kg ha^{-1} with mean value 180.4 kg ha^{-1}; soils of Hamtapada found to be between 112 -459.2 kg ha^{-1} with mean valve of 195.01 ka ha^{-1}; that soils of Rampur found to be between 56 -201.6 kg ha^{-1} with mean value of 101.81 kg ha^{-1}; soils of Maaajishani found to be between 56 -257.6 kg ha^{-1} with mean value of 130.66 kg ha^{-1}; Soils of Baghiapada found to be between 100.8 -257.6 kg ha^{-1} with mean value of 179.2 kg ha^{-1}; soils of Nuapali found to be between 100.8 -302.4 kg ha^{-1} with mean value of 159.28 kg ha^{-1}; soils of kanakpur found to be between 100.8 - 257.6 kg ha^{-1} with mean value of 149.0 kg ha^{-1}; soils of Bondaparatra found to be between 78.4 -268.8 kg ha^{-1} with mean value of 136.64 kg ha^{-1}; soils of Pankimal found to be between 179.2-336 kg ha^{-1} with mean value of 238 kg ha^{-1}; soils of Boudh found to be 89.6-392 kg ha^{-1} with mean value of 211.2 kg ha^{-1}; soils of Bhuktapada found to be between 145.6 -235.2 kg ha^{-1} with mean value of 184.8 kg ha^{-1}; soils of Khuntiapada found to be between 100.8 -145.6 kg ha^{-1} with mean value 123.2 kg ha^{-1}; soils of Badhigaon found to be between 100.8 -302.4 kg ha^{-1} with mean value 153.06 kg ha^{-1}; soils of Paljhar found to be between 123.2-224 kg ha^{-1} with mean value 179.2 kg ha^{-1}; soils of Mundapada found to be between 56-336 kg ha^{-1} with mean value of 142.4 kg ha^{-1}; soils of Bijapadar found to between 56 -78.4 kg ha^{-1} with mean value 67.2 kg ha^{-1}; soils of Kasalpur found to be between 78.4 -257.6 kg ha^{-1} with mean value 197.86 kg ha^{-1}; soils of Lambakani found to be between 100.8 -201.6 kg ha^{-1} with mean value 154 kg ha^{-1} and soils of Olanda found to be 100.8 -257.6 kg ha^{-1} with mean value 184.8 kg ha^{-1}. Form the above analysis it is clear that most of the soils in all villages are low in available nitrogen. In overall study the nitrogen levels are between low to medium. In overall Available Nitrogen content was at medium range. (Table 1) Nitrogen is positively correlated with phosphorus (r = 0.157**) (Table 3). Similar results reported by Manoranjan *et al.,* (2018) [26]

3.2 Available Phosphorus

The overall available Phosphorous content of twenty villages were found to be to between 0.38 to 60.99 kg ha^{-1} with mean value of 12.44 kg ha^{-1}; the available phosphorus status of the respective villages are as followed; soils of Ereda found to be between 0.38 -8.67 kg ha^{-1} with mean value of 3.63 kg ha^{-1}; soils of Bandharathar found to be between 1.01 -5.51 kg ha^{-1} with mean value 3.04 kg ha^{-1}; soils of Hamtapada found to be between 1.94 -9.63 kg ha^{-1} with mean valve of 4.47 kg ha^{-1}; that soils of Rampur found to be between 0.41 -7.02 kg ha^{-1} with mean value of 4.35 kg ha^{-1}; soils of Maaajishani found to be between 3.37 -6.44 kg ha^{-1} with mean value of 4.41 kg ha^{-1}; Soils of Baghiapada found to be between 3.18 -3.53 kg ha^{-1} with mean value of 3.36 kg ha^{-1}; soils of Nuapali found to be between 2.35 -10.67 kg ha^{-1} with mean value of 5.21 kg ha^{-1}; soils of kanakpur found to be between 2.05 -14.79 kg ha^{-1} with mean value of 5.98 kg ha^{-1}; soils of Bondaparatra found to be between 2.96 -10.01 kg ha^{-1} with mean value of 6.02 kg ha^{-1}; soils of Pankimal found to be between 4.33 -34.51 kg ha^{-1} with mean value of 15.65 kg ha^{-1}; soils of Boudh found to be 14.51-60.99 kg ha^{-1} with mean value of 45.09 kg ha^{-1}; soils of Bhuktapada found to be between 53.97 -54.74 kg ha^{-1} with mean value of 54.42 kg ha^{-1}; soils of Khuntiapada found to be between 11.93 -12.07 kg ha^{-1} with mean value 12.00 kg ha^{-1}; soils of Badhigaon found to be between 2.55 -20.47 kg ha^{-1} with mean value 11.46 kg ha^{-1}; soils of Paljhar found to be between 2.77-14.04 kg ha^{-1} with mean value 8.65 kg ha^{-1}; soils of Mundapada found to be between 4.96-48.07 kg ha^{-1} with mean value of 12.02 kg ha^{-1}; soils of Bijapadar found to between 4.93 -7.60 kg ha^{-1} with mean value 5.83 kg ha^{-1}; soils of Kasalpur found to be between 5.15 -7.54 kg ha^{-1} with mean value 6.44 kg ha^{-1}; soils of Lambakani found to be between 4.30 -7.27 kg ha^{-1} with mean value 6.11 kg ha^{-1} and soils of Olanda found to be 3.62 -19.70 kg ha^{-1} with mean value 7.701. Form the above analysis it is clear that most of the soils in all villages are boudh village phosphorus content was medium, Bandharathar villages phosphorus content was high and rest all villages soils are very low in phosphorus content but overall average the phosphorous content was also low in Boudh block. (Table 1) Phosphorous positively correlated with Sulphur (r = 0.174*) (Table 3.) Similar results are observed by Barik *et al.,* (2017) [1].

3.3 Available Potassium

The overall available Potassium content of twenty villages were found to be to between 25.6 to 1597 kg ha^{-1} with mean value of 264.98 kg ha^{-1}; the available Potassium status of the respective villages are as followed; soils of Ereda found to be between 81.3 -1597 kg ha^{-1} with mean value of 324.52 kg ha^{-1}; soils of Bandharathar found to be between 53.5-680 kg ha^{-1} with mean value 184.73 kg ha^{-1}; soils of Hamtapada found to be between 27.5-897 kg ha^{-1} with mean valve of 245.82 kg ha^{-1}; that soils of Rampur found to be between 25.6 -189.4 kg ha^{-1} with mean value of 101.65 kg ha^{-1}; soils of Maaajishani found to be between 114.6-131 kg ha^{-1} with mean value of 122.66 kg ha^{-1}; Soils of Baghiapada found to be between 211.8 -248.3 kg ha^{-1} with mean value of 230.05 kg ha^{-1}; soils of Nuapali found to be between 152.7 -444.6 kg ha^{-1} with mean value of 296.56 kg ha^{-1}; soils of kanakpur found to be between 131.2 -551.5 kg ha^{-1} with mean value of 314.52 kg ha^{-1}; soils of Bondaparatra found to be between 165.1 -545.1 kg ha^{-1} with mean value of 354.92 kg ha^{-1}; soils of Pankimal found to be between 163.6-489 kg ha^{-1} with mean value of 314.7 kg ha^{-1}; soils of Boudh found to be 47.9-513.5 kg ha^{-1}

with mean value of 230.61 kg ha^{-1}; soils of Bhuktapada found to be between 484.8 -591.4 kg ha^{-1} with mean value of 524.12 kg ha^{-1}; soils of Khuntiapada found to be between 343.8 - 345.2 kg ha^{-1} with mean value 344.5 kg ha^{-1}; soils of Badhigaon found to be between 230.8-381.0 kg ha^{-1} with mean value 327.53 kg ha^{-1}; soils of Paljhar found to be between 137.2-428.2 kg ha^{-1} with mean value 367.8 kg ha^{-1}; soils of Mundapada found to be between 98.2-447.6 kg ha^{-1} with mean value of 276.01 kg ha^{-1}; soils of Bijapadar found to between 106 -277.8 kg ha^{-1} with mean value 187.12 kg ha^{-1}; soils of Kasalpur found to be between 221.9 -239.1 kg ha^{-1} with mean value 231 kg ha^{-1}; soils of Lambakani found to be between 238.5 -489.4 kg ha^{-1} with mean value 337.95 kg ha^{-1} and soils of Olanda found to be 224.2 -416.1 kg ha^{-1} with mean value 312.58 kg ha^{-1}. Form the above analysis it is clear that soils of Bandharathar, Maaajishani, Bijapadar, Kasalpur are found to be low in available potassium content and remaining all other soils are in medium range but overall available potassium content was high. (Table 1) Potassium is positively correlated with pH (r = 0.229**), EC (r = 0.231**), Fe (r = 0.163*) and Zn (r = 0.166*) (Table 3). Same finding was observed by Mishra *et al.,* (2017) [11].

3.4 Available Sulfur

The overall available Sulfur content of twenty villages were found to be to between 6.90 to 161.6 kg ha^{-1} with mean value of 36.23 kg ha-1; the available sulfur status of the respective villages are as followed; soils of Ereda found to be between 9.85-51.56 kg ha^{-1} with mean value of 23.16 kg ha^{-1}; soils of Bandharathar found to be between 9.98-75.36 kg ha^{-1} with mean value 30.68 kg ha^{-1}; soils of Hamtapada found to be between 6.90-85.09 kg ha^{-1} with mean valve of 13.70 kg ha^{-1}; that soils of Rampur found to be between 8.44 -18.17 kg ha^{-1} with mean value of 10.31 kg ha^{-1}; soils of Maaajishani found to be between 23.67-30.32 kg ha-1 with mean value of 26.44 kg ha^{-1}; Soils of Baghiapada found to be between 25.97 - 29.17 kg ha^{-1} with mean value of 27.57 kg ha^{-1}; soils of Nuapali found to be between 22.64 -70.63 kg ha^{-1} with mean value of 41.53 kg ha^{-1}; soils of kanakpur found to be between 29.68 -104.54 kg ha^{-1} with mean value of 54.18 kg ha^{-1}; soils of Bondaparatra found to be between 25.84 -46.19 kg ha^{-1} with mean value of 36.34 kg ha^{-1}; soils of Pankimal found to be between 30.96-55.02 kg ha^{-1} with mean value of 44.33 kg ha^{-1}; soils of Boudh found to be 9.46-161.61 kg ha^{-1} with mean value of 49.26 kg ha^{-1}; soils of Bhuktapada found to be between 11.77 -34.16 kg ha^{-1} with mean value of 21.49 kg ha^{-1}; soils of Khuntiapada found to be between 12.28 -27.63 kg ha^{-1} with mean value 19.96 kg ha^{-1}; soils of Badhigaon found to be between 9.98-65.38 kg ha^{-1} with mean value 34.14 kg ha^{-1}; soils of Paljhar found to be between 17.91-53.48 kg ha^{-1} with mean value 32.58 kg ha^{-1}; soils of Mundapada found to be between 10.62-161.61 kg ha^{-1} with mean value of 52.68 kg ha^{-1}; soils of Bijapadar found to between 36.21 -104.54 kg ha^{-1} with mean value 63.91 kg ha^{-1}; soils of Kasalpur found to be between 47.98 -94.43 kg ha^{-1} with mean value 66.07 kg ha^{-1}; soils of Lambakani found to be between 25.84 -33.26 kg ha^{-1} with mean value 30.45 kg ha^{-1} and soils of Olanda found to be 24.18 -46.19 kg ha^{-1} with mean value 36.93 kg ha^{-1}. Form the above analysis it is clear that soils of kanakpur, Mundapada, Bijapadar, Kasalpur are medium range and rest all village soils are low in sulfur. In overall available sulfur content was at medium range (Table 1). Sulfur is positively corrected with Mg (r = 0.158*) and pH (r = 0.321), (Table 3).

3.5 Exchangeable Ca and Mg

The overall available Exchangeable Ca and Mg content of twenty villages were found to be to between 42 to 200 meg 100 g^{-1} and 1.97 to 576.31 meq 100 g^{-1} with mean value of 114.47 meq 100 g^{-1} and 77.02 meq 100 g^{-1} respectively; the Exchangeable Ca and Mg status of the respective villages are as followed; soils of Ereda found to be between 60 -200 meq 100 g^{-1} and 15.78 -106.57 meq 100 g^{-1}with mean value of 120.95 meq 100 g^{-1} and 47.83 meq 100 g^{-1} Respectively; soils of Bandharathar found to be between 7.89-203.28 meq 100 g^{-1} with mean value 105.21 meq 100 g^{-1} and 44.90 meq 100 g^{-1} Respectively; soils of Hamtapada found to be between 60.0-200 meq 100 g^{-1} and 5.92 -215.13 meq 100 g^{-1} respectively with mean valve of 125.52 meq 100 g^{-1} and 60.83 meq 100 g^{-1} respectively; that soils of Rampur found to be between 42 - 174 meq 100 g^{-1} and 9.86 -576.31 meq 100 g^{-1} with mean value of 114 meq 100 g^{-1} and 136.90 meq 100 g^{-1} respectively; soils of Maaajishani found to be between 60.00-134.00 meq 100 g^{-1} and 45.39 -102.63 meq 100 g^{-1} with mean value of 96.66 meq 100 g^{-1} and 69.07 meq 100 g^{-1} respectively; Soils of Baghiapada found to be between 60 - 138 meq 100 g^{-1} and 7.89 -102.63 meq 100 g^{-1} with mean value of 99 meq 100 g^{-1} and 55.26 meq 100 g^{-1} respectively; soils of Nuapali found to be between 44 -168 meq 100 g^{-1} and 1.97 meq 100 g^{-1} with mean value of 100.66 meq 100 g^{-1} and 67.76 meq 100 g^{-1} respectively; soils of kanakpur found to be between 54 -180 meq 100 g^{-1} and 1.97 -189.47 meq 100 g^{-1} with mean value of 118.26 meq 100 g^{-1} and 75.60 meq 100 g^{-1} respectively; soils of Bondaparatra found to be between 90 - 200 meq 100 g $^{-1}$ and 13.81 -163.81 meq 100 g^{-1} with mean value of 138 meq 100 g^{-1} and 71.84 meq 100 g^{-1} respectively; soils of Pankimal found to be between 80-154 meq 100 g^{-1} and 21.71 -106.57 meq 100 g^{-1} with mean value of 115.5 meq 100 g^{-1} 67.10 meq 100 g^{-1} respectively; soils of Boudh found to be 44-200 meq 100 g^{-1} and 9.86 -199.34 meq 100 g^{-1} with mean value of 118.14 meq 100 g^{-1} and 82.89 meq 100 g^{-1} respectively; soils of Bhuktapada found to be between 80 - 154 meq 100 g^{-1} and 51.31 -151.97 meq 100 g^{-1} with mean value of 109 meq 100 g^{-1} and 85.36 meq 100 g^{-1} respectively; soils of Khuntiapada found to be between 86 -124 meq 100 g^{-1} and 13.81 -37.50 meq 100 g^{-1} with mean value 105 meq 100 g^{-1} and 25.65 meq 100 g^{-1} respectively; soils of Badhigaon found to be between 56-200 meq 100 g^{-1} and 13.81 -118.42 meq 100 g^{-1} with mean value 135.33 meq 100 g^{-1} and 54.93 meq 100 g^{-1} respectively; soils of Paljhar found to be between 60.0-162 meq 100 g^{-1} and 43.42 -199.34 meq 100 g^{-1} with mean value 110.33 meq 100 g^{-1} and 120.39 meq 100 g^{-1} respectively; soils of Mundapada found to be between 44-200 meq 100 g^{-1} and 7.89 -228.94 meq 100 g^{-1} with mean value of 116 meq 100 g^{-1} and 106.86 meq 100 g^{-1} respectively; soils of Bijapadar found to between 44-140 meq 100 g^{-1} and 104.60 - 199.34 meq 100 g^{-1} with mean value 95 meq 100 g^{-1} and 131.25 meq 100 g^{-1} respectively; soils of Kasalpur found to be between 54-180 meq 100 g^{-1} and 27.63-300 meq 100 g^{-1} with mean value 98 meq 100 g^{-1} and 169.73 meq 100 g^{-1} respectively; soils of Lambakani found to be between 42-174 meq 100 g^{-1} and 53.28 -201.31 meq 100 g^{-1} with mean value 89 meq 100 g^{-1} and 112.99 meq 100 g^{-1} respectively and soils of Olanda found to be 70 -152 meq 100 g^{-1} and 29.60 -219.07 meq 100 g^{-1} with mean value 112 meq 100 g^{-1} and 93.42 meq 100 g^{-1} respectively. Form the above analysis it is clear that soils of all samples are under medium range including the overall Boudh block under medium range. (Table 1)

Table 1: Soil fertility status of the respective villages

Name of the village	Available Nutrient Status											
	N		P		K		S		Ca		Mg	
	Kg ha-1								meq 100 g-1			
	Range	mean	Range	mean	Range	mean	Range	mean	Range	mean	Range	mean
Ereda	168	187.2	8.28	3.63	1515.7	324.52	41.71	23.16	140	120.95	90.78	47.83
Bandharathar	235.2	180.4	4.50	3.04	626.5	184.73	65.38	30.68	138	105.21	195.39	44.90
Hamtapada	347.2	195.01	7.68	4.47	869.5	245.82	78.18	13.70	140	125.52	209.21	60.83
Rampur	145.6	101.81	6.61	4.35	163.8	101.65	9.72	10.31	132	114	566.44	136.90
Maaajishani	201.6	130.66	3.07	4.41	16.4	122.66	6.65	26.44	73.99	96.66	57.23	69.07
Baghiapada	156.8	179.2	0.35	3.36	36.5	230.05	3.199	27.57	77.99	99	94.73	55.26
Nuapali	201.6	159.28	8.31	5.21	291.9	296.56	47.98	41.53	124	100.66	278.28	67.76
kanakpur	156.8	149.0	12.73	5.98	420.3	314.52	74.85	54.18	126	118.26	187.5	75.60
Bondaparatra	190.4	136.64	7.05	6.02	380	354.92	20.34	36.34	110	138	150	71.84
Pankimal	156.8	238	30.18	15.65	325.4	314.7	24.05	44.33	74	115.5	84.86	67.10
Boudh	302.4	211.2	46.48	45.09	465.6	230.61	152.14	49.26	156	118.14	189.47	82.89
Bhuktapada	89.6	184.8	0.76	54.42	106.6	524.12	22.39	21.49	74	109	100.65	85.36
Khuntiapada	44.80	123.2	0.13	12.00	1.39	344.5	15.35	19.96	37.99	105	23.68	25.65
Badhigaon	201.6	153.06	17.91	11.46	150.2	327.53	55.40	34.14	144	135.33	104.60	54.93
Paljhar	100.8	179.2	11.27	8.65	291	367.8	35.57	32.58	102	110.33	155.92	120.39
Mundapada	280	142.4	43.10	12.02	349.4	276.01	150.99	52.68	156	116	221.05	106.86
Bijapadar	22.40	67.2	2.66	5.83	171.8	187.12	68.33	63.91	96	95	94.73	131.25
Kasalpur	179.2	197.86	2.38	6.44	17.2	231	46.44	66.07	126	98	272.36	169.73
Lambakani	100.8	154	2.96	6.11	250.9	337.95	7.42	30.45	132	89	148.02	112.99
Olanda	156.8	184.8	16.07	7.701	191.9	312.58	22.00	36.93	82	112	189.47	93.42
Total boudh block	403.2	170.68	60.61	12.44	1571.4	264.98	154.70	36.23	158	114.47	574.34	77.02

3.6 Soil Reaction

Soil pH (1:2) of the surface soil samples of respective twenty villages were found to be vary between 4.1-7.08 with the mean value of 2.73. most of the village's soils are recorded the acidic to neutral respective data of pH (1:2) presented in the table 2. This could the major constrain in the crop production as the most the major and secondary nutrients are low to medium range in the all villages. Similar finding has also reported earlier by Priyadarshini *et al.*, (2017) [21] and Satpathy (2015) [23].

3.7 Electrical conductivity

Electrical Conductivity (1:2) of the surface soil samples of the entire study area was found to be than 2 dSm-1 (Table 2). Hence all the soils under the study area are safe for all type of crop production with respect to the soluble salt content.

3.8 Soil Organic Carbon

Soil Organic Carbon (SOC) of surface soil samples of respective villages were found to be between 0.3-66 g kg^{-1} with mean value of the 7.71 g kg^{-1}. SOC content of the all villages of study area are presented in the table. the results clearly mentioned that there is enough and high quantity of SOC is present in the soils Table 2.

Table 2: Chemical properties of soils of the study area

Name of the village	pH (1:2)		EC (1:2) (dS m-1)		OC (g kg-1)	
	Range	mean	Range	mean	Range	mean
Ereda	2.53	5.93	0.23	0.12	66	19.62
Bandharathar	2.79	5.22	0.16	0.07	19.8	14.42
Hamtapada	1.42	5.07	0.07	0.04	5.1	2.20
Rampur	1.31	5.29	0.03	0.04	5.55	2.11
Maaajishani	0.28	5.51	0.49	0.30	0.15	2.32
Baghiapada	0.48	5.77	0.07	0.19	0	1.05
Nuapali	1.14	5.84	0.88	0.29	17.55	6.38
kanakpur	2.79	6.08	2.73	0.36	29.7	9.54
Bondaparatra	1.61	5.15	0.36	0.40	12.9	5.55
Pankimal	0.51	4.57	0.25	0.40	2.1	3
Boudh	1.6	5.14	0.57	0.23	9.15	2.44
Bhuktapada	1.1	5.3	0.21	0.22	3.45	1.31
Khuntiapada	0.28	5.22	0.24	0.24	0.14	0.52
Badhigaon	1.23	6.07	0.52	0.20	9.75	7.1
Paljhar	2.02	5.83	0.24	0.21	10.2	8.05
Mundapada	1.74	6.15	0.28	0.08	9.44	3.98
Bijapadar	0.44	6.05	0.03	0.04	0.0075	0.09
Kasalpur	0.34	6.73	0.003	0.057	0.75	9.55
Lambakani	0.89	5.75	0.55	0.24	5.25	4.61
Olanda	1.12	5.89	0.80	0.42	3.75	5.02
Total boudh block	2.95	5.58	2.73	0.18	66	7.71

3.9 Micro nutrient Statues

Micro nutrient statues of the respecrtive villages are shown in table it varies between 26.17 -450.74 ppm for Fe, 22.39 -103.74 ppm for Mn, 1.22 -3.5 ppm for Cu, 0.35 -1.44 for Zn and 0.27 -2.085 for B. the clearly indicate that all micro nutrients are in high range table 2. Fe is positively correlated with Cu (r = 0.558**), Zn (r = 0.874**) and boron (r = 0.167*). Cu is positively correlated with Zn (r = 0.454**). (Table 3)

Table 2: Micro nutrients statues of the respective villages' soils

Name of the village	Fe		Mn		Cu		Zn		B	
	ppm									
	Range	mean	Range	mean	Range	mean	Range	mean	Range	mean
Ereda	343.48	97.23	80.56	47.23	2.28	2.13	1.09	0.63	0.90	0.50
Bandharathar	424.57	144.09	36.58	40.37	2	2.131	1.09	0.73	1.79	0.64
Hamtapada	344.8	106.23	35.79	43.88	2	2.07	1.09	0.66	0.88	0.58
Rampur	320.64	122.16	81.35	47.29	2.28	2.26	1.06	0.67	0.73	0.45
Maaajishani	302.1	330.79	17.1	35.71	0.95	2.60	0.41	1.26	0.86	0.63
Baghiapada	21.83	266.32	3.36	24.4	0.6	2.01	0.28	1.01	1.06	1.55
Nuapali	344.8	90.43	24.28	42.55	1.91	2.10	0.95	0.59	0.88	0.61
kanakpur	344.8	124.66	35.79	44.17	2	2.20	1.09	0.68	0.88	0.52
Bondaparatra	284.77	168.24	31.67	39.89	1.85	2.31	0.98	0.76	0.38	0.50
Pankimal	340.31	132.39	20.21	46.60	0.73	1.99	0.95	0.74	0.57	0.66
Boudh	343.48	87.60	81.35	45.05	2.28	2.15	1.09	0.59	0.90	0.51
Bhuktapada	137.6	324.15	34.11	37.21	1.17	2.25	0.46	1.16	1.12	1.30
Khuntiapada	31.67	46.49	4.12	38.68	0.33	1.685	0.32	0.62	0.09	0.33
Badhigaon	102.6	64.87	24.28	42.12	1.93	2.12	0.33	0.51	0.88	0.59
Paljhar	100.3	109.19	31.46	47.03	0.68	1.90	0.38	0.67	0.386	0.57
Mundapada	402.27	181.28	33.65	41.44	1.85	2.35	1.09	0.81	0.67	0.55
Bijapadar	31.67	42.42	6.97	38.42	0.83	1.86	0.42	0.50	0.88	0.57
Kasalpur	102.6	74.93	23.73	43.65	1.91	2.37	0.28	0.55	0.50	0.47
Lambakani	30.82	89.29	23.06	48.45	0.43	1.71	0.27	0.70	0.34	0.58
Olanda	290.19	153.44	31.67	41.83	1.85	2.28	0.98	0.73	0.38	0.50
Boudh block	424.57	124.50	81.35	43.31	2.28	2.15	1.09	0.69	1.81	0.57

Table 3: Correlation between different properties

	N Kg ha^{-1}	P Kg ha-1	K Kg ha^{-1}	S Kg ha^{-1}	Ca meq 100 g $^{-1}$	Mg meq 100 g^{-1}	OC g kg^{-1}	pH	E.C	Fe	Mn	Cu	Zn	B
N Kg ha^{-1}	1													
P Kg ha^{-1}	0.157**	1												
K Kg ha^{-1}	-0.005	0.032	1											
S Kg ha^{-1}	0.133	0.174*	-0.087	1										
Ca meq 100^{-1}	-0.045	0.027	-0.103	-0.015	1									
Mg meq 100 g $^{-1}$	0.070	0.030	-0.083	0.158*	-0.202	1								
OC g kg^{-1}	-0.013	-0.339	0.128	-0.114	-0.053	-0.161	1							
pH	-0.121	-0.250	0.229**	0.321*	-0.070	0.024	0.140	1						
E.C	0.009	0.104	0.231**	0.054	0.006	-0.053	-0.146	-0.050	1					
Fe	0.001	0.004	0.163*	0.034	-0.045	0.017	-0.054	0.025	0.104	1				
Mn	0.107	0.006	0.114	-0.087	0.033	-0.005	-0.049	0.043	-0.072	-0.149	1			
Cu	-0.026	0.027	0.098	0.099	0.056	-0.014	0.079	0.022	0.017	0.558**	0.091	1		
Zn	0.016	0.001	0.166*	-0.006	-0.013	0.004	-0.038	0.008	0.044	0.874**	-0.038	0.454**	1	
B	0.062	0.076	0.041	-0.039	-0.071	0.029	0.027	-0.111	-0.057	0.167*	-0.134	-0.074	0.143	1

* = 5% level of significant, ** = 1% level of significant

4. Summary

From the above study it was found that the soils were very slightly acidic (5.07) to almost neutral (6.73). most of the soils are low to medium in major and secondary nutrients, micro nutrients are well sufficient. Research finding suggesting the application of major and secondary nutrients in the villages where the nutrients status was very low. Mostly intergraded approach was the best way to overcome the low fertility status of the soils and improve the soil heath condition.

5. Conclusion

From overall study it was found that all major and secondary nutrients are in medium to low content and soil reaction was in acidic condition all this finding suggested that there should be application of the respective nutrients and some villages need lime application to over come the problem of acidity which in in turn help in improve the soil reaction and other chemical properties. SOC content and other micro nutrients are in sufficient quantity. Application of organic manures, Phosphoric and nitrogenous fertilizers can improve the soil nutrient status and soil health.

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