

# ASSESSMENT OF SULPHUR STATUS AND SOIL PROPERTIES OF DIFFERENT SOIL TYPE OF MALKHARAUDA BLOCK IN JANJGIR, CHAMPA DISTRICT OF CHHATTISGARH

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## ABSTRACT

The study was carried out to assess the soil fertility status with respect to available sulphur nutrient status and soil properties in different soil types of Malkharauda block under Janjgir-Champa district of Chhattisgarh during 2013-14. Grid based 1975 surface (0-15 cm depth) soil samples were collected using Global positioning system (GPS) from 110 villages of Malkharauda block. The soil samples were analyzed for pH, EC, OC and Sulphur. Most of the soil pH varied from 4.2 – 8.0 and indicated that soils were found to be moderately acidic to slightly acidic in reaction. The organic carbon content in these soils varied from 0.14 – 1.00 per cent which was observed to be medium to low in organic matter status. The electrical conductivity (EC) varied from 0.05 to 0.81 dS m<sup>-1</sup> with a mean value of 0.21 dS m<sup>-1</sup> at 25°C of the Malkharauda block. The available sulphur status varied from 7.56-89.32 kg ha<sup>-1</sup> with a mean value of 38.43 kg ha<sup>-1</sup>. It can be concluded that the soils group of Malkharauda block of Janjgir-Champa district of Chhattisgarh had low to high level of available S and characterized under moderately acidic to slightly alkaline in soil pH comes under safe limit for soils.

## INTRODUCTION

Soil fertility has a direct relation with the crop yields, provided other factors are in optimum level. Soil fertility must be periodically estimated as there is continuous removal of macro and micro nutrients by the crop intensively grown in every crop season. In order to achieve higher productivity and profitability, every farmer should realize that fertility levels must be measured as these measurements can then be used to manage soil fertility. It is determined by the presence or absence of nutrients *i.e.* macro and micronutrients. Balanced nutrient use ensures high production level and helps to maintain the soil health. Fertilizing soils to bring all the deficient elements at high levels as to provide sufficient ionic activity in soil solution for crop uptake is one of the most important considerations for maximization of the crop yield and the study of physico-chemical characteristics of agricultural soils were reported by several researchers (Deka *et al.*, 2008 and Du Zhanglia *et al.*, 2009). Malkharauda is a prominent block in Janjgir-Champa district of Chhattisgarh and when fertility status of a soil is known in terms of soil test values, the soil test values could be calibrated into different fertility categories such as low, medium and high (Welch and Wiere 1987 and Rashid and Memon, 1996). Continuous monitoring of physical properties should be carried out necessary for maintaining soil health and enhancing the crop production. Evaluation of soil physical properties is necessary to make sound fertilizer recommendations for optimizing the productivity of field crops

more so in case of submerged rice. Therefore, the paper deals with influence of organic and inorganic fertilization on soil physical properties in all soil.

## MATERIALS AND METHODS

The investigation to evaluate the fertility status of Malkharauda block of Janjgir-Champa district of Chhattisgarh. Three types of soil present namely *Inceptisol*, *Alfisol* and *Vertisol*. These samples will be analyzed for available sulphur status to categorize them into low, medium and high categories with pH and organic carbon level and standard statistical procedure for correlation study will be followed. The soil samples were collected and prepared by drying, crushing and sieving through 2 mm sieve. The selected samples were analyzed for soil pH (1:2.5) soil: water suspension after stirring for 30 minutes, by glass electrode pH meter as suggested by Piper (1967). 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 Walkley and Black's rapid titration method (1934) and available S was determined by turbidity method using spectrophotometer (Williams and Stainberg, 1969). Samples were taken at fixed intervals systematically across a grid from each of 10 ha area. The soil of study area was analysed for the available nutrient content of Sulphur and pH, EC, OC. For this purpose, 961 soil samples were selected randomly from 1975

samples of Malkhaurada block for present study. Sampling points were determined prior to sampling with the help of GPS across a field for a soil type under study. Standard statistical procedure including correlation studies was adopted to analyze the data.

## RESULTS AND DISCUSSION

### Physico-chemical characterization of soil

The data pertaining to status of pH, organic carbon and electrical conductivity content of soil samples of Malkharouda block under investigation are summarized in Table. 1 to 4

#### Soil reaction (pH)

The rating for pH values used to classify soils of the study area has been presented in the Table 2. The soils having pH < 5.0 designated as strongly acidic, 5.0 to 6.0 as moderately acidic, 6.1 to 6.5 as slightly acidic, neutral 6.6 to 7.5 as and as 7.6 to 8.5. slightly alkaline.

The overall soil pH of farmer's field was moderately acidic to slightly alkaline in reaction and ranged from 4.2 to 8.0 with an average of 5.9 in different soils type of Malkharouda block.

The pH ranged from 4.2 to 8.0, 5.0 to 8.0 and 4.6 to 8.0 in

*Inceptisols*, *Alfisols* and *Vertisols* with an average of 5.9, 6.0 and 6.0 in Malkharouda block, respectively (table 1). Considering over all 961 Malkharouda block soil samples, 41.62 per cent soils were moderately acidic, 26.53 per cent slightly acidic, 11.55 per cent strongly acid, 18.41 per cent neutral and 1.87 per cent slightly alkaline in reaction in Malkharouda block, (Table 2). Shukla (2011) also reported that the soil pH varied from 4.5 to 8.1 in Pamgarh block of Janjgir-Champa district (C.G.) Jena *et al.* (2008) also reported that pH ranged from 4.6-7.5 with the mean value of 5.9 soils of deltaic alluvium of coastal Orissa.

The relative low pH of the soils might be due to low degree of base saturation. As majority of the soil samples are acidic in nature, the farmers are suggested to grow acid loving crops like rice etc. or liming should be advised for harvesting optimum production of the crops.

#### Electrical conductivity (EC)

The electrical conductivity (EC) varied from 0.01 to 0.97 dS m<sup>-1</sup> with a mean value of 0.16 dS m<sup>-1</sup> at 25°C of the Malkharouda block. The total salt content of these soils expressed as EC are categorized as <0.1, 0.1 to 0.2, 0.2 to 0.3 and >0.3 dS m<sup>-1</sup>. The normal EC may be ascribed to leaching of salts to lower

**Table 1: Range and Mean values of Malkharouda block**

Soil Parameters	Inceptisols		Alfisols		Vertisols	
	Range	Mean	Range	Mean	Range	Mean
pH (1:2.5, Soil water)	4.2-8.0	5.9	5.0-8.0	6.0	4.6-8.0	6.0
EC (dS m <sup>-1</sup> )	0.06- 0.74	0.18	0.05 -0.77	0.18	0.05- 0.86	0.15
O.C. (%)	0.14-0.92	0.54	0.28-0.97	0.59	0.33-1.00	0.66
Available S (kg ha <sup>-1</sup> )	7.56-89.3	38.96	12.6-80.9	37.95	12-71.4	34.07

**Table 2: Category of soil samples under different pH rating of Malkharouda block**

pH Classes/ Limit	Soil type Inceptisols		Alfisols		Vertisols		Total (%)	
	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples
Strongly acid < 5.0	104	14.46	1	0.57	6	8.82	111	11.55
Moderately acid 5-6.0	287	39.77	90	51.72	23	33.82	400	41.62
Slightly acid 6.1-6.5	183	25.45	49	28.16	23	33.82	255	26.53
Neutral 6.6-7.5	132	18.35	31	17.81	14	20.58	177	18.41
Slightly alkaline 7.6-8.5	13	1.80	3	1.72	2	2.94	18	1.87
Total sample	719	78.81	174	18.10	68	7.94	961	
Soil Characteristics	Range		Mean		SD			
pH	4.2 – 8.0		5.9		± 0.75			

**Table 3: Distribution and categorization of electrical conductivity status**

Electrical conductivity (EC) dS m <sup>-1</sup> . Classes/ Limit	Soil type Inceptisols		Alfisols		Vertisols		Total (%)	
	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples
(<0.1)	152	27.55	31	14.84	18	16.27	201	23.86
(0.1-0.2)	389	49.93	103	55.84	35	72.09	527	52.36
(0.2-0.3)	125	14.82	28	21.09	15	11.62	168	16.27
(>0.3)	53	7.69	12	8.20	0	0	65	7.49
Total sample	719	74.81	174	18.10	68	7.07	961	
Soil Characteristics	Range		Mean		SD			
(EC) dS m <sup>-1</sup> .	0.01-0.97		0.16		± 0.10			

**Table 4: Distribution and categorization of organic carbon status in soils of Malkharouda block.**

OrganicCarbon (%) Classes/ Limit	Soil type <i>Inceptisols</i>		Alfisols		Vertisols		Total (%)	
	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples
Very Low(<0.25)	14	1.94	0	0	0	0	14	1.45
Low(0.25-0.50)	256	35.60	46	26.43	9	13.23	311	32.36
Medium(0.50-0.75)	415	57.71	112	64.36	35	51.47	562	58.48
High(>0.75)	34	4.72	16	9.19	24	35.29	74	7.70
Total sample	719	74.81	174	18.10	68	7.07	961	
Soilcharacteristics	Range		Mean		SD			
OC	0.14 – 1.00		0.56		± 0.12			

**Table 5: Distribution and categorization of Sulphur status in soils of Malkharouda block**

Available S(kg ha <sup>-1</sup> ) Classes/ Limit	Soil type <i>Inceptisols</i>		Alfisols		Vertisols		Total (%)	
	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples	No. of Samples	%Samples
Low (<22.4)	140	19.47	35	20.11	22	23.35	197	20.49
Medium(22.4-35)	191	26.56	51	29.31	15	22.05	257	26.74
High (>35)	388	53.96	88	50.57	31	45.58	507	52.75
Total sample	719	74.81	174	18.10	68	7.07	961	
SoilCharacteristics	Range		Mean		SD			
Available S(kg ha <sup>-1</sup> )	7.56-89.32		38.43		± 17.06			

horizons due to its light textured nature and heavy rainfall and surface run-off. The EC ranged from 0.06 to 0.74, 0.05 to 0.77 and 0.05 to 0.86 dS m<sup>-1</sup> in *Inceptisols*, *Alfisols*, and *Vertisols*, respectively with an average of 0.18, 0.18 and 0.15 dS m<sup>-1</sup> (Table 1)

Data presented in table 3 revealed that in Malkharouda block, 52.36% soil samples were found under (0.1-0.2 dS m<sup>-1</sup>), 32.86% samples under (<0.1 dS m<sup>-1</sup>), 16.27% samples under (0.2-0.3 dS m<sup>-1</sup>) and 7.49% samples under (>0.3 dS m<sup>-1</sup>) limits. The results have shown that all the EC values were under normal range (<1.0 dS m<sup>-1</sup>), therefore these soils are denoted as non-saline and it was reported by Nayak *et al.* (2015) and Bali *et al.* (2010). Similar results were also found in soils of Pamgarh block in Janjgir-Champa district (C.G.).

#### Organic carbon (OC)

Organic carbon status of different soils of Malkharouda block is presented in the Table 4. The soils of Malkharouda blocks are low to medium in organic carbon status it ranged from 0.14 to 1.00 per cent with a mean value of 0.56 per cent.

Nearly 58.48 per cent soil samples of Malkharouda block were medium in organic carbon content. The organic carbon content ranged from 0.14 to 0.92, 0.28 to 0.97 and 0.33 to 1.00 per cent with mean of 0.54, 0.59 and 0.66 per cent in *Inceptisols*, *Alfisols* and *Vertisols*, respectively in Malkharouda block (table 1). On an average, 1.45 per cent soils samples are very low, 32.36 per cent low, 58.48 per cent medium and 7.70 per cent high in organic carbon content in Malkharouda block (Table 4).

The high temperature prevailing in the area is responsible for the rapid burning of organic matter, thus resulting in low to medium organic carbon content of these soils. Similarly, Sharma *et al.* (2008) reported in soil of Amritsar district the

organic carbon ranged between 0.16 to 0.97 % with an average value of 0.61 per cent. Jatav *et al.* (2010) also found that the organic carbon of soil ranged between 0.23 to 0.83 with the mean value of 0.44 per cent in Baloda block of Janjgir-Champa district of Chhattisgarh. The results are in close conformity with findings of Divya (2012) and Choudhary *et al.* (2015).

#### Available sulphur status

The sulphur content ranged from 7.56 to 89.32 kg ha<sup>-1</sup> with an average value of 38.43 kg ha<sup>-1</sup> in soils of Malkharouda block irrespective of soil samples of different orders. In *Inceptisols*, *Alfisols* and *Vertisols*, it ranged from 7.56 to 89.3, 12.6 to 80.9 and 12 to 71.4 kg ha<sup>-1</sup> with an average 38.96, 37.95 and 34.07 kg ha<sup>-1</sup>, respectively (table 1). Overall in Malkharouda block, 52.72 per cent of soil samples showed high status of sulphur, 26.74 per cent of soil samples showed medium and only 20.49 per cent of samples falls under low available sulphur category. In Malkharouda block, 53.96, 50.57 and 45.58 per cent of soil samples under *Inceptisols*, *Alfisols* and *Vertisols*, respectively are observed under high available sulphur status (table 5). The results are in close conformity with findings of Manasa *et al.* (2015) and Goswami *et al.* (2014).

#### Soil fertility assessment

Based on the criteria given in Table 6, the soils of the different soil group (having *Alfisols*, *Inceptisols* and *Vertisols*) of Malkharouda block have been characterized into three soil

**Table 6: Soil fertility assessment based on soil fertility index for sulphur nutrients**

Fertility class	No. of villages
High	41
Medium	51
Low	18

**Appendix I: Mean values of different parameters in different villages of study area block- Malkharauda, dist- Janjgir-Champa, no. of villages [110]**

Name of Village	pH	OC(%)	SKg ha <sup>-1</sup>	Name of Village	pH	OC(%)	SKg ha <sup>-1</sup>	Name of Village	pH	OC(%)	SKg ha <sup>-1</sup>
PIRDA	6.6	0.54	30.50	SONADULA	5	0.48	58.05	ANDI	5.6	0.64	41.83
PARSI	5.58	0.52	50.79	SULOUNI	6.4	0.55	42.19	ANDA	5.9	0.73	39.01
BADODA	5.52	0.61	46.2	RUNPOTA	6.7	0.58	35.25	CHOTE KOTE	5.9	0.88	31.92
DONGARI DEH	7.01	0.54	28.88	BARPALI	6.2	0.49	37.69	DALAL PALI	4.9	0.69	36.29
BAR BHATHA	6.21	0.58	49	CHATI PALI	5.1	0.47	41.81	TULSI DIH	4.7	0.45	64.07
CHAR PARA	6.2	0.47	45.44	KHEMDA	4.9	0.52	52.16	BADEY MUDPAR	5.4	0.66	50.09
NAVAGAON	6	0.65	44.91	BILAIGARH	6.5	0.55	34.48	BHATHA	6	0.64	33.24
CHOTE RABLI	5.7	0.55	48.69	BHATHORA	6.3	0.43	34.16	PARSHA	5.5	0.46	22.26
SATGARH	5.8	0.6	41.24	BANDORA	4.6	0.46	68.12	MUDPAR	5.6	0.55	32.2
BADEY SIPAT	6.4	0.61	34.08	POTA	6.3	0.61	27.56	SAPIYA	5.6	0.72	26.39
ANDBHAR	6.6	0.6	32.44	NOURAGPUR	6.2	0.65	34.39	BUNDELI	6.8	0.61	21.7
AMERADIH	6.6	0.53	34.37	KHARRI	5.4	0.59	60.76	KARIPALI	5.9	0.55	41.72
BHUTAHA	6.5	0.57	41.31	SANJARI	6.6	0.58	38.85	CHHATAUNA	6.3	0.55	40.13
NAGJHAR	5.9	0.48	50.12	GHUGHARI	6.3	0.62	35.35	TATA	6.4	0.54	32.98
PIHARID	6.3	0.49	35.23	NAVA PARA	5.6	0.69	32.24	SAKARI	6.1	0.53	34.02
CHOTE SIPAT	5.1	0.41	48.37	KARIGAON	5.2	0.47	37.24	JAROUDA	6.2	0.53	37.15
MUKTA TKUR	7.1	0.6	29.06	AAMDULA	6.8	0.52	44.12	DIMINI	6	0.5	28.56
KANAI DIH	5.5	0.59	38.29	BANJARI	6.3	0.54	27.76	JODA SAGAR	7	0.51	30.43
BASNTPUR	5.4	0.71	31.42	MOHATRA	5.3	0.59	44.92	TURRI	6.1	0.59	33.04
HARDI	4.9	0.65	34	BIR BHATHA	5.7	0.61	31.75	KULKI	5.9	0.62	42.93
MANDA GUDI	5.4	0.45	29.18	LIMGAON	5.7	0.61	56.77	BADEY SIPARA	5.5	0.55	63.33
MARGHATI	7	0.5	31.08	MALKHRODA	6.6	0.53	29.92	PARAMA	5.9	0.34	38.78
PIKARI	5.4	0.58	47.5	KALMI	6.0	0.58	38.08	PHAGUL	5.4	0.61	31.24
CHAROUDI	7.1	0.72	31.01	SARAS KERA	4.7	0.32	38.81	SAKARRA	5.6	0.55	31.24
CHAROUDA	6.4	0.48	39.85	SERO	5.1	0.44	30.84	DARI MANDA	5.7	0.7	20.04
JAMGHAN	5.7	0.43	50.52	DOMA	6.1	0.44	18.85	KULWA	5.6	0.59	43.26
BASIT	6.6	0.5	30.21	MAHALDWIP	5.8	0.44	22.44	BADEY KHOLI	5.4	0.51	36.43
SARASDOL	5.6	0.57	43	JOGIDIPA	6.3	0.66	33.27	BHEDO KONA	5.4	0.51	32.48
MIROUNI	6.2	0.71	33.75	KURDI	6.2	0.66	30.35	BHADRA GOUDI	6.9	0.56	52.7
BADEY DARMUDA	5.8	0.54	41.23	ACHARI PALI	5.4	0.56	28.78	PUGURAM	5.5	0.36	53.48
ARUDA	6.7	0.68	32.6	AMALI DIH	5.8	0.56	39.44	BADEY RABELI	6	0.49	50.65
DICXI	6.6	0.55	31.49	NARIYARA	5.2	0.43	40.88	MOGHARI	6.5	0.52	30.97
MOHADI KLA	6.4	0.57	33.49	CHAPORA	6.7	0.61	33.28	PHOOLBA	6.1	0.54	47.37
KATARI	6.3	0.55	35.02	KURDA	5.5	0.48	39.05	CHANDELA DIH	5.1	0.46	46.73
BELHADIH	6.2	0.43	40.97	SINGHARA	5.4	0.52	42.62	PARSHA DIH	4.9	0.59	51.14
DEV GAON	6.3	0.72	37.15	BADEY KOTE	5.9	0.81	26.81	KIRARI	5.4	0.62	40.15
CHIKHALI	6.3	0.68	36.54	KIRKAR	5.6	0.75	36.4				

fertility categories of available Sulphur, viz., High-medium-low (HML).

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