International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(3): 803-807

Received: 14-03-2020
Accepted: 16-04-2020

S Shailja Iyer
Department of Soil Science and Agricultural Chemistry, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

GP Ayam
Department of Soil Science and Agricultural Chemistry, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
S Shailja Iyer
Department of Soil Science and Agricultural Chemistry, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Soil fertility status of available phosphorus in soil through soil fertility mapping using GPS and GIS techniques of dharmaur micro-watershed Jagdalpur block, Bastar District of (C.G.) State

S Shailja Iyer and GP Ayam

DOI: https://doi.org/10.22271/chemi.2020.v8.i3j.9301

Abstract
The present research on the soil fertility status of available phosphorus in soil by soil fertility mapping using GPS and GIS techniques of the Dharmaur microwatershed Jagdalpur block, Bastar district of C.G. The goal of the study was to quantify the soil fertility status of available phorphorus in Dharmaur micro-watershed soils through soil fertility mapping using GPS and GIS techniques. Soil fertility maps have been modified using the Geostatistical Interpolation Process Kriging technique. The soil fertility analysis of the study area will be carried out on a scale of 1:10000. Grid point based soil samples (0-15 cm) will be collected, dried, grounded and processed for part of the villages of Kumhrawand and Tekameta and surrounded by the village of Kumhrawand to the east, the village of Tekameta to the west, the river Indravati to the north and the villages of Bhadisgaon & Biringpal to the south at a distance of 100 metres.

Keywords: Soil fertility mapping, GPS, GIS

Introduction
Soil fertility can be defined as the inherent capacity of soil to supply plant nutrients in an adequate quantity, in an acceptable proportion and free of toxic substances. As a consequence, fertile soil may or may not be productive depending on crops, marketing conditions and a variety of other factors (i.e., excessive acidity or alkalinity, presence of harmful contaminants, poor physical properties or abundance or deficiency of water). However, any productive soil must be fertile. Soil fertility maps be used for land assessment and setting up projects, soil and terrain resource inventory reports, soil survey reports, watershed reports, and fertility assessment study. Steps concerned in fertility maps be – a collection of the soil sample, analysis of the sample, and mapping. Soil fertility maps play an essential role into determining the nutrient availability for soil and distribution and outline of nutrient depletion in the area of study. GIS function in agriculture also provide help in the managing and control of agricultural resources. GPS stand for geographical positioning system means an device which receives satellite signal for calculating your exact position, i.e., longitude, latitude, elevation. GPS tools plays an vital role in agriculture. GPS application used in soil sampling that provide the specific data to determine soil variability and to establish whether a given type of soil is ideal for the growth of a particular crop. (ISSS 2015).

Material and methods
Study Area
Chhattisgarh state is divided into 3 Agro-climatic zones – Chattisgarh plains, Bastar Plateau, and Northern Hill zone, each covering 51%, 28%, and 21% of the total geographical area respectively. Bastar district comes under the Bastar Plateau zone. The study area is the Dharmaur Micro-Watershed in Jagdalpur block, Bastar District of Chhattisgarh state, which is located between 19° 2′ 30″ to 19° 07′ 30″ N latitude and 81° 55′ to 81° 57′ 30″ E longitude with an altitude of ranging from 540-562 m above MSL. The study area covers the majority of the part of Dharmaur, Kumhrawand and Tekameta villages and is surrounded by Kumhrawand village to the East, Tekameta village to the West, Indravati River to the North, and Bhadisgaon & Biringpal villages to the South.

District Profile

Bastar district is situated in the southern part of Chhattisgarh state, at the height of 550 meters above mean sea level. Bastar is surrounded by Kanker to the north, Dantewada to the west, Nowrangpur to the East and Sukma to the South. The area covered by forest in Bastar is 7112 sq km, which is more than 75% of the total area of the district.

Agro-ecological region

The study area falls under Garjat Hills, Dandakaranya and the Eastern Ghats, hot moist sub-humid ESR, with deep loamy red and lateritic soils, low to medium AWC and LGP 180-210 days with average annual rainfall 1295 mm out of which 70% rainfall occurs during June-September.

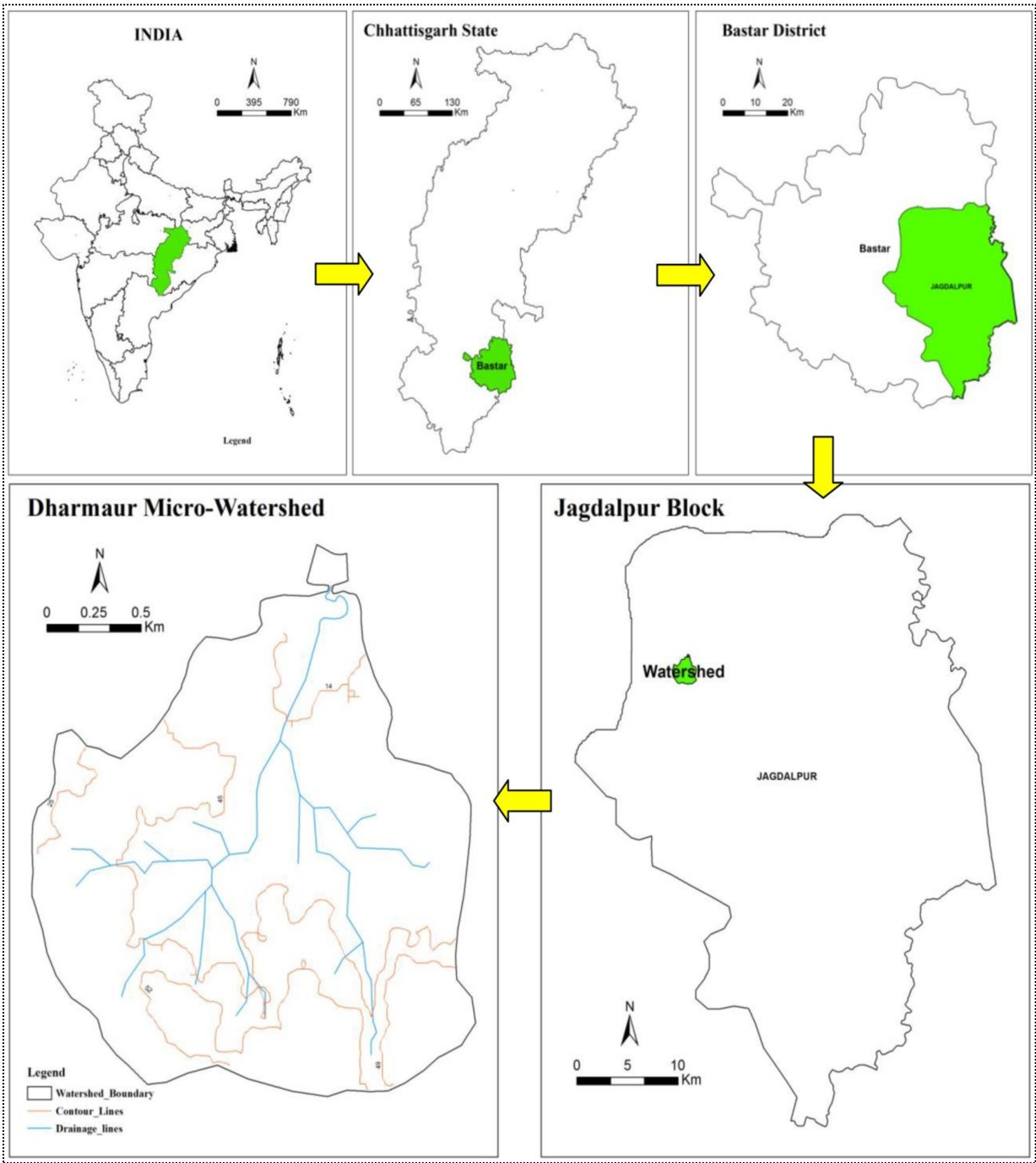

Fig 1: Location Map of the Dharmaur Micro-Watershed in Bastar district

Estimation of available phosphorus (in soil)

Olsen's method for slightly acidic, neutral and alkaline soils (Olsen *et al*., 1954)

The extracting reagent for Olsen's method is 0.5 M sodium bicarbonate (pH 8.5) prepared by dissolving 42.0 g of $NaHCO_3$ (laboratory reagent) in distilled water to give one litre of the solution. The pH is adjusted to 8.5 with small quantities of 10 per cent NaOH. The method has been found widely applicable in slightly acid, neutral and calcareous soils.

Extraction of available phosphorus

Add a little Darco G 60 charcoal powder (free of phosphorus) followed by 50 ml of Olsen reagent to 2.5 g of soil in 100 ml of conical flask. Run the blank without the soil. Shake the flasks on a platform shaker for 30 minutes and filter the contents immediately through dry filter paper (Whatman No.1) into a clean, dry beaker or vial. Estimate phosphorus colorimetrically by Dickman and Bray's (excess acid) procedure or Watanabe and Olsen procedure.

Note: The activated carbon (even if marked phosphorus – free) is likely to contain traces of P, which have to be removed by repeated washings with Olsen's reagent followed by warm distilled water. The material should test free of phosphorus when extracted with Olsen's reagent. The sodium bicarbonate should also be free from any phosphate contamination.

Estimation of phosphorus in the Olsen's extract by ascorbic acid method (Watanabe and Olsen, 1965)

Reagents

i. **Reagent A**: Dissolve 12 g of ammonium molybdate (AR) in 250 ml of distilled water and 0.291 g of antimony potassium titrate in 100 ml distilled water separately. Add these two solutions to 1000 ml of approx. 5 N H_2SO_4 (140 ml conc. H_2SO_4 in one litre), mix them thoroughly and makeup the volume to two liters with distilled water.
ii. **Ascorbic acid solution**: Dissolve 1.056 g of ascorbic acid (LR) in 200 ml of reagent (i) and mix well. This should be prepared fresh as and when required.

Procedure

Take 5 ml of Olsen extract in a 25 ml volumetric flask and carefully acidify with 5N H2SO4 to pH 5. (This can be easily achieved by taking 5 ml of the extracting reagent in a separate 25 ml flask and by calculating the volume of acid needed to raise the pH of the solution to 5 using the p-nitro phenol indicator, the yellow color of which disappears at this pH). After changing the pH, dilute the contents to 20 ml with distilled water and apply 4 ml of reagent (ii) and make-up to thickness. Shake the contents after 10 minutes. Read the intensity of the blue color in the photoelectric colorimeter for 30 minutes, using a red filter or 730-840 nm wavelengths. A blank must also be run (without soil) along with the sample. The colour is relatively more stable than with stannous chloride reduction.

Result and discussion

Available Phosphorus

The accessible soil phosphorus ranged from 6 to 21.8 kg $ha^{-1,}$ with an average of 10.69 kg ha^{-1}. Among the complete amount of soil samples (88.2 percent) were in a low category and the mild category (11.7 percent). The nutrient index value of accessible phosphorus in the study region soil falls under the low category. Status of accessible P in the research region soils shown on the soil fertility map in Fig.2.Devdas (2013) in Navagarh block soils under Chhattisgarh District of Janjgir.

Singh (2014) [2] disclosed that for the Chambal area of Madhya Pradesh, the fertility status of alluvial and medium black soil and ravenous soil and their correlation studies were conducted. The accessible P range was 7.0 to 29.5 kg ha^{-1} in alluvial soil; 7.9 to 28.8 kg ha^{-1} in medium black soil and 6.2 to 25.3 $kgha^{-1}$ in ravenous soil respectively. Of alluvial soil samples, 14 per cent low, 68 per cent medium and 18 per cent high in P. of medium black soil sample 21 per cent low 69 per cent medium and 10 per cent high in P. of ravenous soil samples, 68 per cent low and 32 per cent medium in P. The low soil status of P available in soils may be due to alkaline soil response and elevated soil content of $CaCO_3$.

The distribution of available P in different farming situation in the map shows that in Marhan, Tikra, Mal farming situation available P were low status in soil and in Gabhar farming situation available P were medium status in soil. Distribution of available P status in the study area shown in Table 1.

Table 1: Distribution of available P status in the study area

Available P_2O_5 (kg/ha)	No. of Samples	% Samples	Nutrient Index	Fertility Rating
Low (<12.5)	382	88.2	1.00	Low
Medium(12.5-25.0)		11.7		
High (>25.0)				

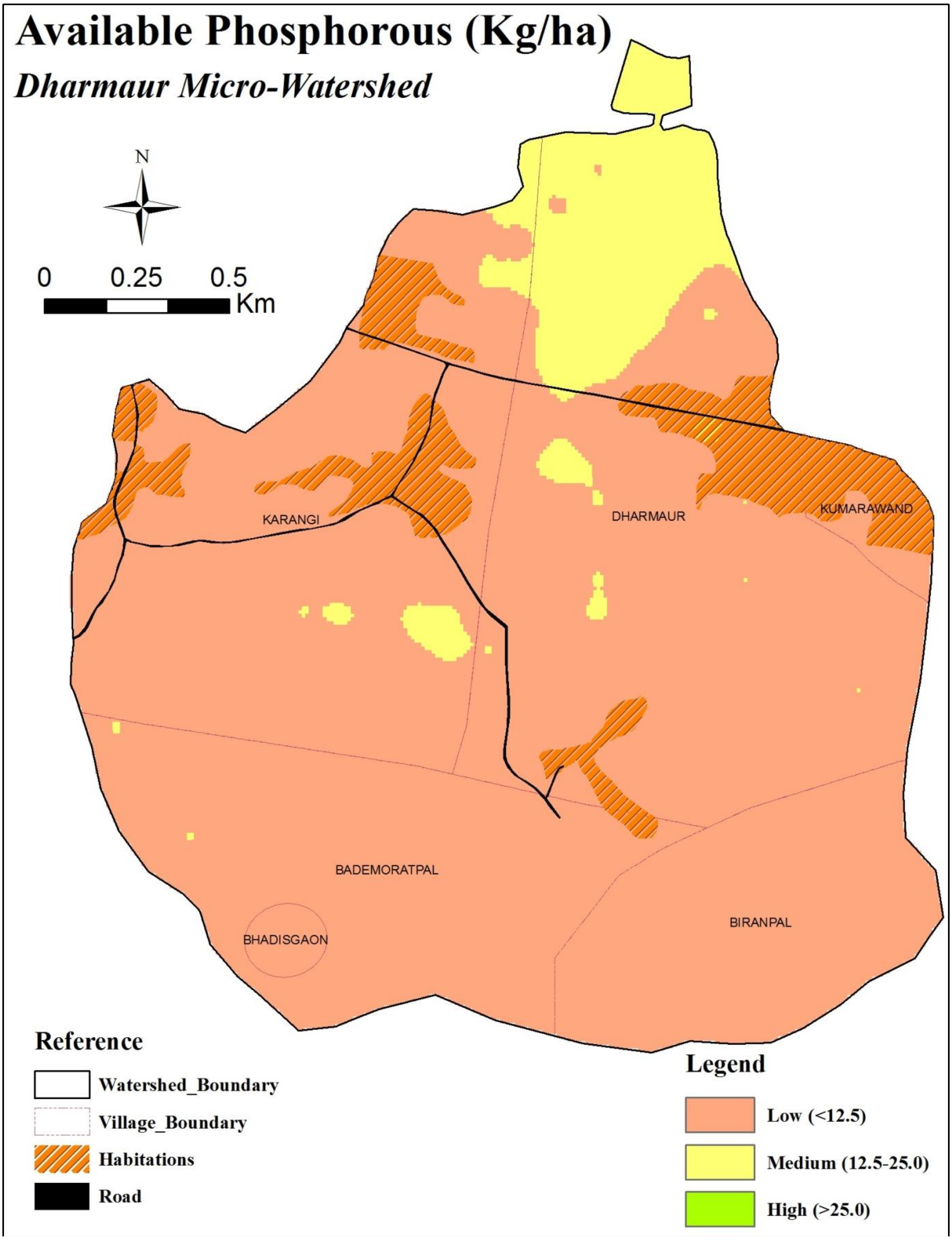

Fig 2: Status of available P in soils of Dharmaur micro-watershed

Descriptive statistics analysis

The descriptive statistics of available Phosphorus are shown in Table 2 which suggested that they were all normally distributed. The science that deals with the compilation, evaluation and interpretation of numerical information (Corxton & Cowden, 1969). This method summarizes both statistically and graphically data. It measures central of tendency of all soil parameters. The method offers a wide range of statistical data about a single variable. A logarithmic transformation is considered where the coefficient of skewness is greater than one (Webster and Oliver, 2001) [6].

Table 2: Descriptive statistics of Available P(0-15 cm) depth of 382 soil Samples

Descriptive Statistics	P(Kg/ha)
Minimum	6
Maximum	21.8
1st Quartile	9.1
Median	10.5
3rd Quartile	12.2
Mean	10.69
Standard deviation	2.63
Skewness	1.26

References

1. Agriculture Contingency Plan for District: Bastar by CRIDA Source: Agricultural Statistics, Commissioner land records, Raipur, Govt. of Chhattisgarh, 2009.
2. Singh YP, Raghubanshi BPS, Tomar RS, Verma SK, Dubey SK. Soil Fertility Status and Correlation of Availabal Macro and Micronutients in chambal reigion of Madhya Pradesh. J Indian Soc. Soil Sci. 2014; 62(4):369-375.
3. Devdas Deepika. soil fertility mapping and tracing out limiting nutrients as production constraints for Gariyaband district of Chhattisgarh Ph.D thesis, I.G.K.V. Raipur, (Chhattisgarh), 2016.
4. Das DK. Introductory Soil Science. Kalyani Publishers, Ludhiana, 2004, 493.
5. Das. soil fertility mapping of Nayranpur through GPS and GIS, 2016.
6. Webster R, Oliver MA. Geostatistics for Environmental Scientists. Hoboken, N.J. John Wiley and Sons Inc, 2001.