Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP2: 137-140

Dr. Adarsh Kumar Srivastava
Scientist, KVK, Dhanbad, Jharkhand, India

Mahesh Chandra Jerai
Scientist, KVK, Latehar, Jharkhand, India

Dr. JK Lal
Scientist, KVK Dumka, Jharkhand, India

Correspondence
Dr. Adarsh Kumar Srivastava
Scientist, KVK, Dhanbad, Jharkhand, India

Nutrient status of Dhanbad district soils

Dr. Adarsh Kumar Srivastava, Mahesh Chandra Jerai and Dr. JK Lal

Abstract
Soil fertility is a complex quality of soils that is closest to plant nutrient management. Soil fertility is an aspect of the soil-plant relationship. Fertility status of the soils is primarily and importantly dependent upon both the macro and micronutrient reserve of that soil. Continued removal of nutrients by crops, with little or no replacement will increase the nutrient stress in plants and ultimately lowers the productivity. Soil test based nutrient management has emerged as a key issue in efforts to increase agricultural productivity and production since optimal use of nutrients, based on soil analysis can improve crop productivity and minimize wastage of these nutrients, thus minimizing impact on environmental leading to bias through optimal production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas. This Physio-Chemical study of soil is based on various parameter like pH, Electrical Conductivity(EC),Total Organic Carbon, Available Nitrogen (N), Available Phosphorus (P2O5) and available Potassium (K2O), Sulphur (S), Zinc (Zn), Boron (B) and Iron (Fe).

Keywords: Alfisols, entisols, soil fertility, nitrogen, phosphorous

Introduction
Soil fertility is a complex quality of soils that is closest to plant nutrient management. It is the component of overall soil productivity that deals with its available nutrient status, and its ability to provide nutrients out of its own reserves and through external applications for crop production. It combines several soil properties (biological, chemical and physical), all of which affect directly or indirectly nutrient dynamics and availability. Fertility status of the soils is primarily and importantly dependent upon both the macro and micronutrient reserve of that soil. Continued removal of nutrients by crops, with little or no replacement will increase the nutrient stress in plants and ultimately lowers the productivity.

Soils
The soils occurring in different landforms have been characterized during soil resource mapping of the state on 1:250,000 scale (Haldar *et al.* 1996) [2] and three soil orders namely Entisols, Inceptisols and Alfisols were observed in Dhanbad district (Fig.1 and table 1). Alfisols were the dominant soils covering 69.7 percent of TGA followed by Entisols (18.1 %) and Inceptisols (7.6 %)

Methodology
Surface soil samples (200 from each Block of Dhanbad district) from demarcated grid points and other related information's were collected through field survey. Soil samples were air dried, processed and analyzed for pH, EC, organic carbon, available nitrogen available phosphorous, available potassium, available sulphur, exchangeable Fe, Zn and available B by Mridaparikshak Minilab Soil Kit.

Result and discussion
Physio-chemical Properties
Soil pH is an important soil property, which affects the availability of several plant nutrients. It is a measure of acidity and alkalinity and reflects the status of base saturation. The whole sample divided in to three categories acidic, moderate acidic and neutral soils. The majority (40%) of the soil in Baliapur is acidic followed by strongly acidic (35%) and neutral (25%). In Govindpur Block, 66 percent soils are acidic fallowed by moderate acidic (30.5%). Only 3.5 percent soils are having neutral properties. 39.5 percent Soils of Topchanchi block are acidic fallowed by 37% are moderate acidic and 23.5% soils are neutral in nature. In Nirsa Block 58% soils are acidic in nature followed by 31% moderate acidic and only 11% soils are neutral in nature. In Tundi block majority of the soils are acidic (56%) followed by moderate acidic soils and only 7 percent soils of the block is neutral in nature.

53 percent soils of the East Tundi blocks are acidic in nature fallowed by moderate acidic (40.5%) and only 6.5% soils are neutral. In Dhanbad block 48.5 soils are acidic in nature followed by moderate acidic soils and only 19.5 percent soils are neutral, while 37.5 soils of the Baghmara block are acidic and 33.5 percent soils are neutral in nature. It is clear from the table that, the majority of the soils of district are either acidic or moderate acidic in nature and require treatment to neutralize them to take optimum production. Therefore, In Dhanbad district 48%soils are highly acidic whereas 35.7 percent soils are moderate acidic and only 16.3 % are neutral in nature.

In soil, electrical conductivity (EC) is a measure of the ability of the soil to conduct an electrical current. Most importantly to fertility, EC is an indication of the availability of nutrients in the soil. It can be used to show the capacity of the soil to store nutrients, as an indicator of soil texture and as an indication of an excess of soil nutrients. It is clear from the above table, majority of the blocks soil has low <0.5 fallowed by >0.5. The EC value between 1-2of the soils of different blocks is very less. Majority (78.6) of soil of the distict having EC less than 0.5.

Total organic carbon (TOC) is the carbon (C) stored in soil organic matter (SOM). Organic carbon (OC) enters the soil through the decomposition of plant and animal residues, root exudates, living and dead microorganisms, and soil biota. Organic matter exerts numerous positive effects on soil physical and chemical properties, as well as the soil's capacity to provide regulatory ecosystem services. The effect of soil organic matter on soil properties is well recognized. Soil organic matter plays a vital role in supplying plant nutrients, cat ion exchange capacity, improving soil aggregation and hence water retention and soil biological activity. It is clear from the above table that, majority of the soils (87.3) rich in organic carbon followed by medium organic carbon content and only few soils have very low OC content in the soil.

Major Nutrients

Nitrogen is an integral component of many compounds including chlorophyll and enzyme essential for plant growth. It is an essential constituent for amino acids which is building blocks for plant tissue, cell nuclei and protoplasm. Phosphorus is important component of adenosine di-phosphate (ADP) and adenosine tri-phosphate (ATP), which involves in energy transformation in plant. It is essential component of deoxyribonucleic acid (DNA), the seat of genetic inheritance in plant and animal. Phosphorous take part in important functions like photosynthesis, nitrogen fixation, crop maturation, root development, strengthening straw in cereal crops etc. The availability of phosphorous is restricted under acidic and alkaline soil reaction mainly due to P-fixation. Potassium is an activator of various enzymes responsible for plant processes like energy metabolism, starch synthesis, nitrate reduction and sugar degradation. It is extremely mobile in plant and help to regulate opening and closing of stomata in the leaves and uptake of water by root cells. It is important in grain formation and tuber development and encourages crop resistance for certain fungal and bacterial diseases. It is clear from the above table that, out of 1600 soil samples analyzed 55.2% are rich in nitrogen and only 15.2% are deficient in nitrogen. Among the blocks, Nirsa is rich in N i.e. 77%. In case of Phosphorous 49.8% are high content and 23.9% are poor. But in case of Potash in soils of Dhanbad district 43% are poor. In Dhanbad and East Tundi are in middle range.

Secondary and Micro nutrients

Sulphur is involved in the formation of chlorophyll, activation of enzymes and improvement in crop yield and oil percent (Tandon, 1995) [6]. Sulphur is essential for synthesis of proteins, vitamins and S containing essential amino acids is also associated with nitrogen metabolism. Sulphur improves both yield and quality of crops. Sulphur containing amino acids like cysteine, cysteine and methionine and promotes nodulation in legumes, also helps in increasing protein percent in legumes and oil percent in oilseeds and involved in the formation of chlorophyll that permits photosynthesis. (Patel *et al*. 2012) [3]. In Dhanbad district of Jharkhand, about 46.8% rich in sulphur and 23.3 % showed its deficiency. Soils of all the blocks are high content of S.55% soils of Baliapur blocks are rich in sulphur. It means farmers of the district using sufficient amount of sulphur in crop production. Zinc in plants required for biosynthesis of harmone. they recommended combined application of soil and foliar when high concentration of grain Zn is aimed along with high grain yield. Zn is also involved in the activation of various metabolic enzymes in the roots and plant body. (Shojaei and Makariian, 2015) [5]. Zn content in majority of the soil of the district are rich in zinc (>2.5) while the medium and low content of the soil also found in the district. Therefore, it is clear from the table that, majority of the soils of the district rich in sulphur and zinc.

Boron (B) is a micronutrient critical to the growth and health of all crops. It is a component of plant cell walls and reproductive structures and Boron plays a key role in a diverse range of plant functions including cell wall formation and stability, maintenance of structural and functional integrity of biological membranes, movement of sugar or energy into growing parts of plants, and pollination and seed set. Iron is a catalyst required for chlorophyll formation. That's why symptoms of iron problems show up as changes in the plants' color. "Iron also is essential for synthesizing proteins within the plant," Table 6 shows that, 76.6 percent of the soil of the Dhanbad are rich in Boron. In spite of highly acidic soils, rich in Boron indicate that farmers of the district are using Boron in their cropping practice. Iron is constituent of cytochromes, haems and nonhaem enzymes. It is capable of acting as electron carrier in many enzyme systems that bring about oxidation-reduction reactions in plants. It promotes starch formation and seed maturation. The majority of soils in all blocks of Dhanbad are rich in Boron (>0.75 mg kg^{-1}) followed by medium and low (<0.25-0.5 mg kg^{-1}) While the majority of the soils are deficient in iron content followed by medium and high.

Soils of the district and their extent

Map unit	*Taxonomy*	Area ('00ha)	% of TGA
15	Loamy-skeletal, mixed, hyperthermic Lithic Ustorthents Fine loamy, mixed, hyperthermic Ultic Haplustalfs	116	5.56
19	Loamy-skeletal, mixed hyperthermic Lithic Ustorthents Fine loamy, mixed, hyperthermic Typic Haplustepts	32	1.53
23	Fine-loamy, mixed, hyperthermic, Typic Haplustepts Fine-loamy, mixed, hyperthermic, Typic Haplustalfs	40	1.92
25	Fine, mixed, hyperthermic Typic Paleustalfs Fine, mixed, hyperthermic Rhodic Paleustalfs	37	1.77
29	Loamy, mixed, hyperthermic Lithic Haplustepts Fine-loamy, mixed, hyperthermic Typic Ustorthents	79	3.79
34	Fine loamy, mixed, hyperthermic Typic Paleustalfs Fine-loamy, mixed, hyperthermic Typic Rhodustalfs	396	18.98
35	Loamy-skeletal, mixed, hyperthermic Lithic Ustorthents, Fine-loamy, mixed, hyperthermic Typic Haplustalfs	27	1.29
41	Coarse loamy, mixed, hyperthermic Typic Ustorthents, Fine loamy, mixed, hyperthermic Typic Paleustalfs	90	4.31
80	Fine loamy, mixed, hyperthermic Typic Haplustalfs Loamy, mixed, hyperthermic Lithic Ustorthents	467	22.39
82	Fine loamy, mixed, hyperthermic Typic Haplustalfs Fine, mixed, hyperthermic Aeric Endoaqualfs	609	29.20
83	Fine loamy, mixed, hyperthermic Typic Haplustalfs Loamy, mixed, hyperthermic Lithic Haplustepts	36	1.73
87	Fine silty, mixed, hyperthermic Typic Haplustepts Fine loamy, mixed, hyperthermic Aeric Endoaquepts	60	2.88
Miscellaneous		97	4.65
Total		2086	100.00

Table 1: pH value of soil samples of different Blocks

Name of Block	Acidic (pH <5.5)		Moderate Acidic (pH 5.5-6.7)		Neutral (pH 6.7-7.3)	
	No of sample	Percentage	No of sample	Percentage	No of sample	Percentage
Baliapur	70	35	80	40	50	25
Govindpur	132	66	61	30.5	07	3.5
Topchanchi	79	39.5	74	37	47	23.5
Nirsa	116	58	62	31	22	11
Tundi	112	56	74	37	14	7
Tundi East	106	53	81	40.5	13	6.5
Dhanbad	97	48.5	64	32	39	19.5
Baghmara	58	29	75	37.5	67	33.5
Total	770	48	571	35.7	259	16.3

Table 2: EC value of soil samples of different Blocks

Name of Block	< 0.5		>0.5		1-2	
	No of sample	Percentage	No of sample	Percentage	No of sample	Percentage
Baliapur	160	80	30	15	10	5
Govindpur	190	95	06	3	04	2
Topchanchi	148	74	40	20	12	6
Nirsa	180	90	15	7.5	5	2.5
Tundi	126	63	58	29	16	8
Tundi East	170	85	25	12.5	05	2.5
Dhanbad	126	63	48	24	26	13
Baghmara	160	80	30	15	10	5
Total	1260	78.6	252	15.8	88	5.5

Table 3: OC value of soil samples of different Blocks

Name of Block	Low (below 0.50 %)		Medium (0.50-0.75 %)		High (above 0.75 %)	
	No of sample	Percentage	No of sample	Percentage	No of sample	Percentage
Baliapur	09	4.5	20	10	171	85.5
Govindpur	02	01	-	-	198	99
Topchanchi	05	2.5	10	05	185	92.5
Nirsa	08	4	15	7.5	177	88.5
Tundi	23	11.5	45	22.5	132	66
Tundi East	14	7	20	10	166	83
Dhanbad	06	3	20	10	174	87
Baghmara	01	0.5	05	2.5	194	97
Total	68	4.3	135	8.4	1397	87.3

Table 4: Value of soil samples of different Blocks

Name of Block	Nitrogen						Phosphorus						Potash					
	Low (<280Kg/ha)		Medium (280-560Kg/ha)		High (>560Kg/ha)		Low (<10kg/ha)		Medium (10-25kg/ha)		High (>25kg/ha)		Low (<120kg/ha		Medium (120-280kg/ha)		High (>280kg/ha)	
	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%
Baliapur	40	20	40	20	120	60	40	20	60	30	100	50	90	45	60	30	50	25
Govindpur	20	10	50	25	130	65	20	10	50	25	130	65	100	50	39	19.5	61	30.5
Topchanchi	10	5	20	10	170	85	30	15	30	15	140	70	110	55	60	30	30	15
Nirsa	16	8	30	15	154	77	61	30.5	33	16.5	106	53	96	48	56	28	48	24
Tundi	61	30.5	54	27	85	42.5	70	35	51	25.5	79	39.5	82	41	57	28.5	61	30.5
Tundi East	22	11	98	49	80	40	52	26	78	39	70	35	60	30	80	40	60	30
Dhanbad	48	24	92	46	60	30	58	29	79	39.5	63	31.5	53	26.5	78	39	69	34.5
Baghmara	26	13	90	45	84	42	51	25.5	40	20	109	54.5	97	48.5	53	26.5	50	25
Total	242	15.2	478	29.6	883	55.2	382	23.9	421	26.3	797	49.8	688	43	483	30.2	429	25.8

Table 5: Sulphur and Zinc status of soil samples of different Blocks

Name of Block	Sulphur (mg kg^{-1})						Zinc (mg kg^{-1})					
	Low (<10kg/ha)		Medium (10-25kg/ha)		High (>25kg/ha)		Low (<0.5-1)		Medium (1.0-2.5)		High (>2.5)	
	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%
Baliapur	30	15	60	30	110	55	40	20	60	30	100	50
Govindpur	45	22.5	50	25	105	52.5	30	15	40	20	130	65
Topchanchi	50	25	60	30	90	45	25	12.5	35	17.5	140	70
Nirsa	47	23.5	68	34	85	42.5	20	10	60	30	120	60
Tundi	49	24.5	60	30	91	45.5	54	27	60	30	86	43
Tundi East	51	25.5	69	34.5	80	40	20	10	40	20	140	70
Dhanbad	56	28	62	31	82	41	61	30.5	67	33.5	72	36
Baghmara	45	22.5	50	25	105	52.5	25	12.5	50	25	125	62.5
Total	373	23.3	479	29.9	748	46.8	275	17.2	412	25.8	913	57.1

Table 6: Boron and Iron status of soil samples of different Blocks

Name of Block	Boron(mg kg^{-1})						Iron (mg kg^{-1})					
	Low (<0.25-0.5)		Medium (0.5-0.75)		High (>0.75)		Low (25-50)		Medium (50-100)		High (>100)	
	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%	No of sample	%
Baliapur	20	10	40	20	140	70	20	10	70	35	110	55
Govindpur	10	5	15	7.5	175	87.5	25	12.5	50	25	125	62.5
Topchanchi	05	2.5	15	7.5	180	90	20	10	25	12.5	155	77.5
Nirsa	06	3	23	11.5	171	85.5	06	3	18	9	176	88
Tundi	23	11.5	35	17.5	142	71	43	21.5	29	14.5	128	64
Tundi East	06	3	32	16	162	81	17	8.5	16	8	167	83.5
Dhanbad	54	27	50	25	96	48	57	28.5	61	30.5	82	41
Baghmara	05	2.5	35	17.5	160	80	10	5	35	17.5	155	77.5
Total	129	8.1	245	15.3	1226	76.6	198	12.4	304	19	1098	68.6

Conclusion

The soil pH ranges from 5.5 to 7.3. The acidic reaction covers 48 percent of the area followed by moderate acidic soil (35.7%). Soils of neutral in nature covers only 16.2 percent. The EC value of majority of soils (78.6%) of the district is less than 0.5. The EC more than 0.5 found in 15.8 percent soils in the district. Only 5.5 percent soils having EC value between1-2. The 87.3 percent soils of the district rich in organic carbon content followed by medium carbon content (8.5%). Only 4.3 percent soils of the district are poor in organic carbon content. Available nitrogen content in the surface soils of the district ranges between 280 and 560 kg/ha. Majority of the soils (55.2%) are rich in nitrogen content followed by 29.6% soils are medium content of nitrogen in the soils. Only 15.2 percent soils of the district are poor content in nitrogen. Available phosphorus content in these soils ranges between 10.0 and 25 kg/ha. The phosphorus content of majority (49.8%) soils of the district very rich. Phosphorus content of the 26.3 percent soils having medium soil content and 23.9 percent soil poor in phosphorus content. Available potash content in these soils ranges between 120 to 280 kg/ha. Majority of soils 43 percent soils of the district are poor in potash content followed by medium potash content (30.2%). It means farmers of the district apply very little dose of the potash. The sulphur content of the soil of the district are rich in sulphur (48.8%).The zinc content of the soils of the district also rich in zinc (57.1%). Only 17.2 percent soils are deficient in zinc content. The Boron content of the soil in the district are rich (76.6%) followed by low boron content (8.1%). The majority of the soils are poor in iron content in the soil of the district (68.6%). Only 12.4 percent of the soil in the district are rich in iron content.

References

1. Bardsley AK, Lancaster JD. Determination of reserve Sulphur and soluble Sulphate in soils. Soil Sci. Soc. Ajmer. Proc. 1960; 24:265-268.
2. Haldar AK, Srivastava R, Thampi CJ, Sarkar D, Singh DS, Sehgal J *et al*. Soils of Bihar for optimizing land use. NBSS Publ. 50b. (Soils of India Series), National Bureau of Soil Survey and Land Use Planning, Nagpur, India, pp. 70+4 sheets soil Map (1:500,000 scale), 1996.
3. Patel HR, Patel HF, Maheriya VD, Dodia IN. Response of kharif Greengram (Vigna raditta L. Wilczek) to sulphur and phosphorus Fertilization with and without biofertilizer Application, The bioscan. 2012; 8(1):149-152.
4. Sipai AH, Jat JR, Rathore BS. Effect of Phosphorus, Sulphur and Biofertilizer on growth, yield and nodulation in mungbean on loamy sand soils of kutch. A Scitechnol journal. 2016; 51(1)51-56.
5. Shojaei H, Makarian H. The effect of Nano and NonNano Zinc oxide particles foliar application on yield and yield components of Mungbean (*Vigna radiata* L.) under drought stress. Iranian journal of field crops research. 2015; 12:76.
6. Tandon HLS. Sulphur fertilizers for Indian Agriculture. A Guide book. Fertilizer Development and Consulation Organization, New Dehli, India, 1995.
7. Wilcox LV. Electrical conductivity Am. water works Assoc. J. 1950; 42:775-776.