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Vertical Distribution of Major, Micronutrients and Sulfur Nutrients in Kantamal Block of Boudh District Catena

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ABSTRACT

A study was conducted in the Kantamal block to find out the vertical distribution of the nutrients it was observed that nutrients are decreasing with increase in depth but in case of potassium it was positively correlated with the clay in the pedons. In case of micronutrients similar results were found i.e., decreases with increase in depth.

Keywords Pedons, Vertical distribution, Available nutrients, Micronutrients.

INTRODUCTION

Since the roots of the majority of crops reach beyond the soil's surface layers and draw part of the nutrients they require from there, it is crucial to comprehend how plant nutrients are distributed vertically in soils (Kishore *et al.* 2022). In the study of the vertical distribution of plant-available nutrients in Jharkhand soils, Kumar *et al.* (2012) discovered that soil pH and calcium carbonate increase as soil depth does. The trend of the soil's organic carbon decreased. Clay content and CEC in sub surface horizons were positively correlated. Dorji *et al.* (2014) examined the vertical distribution of plant nutrients Jharkhand soils, that soil organic carbon decreases with depth. The grasslands had the highest SOC, followed by the forests, shrubland, and agricultural land. SOC was evenly distributed throughout agricultural land. Barla (2021) discovered that the pH of the soil was steadily increasing with depth in every pedon in R. Udayagiri, when he examined the vertical distribution of soil nutrients in three pedons of the upland, medium land, and low land regions of KVK Farm. All pedons have the highest level of organic carbon in their surface layers. In saline soils of Bangladesh, Munny *et al.* (2021) investigated the vertical distribution of soil characteristics and organic carbon under various land-use systems and discovered that the practices

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have a considerable impact on the SOC stock and soil characteristics with depth increment.

MATERIALS AND METHODS

The study area located in the kantamal block of Boudh district, Odisha state India. Selection of pedons was based on the slope and elevation, the study area has been divided into three major physiographic units such as upland 128 m above mean sea level (N 20 o 46' 20.1" E 83 o 52' 46.1"), Medium land 131 m above mean sea level (N 20 o 46' 27.3" E 83 o 52' 48.9"), and Low land 130 m above mean sea level (N 20 o 46' 25.6" E 83o 52' 41.6"). Total three pedons are studied in the present investigation with pedon 1, 123 m depth, pedon 2, 92 m depth and pedon 3 133 m depth. Soil samples are collected from the soil horizons which was further analyzed for available Nitrogen (Subbiah *et al.* 1956), Phosphorous (Bray *et al.* 1945), Potassium (Hanway *et al*. 1952), Sulphur (Chesnin *et al.* 1950) and micronutrients (Lindsay *et al.* 1978)

RESULTS AND DISCUSSION

Distribution of Major nutrients and sulfur in the pedons

In pedon 1, soil available N, P, K and S ranged from 156 – 98, 10.6 – 8.9, 137 – 161 kg ha^{-1} and 5.0 – 2.9 mg kg^{-1} respectively. All soil available nutrients were found with the highest values of 156, 10, 137 kg ha^{-1} and 5.0 mg kg^{-1} in the surface horizon and lowest values 98, 8.9, 161 kg ha^{-1} and 2.9 mg kg^{-1} in the bottom horizon respectively.

In pedon 2, soil available N, P, K and S ranged from 257 – 78, 10.4 – 5.9, 493 – 303 kg ha^{-1} and 4.6 – 4.0 mg kg^{-1} respectively. All soil available nutrients were found with the highest values of 257, 10.4, 493 kg ha^{-1} and 4.6 mg kg^{-1} in the surface horizon and lowest values 78, 5.9, 303 kg ha^{-1} and 4.0 mg kg^{-1} in the bottom horizon respectively.

In pedon 3, soil available N, P, K and S ranged from 336 – 235, 7.7 – 5.9, 656 – 716 kg ha^{-1} and 3.1 – 2.7 mg kg^{-1} respectively. All soil available nutrients were found with the highest values of 336, 7.7, 656 kg ha^{-1} and 3.1 mg kg^{-1} in the surface horizons and lowest values 235, 5.9, 716 kg ha^{-1} and 2.7 mg kg^{-1} in the bottom horizon respectively.

Soil available N, P, K and S were found highest in the surface horizons and lowest value in the bottom horizons in all three pedons. In pedons 2, available K content was increased with increasing soil depth; whereas in pedons 1 and 3 decreased with increasing

Table 1. Depth wise vertical distribution of available macro and micro nutrients in different pedons of Kantamal Block.

Horizon	Depth (cm)	Kg ha^{-1}				Mg kg^{-1}				
		Avail. N	Avail. P	Avail. K	S	Fe	Mn	Cu	Zn	B
Pedon-1 (Up land)										
Ap	0 - 39	156	10.6	189	5.0	18.6	5.5	0.7	0.6	0.52
A_1	39 - 61	134.4	9.8	161.2	3.4	10.2	5.2	0.7	0.5	0.49
A_2	61 - 104	98.2	8.9	137.2	2.9	4.6	3.0	0.4	0.2	0.42
Cr	104 - 123	Partially weathered parent material								
Pedon-2 (Medium land)										
Ap	0 -26	257	10.4	279	4.6	38.6	17.5	1.8	1.3	0.69
Bt_1	26 - 64	100	9.6	291	8.8	12.2	7.4	0.7	0.5	0.56
Bt_2	64 - 77	98	8.2	303	6.1	9.0	3.2	0.3	0.4	0.30
BC	77 - 92	78	5.9	493	4.0	8.8	2.8	0.3	0.2	0.36
Pedon-3 (Low land)										
Ap	0 - 13	336	7.7	656	3.1	21.4	20.8	2.1	1.6	0.56
A_1	13 - 28	268	6.6	716	3.0	15.8	17.2	1.6	1.0	0.96
A_2	28 - 63	235	5.9	535	2.7	11.2	10.2	1.0	0.8	0.46
Cr	63 - 133	Partially weathered parent material								

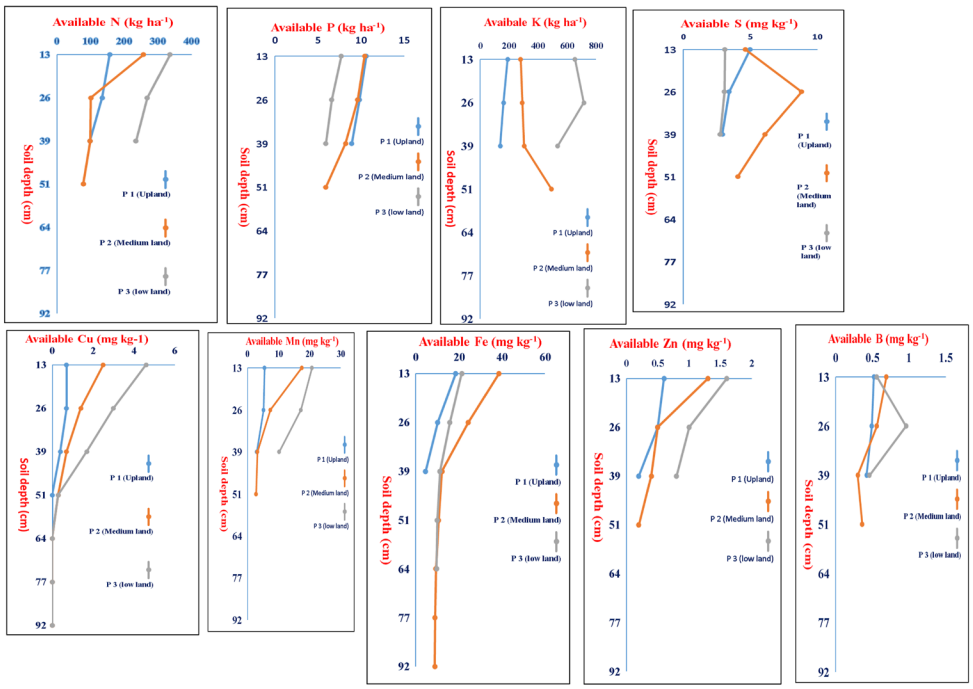

Fig. 1. Depth wise vertical distribution of available macro and micro nutrients in different pedons of Kantamal Block.

depth. This could be due to the fact that clay content increased with depth in pedon 5. The decrease was irregular in case of peodon 3 (Table 1). Available K content showed a positive correlation in all the three pedons (r = 0.17) with clay per cent of the profile samples. Such type of results was obtained by Pattanayak (2016), Dash *et al.* (2019) and Lokya (2020).

Micronutrients

In pedon 1, All soil micronutrients were observed with the highest values of 18.6, 5.5, 0.7, 0.6 and 0.52 mg kg^{-1} in the surface horizon and lowest values 4.6, 3.0, 0.4, 0.2 and 0.42 mg kg^{-1} in bottom horizon of different respective pedons (Fig. 1).

In pedon 2, All soil micronutrients were observed with the highest values of 38.6, 17.5, 1.8, 1.3 and 0.69 mg kg-1 in the surface horizon and lowest values 8.8, 2.8, 0.3, 0.2 and 0.36 mg kg^{-1} in bottom horizon of different respective pedons (Fig. 1).

In pedon 3, Available micronutrients like Fe, Mn, Cu, Zn, and B varied from 21.4 – 11.2, 20.8 – 10.2, 2.1 – 1.0, 1.6 – 0.8 and 0.56 – 0.46 mg kg^{-1} respectively. All soil micronutrients were observed with the highest values of 21.4, 20.8, 2.1, 1.6 and 0.56 mg kg^{-1} in the surface horizon and lowest values 11.2, 10.2, 1.0, 0.8 and 0.46 mg kg^{-1} in bottom horizon of different respective pedons (Fig. 1).

The highest amount of soil available Fe, Mn, Cu, Zn and B content were found in the surface horizons and lowest amount in the bottom horizons in all the fifteen pedons. Available micronutrients in all the fifteen pedons showed a gradual decrease with increasing soil depth which may be attributed to decreasing trend of organic matter with depth (Table 1). Similar results were identified by Lokay (2020). Soil available Fe, Mn, Cu, Zn and B of the profile samples were found to be positively correlated (r = 0.20, 0.05, 0.31, 0.42 and 0.26) with soil organic carbon and a negative correlation (r = - 0.01, 0.11, -0.06, -0.15 and -0.07) with soil pH. Such type of correlation studies was in close conformity with correlation studies of Dash *et al.* (2019).

CONCLUSION

From the present study it identified that all major and micronutrients are available in the surface layers but the content of nutrients decreases with the depth increases but incase of potassium it was completely related to the clay content of the soils so this might be the reason for there is a decrement in pedons 1 and 3 decreased with increasing depth. This because of clay was decrease with increase in depth. In overall observations it was find out that Lower layer's nutrient status was low this might be because of low activity of weathering and nominal activity of the microorganisms.

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REFERENCES

Kishore MA, Mishra A, Dash PK, Saren S, Das TK, Priyadarsini S, Sardar MS (2022) Vertical distribution of available nutrients in Boudh Block of Boudh District Catena. *Int J Pl Soil Sci* 34(23), 1681—1686.

Kumar R, Kumar R, Rawat KS, Yadav B (2012) Vertical distribution of physicochemical properties under different toposequence in soils of Jharkhand. *J Agric Phys* 12 (1) : 63—69.

Dorji T, Odeh IOA, Field DJ (2014) Vertical distribution of soil organic carbon density in relation to land use cover, altitude and slope aspect in the Eastern Himalayas, Land, 3 : 1232—1250.

Barla FX (2021) Preparation of GPS and GIS based soil fertility maps and identification of Soil related Crop production constraints of KVK Farm, R. Udayagiri, MSc Thesis, Department of Soil Science and Agricultural Chemistry, College of Agriculture, OUAT, Bhubaneswar.

Munny, Zulfur Khan, MD Hanfi (2021) Vertical distribution of soil properties and organic carbon under different land use systems in saline soils of Bangladesh, Environ. Chall. 4 100097.

Subbiah BV, Asija GL (1956) A rapid procedure for the determination of available nitrogen in soils. *Curr Sci* 25:259—260.

Bray RH, Kurtz Lt (1945) Determination of total, organic and available forms of phosphorus in soils. *Soil Sci* 59 : 39—45.

Hanway JJ, Heidel H (1952) Soil analysis methods as used in Iowa State College, Soil Testing Laboratory, Iowa State College Bulletin. 57:1—31.

Chesnin L, Yien CH (1950) Turbidimetric determination of available sulphates. *Proceedings of Soil Sci Soc Am J* 14 : 149—151.

Lindsay WL, Norvell W (1978) Development of a DTPA soil test for zinc, iron, manganese and copper. *Soil Sci Soc Am J* 42 (3) : 421—428.

Pattanayak T (2016) Preparation of GPS based soil fertility maps and identification of soil related crop production constrains for Dhenkanal Dsitrict, Odisha, PhD Thesis, Department of Chemistry, Institute of Technical Education and Research, Siksha'O' Anusandhan University, Bhubaneswar.

Dash PK, Mishra A, Saren S (2019) Vertical distribution of available nutrients in an Eastern Indian Catena. *Ann Pl Soil Res* 21(4) : 320—325.

Lokya T, Mishra A, Saren S, Dash PK (2020) GPS and GIS based soil fertility maps of KVK farm, Nayagarh located in the North-Eastern Ghat Agro- Climatic zone of Odisha. *Ind J Pharmacogn Phytochem* 9 : 599—605.