Biospectra : ISSN: 0973-7057, Vol. 20(1), March, 2025, pp. 81-84

An International Biannual Refereed Journal of Life Sciences

Animal Science

ISSN : 0973-7057

Assessment of soil fauna & nutrient level in pre flooded soil of Samastipur District, Bihar.

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Received : 16th February, 2025 ; Revised : 17th March, 2025

DOI:-https://doi.org/10.5281/zenodo.16787948

Abstract- The present study investigated the flooded soil biota and its agricultural chemistry in Samastipur district of Bihar. Soil samples were collected from five villages across three blocks at two depths: 0-15 cm and 15-30 cm. A total of 14 samples were collected from different fields before the flood, during April and May, 2022. The diversity of soil fauna was studied on the basis of soil texture. The majority of soil fauna were categorized into groups such as nematodes, annelids, arthropods, and molluscs. Arthropods, including insects, collembolans, mites, and acari, were found to be dominant. The pH ranged from 7.52 to 8.88 (avg. 8.20); electrical conductivity from 0.168 to 1.456 dS/m (avg. 0.812); organic carbon content from 0.40% to 0.84% (avg. 0.62%), nitrogen ranged from 192.00 - 310.72 kg ha^{-1} (avg. 251.30), phosphorus ranged from 12.00 - 207.00 kg ha^{-1} (avg. 109.5), potassium ranged from 89.20 - 458.00 kg ha^{-1} (avg. 273.4), boron ranged from 0.12 - 0.59 ppm (avg. 0.355), similarly sulphur ranged from 7.76 - 294 ppm (avg. 150.88), zinc ranged from 0.156 - 1.262 ppm (avg. 0.79), copper ranged from 0.628 - 1.434 ppm (avg. 1.031), iron ranged from 3.662 - 21.780 ppm (avg. 12.721) and manganese ranged from 0.890 - 5.696 ppm (avg. 3.293). The electrical conductivity was found to be suitable for plant growth, and the soil pH was alkaline. Levels of nitrogen, phosphorus, potassium, and sulphur were low to medium. The level of boron was low in sample soil. The results indicated that the soil was moderately nutrient-rich, and farmers were advised to adopt nutrient management practices based on soil health card recommendations.

Keywords: Soilfauna, Electrical conductivity, pH, Micronutrients, Samastipur

INTRODUCTION

The physical chemical and biological conditions of soil determine the health of soil.[1] Specially in flood soil the optimal physical and chemical soil properties determine the level of soil fauna. Different strata of soil serve as habitat of different type of soil fauna which play a very significant role in nutrient cycling of soil ecosystem. Healthy soil ensures the nutritional security, water quality, biodiversity, climate change etc.[2,3] In biosphere, soil formation is highly expensive process of ecosystem. According to ecologists, the tag value of soil formation is nearly 50% of the Ecological Services. The quantity of soil is degraded due to employment of Industrial crop production, use of chemical fertilizers and mono cropping.[4-6] The use of biofertilizers and caring of faunal diversity of soil are the good tips for improvement of soil health. Nitrogen, Phosphorous and Potassium ratio is an important factor in crop production.[7] The micronutrients like - Boron, Manganese, Iron, Calcium also determine the health of crop and yield of crops. The food productivity and environment quality are dependent on the physico-chemical properties of soil. The decomposition of liter fall and of crop waste by soil fauna is one of the major factors for maintaining soil health.

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The present study in investigated the soil fauna and nutritional level in the flooded soil of Samastipur district of Bihar.

MATERIALS & METHODS

Experimental site:- The district Samastipur is located in North Bihar. The district covers a region of 2624.82 km^2 and is located between 25º46' -26º05'N Latitudes and 85º10' - 86º23'E Longitudes.

Table 1- Sampling sites of Samastipur District

Sl. No.	Block's Name (B)	Name of the Village (V)	Latitude (Nº)	Longitude (Eº)
1.	Khanpur (B_1)	V_1-Bathanaha-Sadipur	25º9104.51'	85º4038.31'
		V_2-Dinmanpur-Katha	25º9178.77'	85º9239.71'
		V_3-Dinmanpur-Bhanpur	25º9110.38'	85º4048.20'
2.	Warishnagar (B_2)	V_1-Ratras-Dih	25º9251.77'	85º9225.15'
		V_2-Rahuaa	25º9291.54'	85º9161.19'
3.	Tajpur (B_3)	V_1-Baghoni	25º5246.05'	85º4031.13'
		V_2-Hasanpur	25º4447.86'	86º1208.84'

The North boundary is bordered by the River Bagmati, on the South by the Ganges, on the East of Begusarai and some part of Khagaria and the West by Vaishali.

Methodology:- The chemical analysis of sample soil was done at Soil Testing Laboratory office, Joint Director (Chemistry), Bihar, Patna. The pH was determined by 1: 2.5 soil water suspension method using digital pH meter. EC was determined by 1:2 soil water suspension method using digital E.C. meter. Organic carbon was determined by the wet oxidation method. Available P was determined by colorimetric method. Available K was determined by flame photometer method. Available S was determined by turbidimetric method. The details have been given in table 2.

Table-2: Method of Analysis

Parameters	Methods
Soil pH	Digital pH meter
Electrical Conductivity	Digital EC meter
Organic Carbon (%)	Wet oxidation method
Available Nitrogen (Kg/ha^{-1})	Kjeldahi method
Available Phosphorous (Kg/ha^{-1})	Carborimetric method
Available Potassium (Kg/ha^{-1})	Flame photometer method
Available Sulphur (ppm)	Turbidimetric method
Available Boron (ppm)	Spectrometry method
Available Zinc (ppm)	Atomic absorption spectroscopy
Available Copper (ppm)	Atomic absorption spectroscopy
Available Iron (ppm)	Atomic absorption spectroscopy
Available Manganese (ppm)	Atomic absorption spectroscopy

Statistical Analysis:-The data recorded during the time of Investigation was subjected to statistical analysis by the method of Analysis of Variance (ANOVA) Technique. The implemented experimental analysis done was based on Completely Randomized Desigh (CRD). The significant and non-significant treatment effects were judged on the basis of F (Variance) Test.

RESULT & DISCUSSION

Variation was observed in chemical properties of flooded soil in Samastipur district at different depths. The pH ranged from 7.52 to 8.88 (avg. 8.20). The maximum value found in B_2V_1(15-30 cm depth) 8.88 and the minimum value found in B_3V_1 (15-30 cm depth) was 7.52 which indicated that the soil was moderately alkaline. The electrical conductance ranged from 0.168 to 1.456 (avg. 0.812) dS/m. The maximum value found in B_1V_3 (0 -15 cm depth) was 1.456 dS/m and the minimum value found in B_1V_2 (15-30 cm depth) was 0.168 dS/m. The soil organic carbon (%) ranged from 0.4 to 0.84 (avg. 0.62) (%). The maximum value found in B_1V_2 (0-15 cm depth) was 0.84 (%) and the minimum value found in B_3V_1, B_3V_2 (0-15 cm depth) was 0.40 (%) Table-3.

Table 3- Assessment of physico chemical properties of soil i.e., pH, EC and organic carbonate different depth 0 - 15 and 15 - 30 cm of Samastipur district

	pH		EC (Ds m^{-1})		Organic carbon (%)	
Site	0–15cm	15–30cm	0–15cm	15–30cm	0–15 cm	15–30cm
B_1V_1	8.60	8.81	0.522	0.420	0.795	0.555
B_1V_2	8.09	8.23	0.311	0.168	0.84	0.765
B_1V_3	8.28	8.77	1.456	0.464	0.75	0.555
B_2V_1	8.78	8.88	0.282	0.173	0.795	0.66
B_2V_2	7.93	8.38	0.314	0.225	0.795	0.69
B_3V_1	7.72	7.52	0.92	0.98	0.4	0.42
B_3V_2	7.63	7.54	0.52	0.55	0.4	0.42
	F-Test	S.Ed (±)	F-Test	S.Ed (±)	F-Test	S.Ed (±)
Due to depth	S	0.208571429	S	0.108925	S	0.05671429
Due to site	S	0.468557705	S	0.344310771	S	0.25217952

The available nitrogen at 15-30 cm depth ranged from 192.00 to 310.72 kg ha^{-1} (avg. 251.30). The maximum value found in B_3V_1 at 15-30 cm depth was 310.72 kg ha^{-1} and minimum value found in B_1V_2 & B_1V_3 at 15-30 cm depth was 192.00 kg ha^{-1}. The available phosphorous ranged from 12.00 to 207.00 kg ha^{-1} (avg. 109.5). The maximum value found in B_2V_2 at 0-15 cm depth was 207.00 kg ha^{-1} and minimum value found in B_1V_1 at 15-30 cm depth was 12.00 kg ha^{-1}. The available potassium ranged from 89.20 to 458.00 kg ha^{-1} (avg. 273.6). The maximum value found in B_2V_1 (0-15 cm depth) was 458.00 kg ha^{-1} and minimum value found in B_3V_1 at 0-15 cm depth was 89.20 kg ha^{-1} (Table 4).

Table 4- Assessment of chemical properties of soil i.e., nitrogen, phosphorus and potassium at different depth 0 - 15 and 15 - 30 cm of Samastipur district

	N		P_2O_5		K_2O	
Treatment/ Farmer's site	0–15cm	15–30cm	0–15 cm	15–30cm	0–15cm	15–30cm
B_1V_1	234.00	192.00	48.00	12.00	120.00	103.00
B_1V_2	242.00	229.00	82.00	29.00	220.00	177.00
B_1V_3	226.00	192.00	128.00	55.00	234.00	132.00
B_2V_1	234.00	211.00	102.00	74.00	458.00	321.00
B_2V_2	234.00	216.00	207.00	165.00	232.00	173.00
B_3V_1	305.00	310.00	31.20	32.95	89.20	110.20
B_3V_2	266.00	268.00	32.80	33.72	92.20	115.23
	F-Test	S.Ed(±)	F-Test	S.Ed(±)	F-Test	S.Ed(±)
Due to depth	S	9.8	S	16.761428	S	28.85857
Due to site	NS	33.0546	S	47.637527	S	106.177423

The available boron ranged from 0.12 to 0.59 ppm (avg. 0.355). The maximum value found in B_1V_3 at 15-30 cm depth was 0.59 ppm and minimum value found in B_1V_1 at 15-30 cm depth was 0.12 ppm. The available sulphur ranged from 7.76 to 294.00 ppm (avg.150.88). The maximum value found in B_1V_3 at 0-15 cm depth was 294.00 ppm and minimum value found in B_3V_1 at 0-15 cm depth was 7.76 ppm. The available zinc ranged from 0.156 to 1.262 ppm (avg. 0.79). The maximum value found in B_2V_1 at 0-15 cm depth was 1.262 ppm and minimum value found in B_1V_1 at 15-30 cm depth was 0.156 ppm (Table 5).

Table 5- Assessment of chemical properties of soil i.e., boron, sulphur and zinc at different depth 0 - 15 and 15 - 30 cm of Samastipur district

	B		S		Zn	
Treatment/ Farmer's site	0–15cm	15–30cm	0–15 cm	15–30cm	0–15cm	15–30cm
B_1V_1	0.24	0.12	98.00	84.00	0.662	0.156
B_1V_2	0.30	0.27	32.00	16.00	0.292	0.242
B_1V_3	0.34	0.59	29.40	12.90	0.884	0.734
B_2V_1	0.51	0.21	27.00	11.00	1.262	0.634
B_2V_2	0.44	0.34	51.00	27.00	0.876	0.592
B_3V_1	0.32	0.18	7.76	7.99	0.720	0.632
B_3V_2	0.24	0.41	8.23	9.23	0.650	0.432
	F-Test	S.Ed(±)	F-Test	S.Ed(±)	F-Test	S.Ed(±)
Due to depth	S	0.07928	S	1.5445	S	0.654857
Due to site	S	0.099905	S	4.189	S	0.3085854

The available copper ranged from 0.628 to 1.434 ppm (avg 1.031). The maximum value found in B_2V_2 at 0-15 cm depth was 1.434 ppm and minimum value found in B_1V_1 at 15-30 cm depth was 0.628 ppm. The available iron ranged from 3.662 to 21.780 ppm (avg. 12.721). The maximum value found in B_2V_2 at 0-15 cm depth was 21.780 ppm and minimum value found in B_2V_1 at 15-30 cm depth was 3.662 ppm. The available manganese ranged from 0.890 to 5.846 ppm. The maximum value found in B_2V_2 at 0-15 cm depth was 5.846 ppm and minimum value found in B_1V_2 at 15-30 cm depth was 0.890 ppm (Table 6).

Table 6- Assessment of chemical properties of soil i.e., copper, iron and manganese at different depth 0 - 15 and 15 - 30 cm of Samastipur district

	Cu		Fe		Mn	
Treatment/ Farmer's site	0– 15 cm	15–30cm	0 – 15 cm	15 – 30 cm	0 – 15 cm	15 – 30 cm
B_1V_1	1.106	0.628	15.810	5.724	2.740	1.832
B_1V_2	0.894	0.912	8.476	8.246	1.304	0.890
B_1V_3	0.754	0.982	8.246	10.080	2.248	2.134
B_2V_1	1.036	0.842	5.724	3.662	3.846	2.020
B_2V_2	1.434	1.348	21.780	19.940	5.846	3.694
B_3V_1	1.032	0.985	11.232	7.320	1.982	2.324
B_3V_2	0.980	0.868	9.325	8.452	4.321	3.162
	F-Test	S.Ed(±)	F-Test	S.Ed(±)	F-Test	S.Ed(±)
Due to depth	S	0.08314	S	1.48857	S	0.363571425
Due to site	S	0.1980093	S	4.968816811	S	1.118903296

CONCLUSION

The pre-flood soils of Samastipur district were found to be moderately alkaline with suitable electrical conductivity for plant growth. While organic carbon content was satisfactory, the macronutrient levels (N, P, K) were generally low to medium, and several micronutrients including boron, sulphur, and zinc were found to be deficient. Soil fauna was dominated by arthropods, particularly insects and mites, which indicates active biological turnover. However, further monitoring post-flood is essential to understand the resilience of faunal communities. Farmers are advised to adopt integrated nutrient management practices that incorporate region-specific organic amendments and targeted micronutrient supplementation. Conservation of soil biota should also be encouraged through reduced chemical input and enhanced organic matter return to the soil.

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