Impact of Environmental Conditions on Release of Nitrates to Overlying Water from Selective Fertilized Soil of Udaipur District, Rajasthan

Dr. Sabiha Sindhi

Assistant Professor, B. N. University, Udaipur (Raj.), India
Email: *dr.sabihasindhi[at]gmail.com*

Abstract: ***The results in the study probably show that for light intensity, indirect increase of temperature through higher Photic intensity, the black is more responsible for the release of nitrates.***

Keyword: Limnological, Turbation, Photic, Nitrate

1. Introduction

For plant development and reproduction, seventeen elements or nutrients are required. Carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), sulphur (S), calcium (Ca), magnesium (Mg), iron (Fe), boron (B), manganese (Mn), copper (Cu), zinc (Zn), molybdenum (Mo), nickel (Ni), and chlorine (Cl) are the elements. Essential nutrients are those that are necessary for plants to complete their life cycle. Non-essential nutrients are those that help plants develop but aren't required to complete the plant's life cycle. The nutrients are derived from the mineral component of the soil, with the exception of carbon, hydrogen, and oxygen, which are given by carbon dioxide and water, and nitrogen, which is provided via nitrogen fixation. When the accessible form of a nutrient in the soil solution is not in sufficient proportion, other nutrients cannot be taken up at an optimal rate by a plant, according to the Law of the Minimum. For optimal plant growth, a certain nutrient ratio of the soil solution is required, a number that may differ from nutrient ratios determined from plant composition.

Plants can only absorb nutrients if they are in a form that is accessible to them. Nutrients are taken in an ionic form from (or in combination with) soil water in the majority of cases. Despite the fact that minerals are the source of most nutrients and contain the majority of nutritional components in the soil in crystalline form, they weather too slowly to sustain fast plant development. Because most of the nutrients stay bonded in the crystals of finely crushed minerals like feldspar and apatite, applying them to soil seldom produces the requisite amounts of potassium and phosphorus at a rate appropriate for healthy plant development.

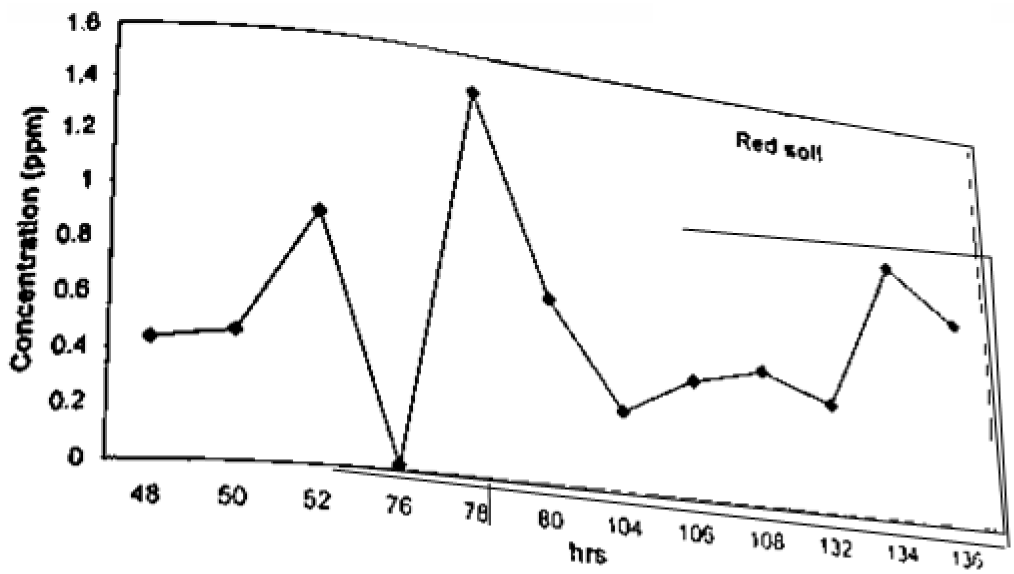
2. Material and Methods

Nutrients	Red soil	Black soil
Nitrate	0.0026mg/g	0.0016mg/g

The nitrate is calculated using the Brucine technique (APHA, 1989). The interaction between nitrate and brucine results in a yellow tint with a wavelength of 410 nm. The quantity of heat created during the test has a substantial impact on the reaction rate between brucine and nitrate ions. The reagent addition sequence and incubation of the reaction mixture for a defined length of time at a given temperature are used to provide heat control in the technique. The acid content and reaction time were chosen to get the best colour development and stability. The concentration of NO3-N in the samples was read directly from this curve, which was presented as a standard curve of absorbance against concentration.

Control		Red soil		Black soil	
Periodicity of reading (hours)	Nitrate in ppm	Periodicity of reading (hours)	Nitrate in ppm	Periodicity of reading (hours)	Nitrate in ppm
0	0.0	48	0 435	24	0 154
2	0.0	50	0 469	26	0 241
4	0.0	52	0 921	28	0 743
28	0.0	76	0.020	52	0 010
30	0.003	78	1 455	54	1 400
32	0.0	80	0.694	56	0 492
56	0.0	104	0 301	80	0 146
58	0.0	106	0.450	82	0 155
60	0.066	108	0 520	84	0 144
84	0.0	132	0 422	108	0 0
86	0.0	134	1 006	110	0 588
88	0.0	136	0 803	112	0 487
		Average per hour	0 084	Average per hour	0 051

The percentage drop in average per hour release of nitrate was 39 29 % in black in relation to red soil.



Paper ID: SR22426204218 DOI: 10.21275/SR22426204218

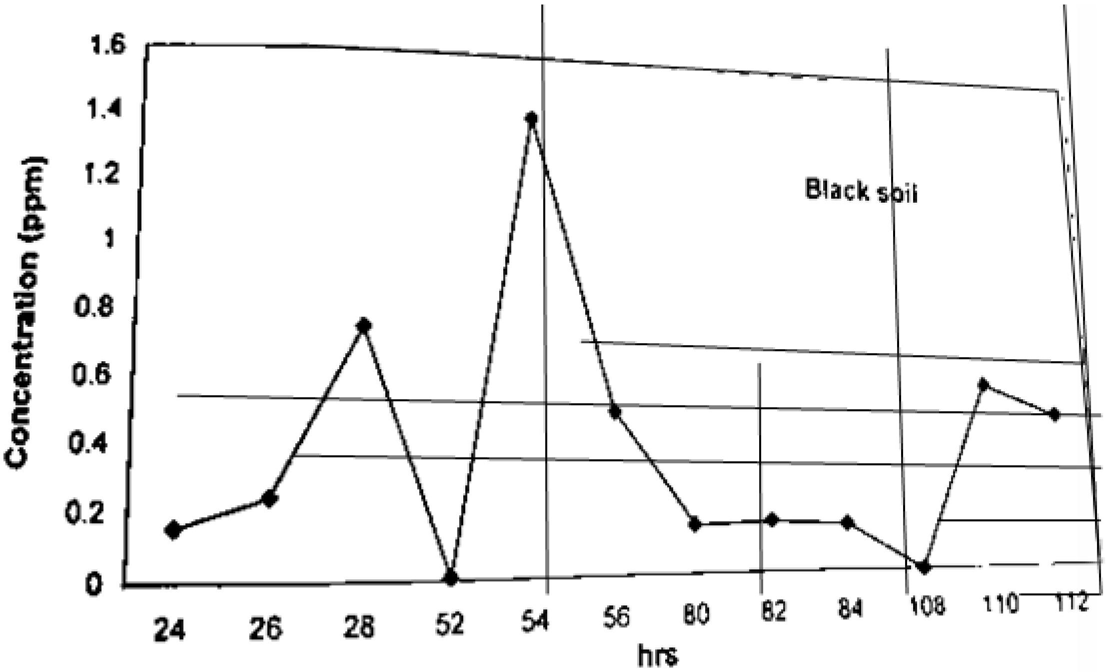


Figure: Effect of turbulence on periodic release of nitrate from red and black soil (turbation)

Nitrate levels under different simulated photic conditions.
Variable – Photic intensity (200 watt bulb)

Control 7500 lux		Red soil 6500 lux		Black soil 6500 lux	
Periodicity of reading (hours)	Nitrate in ppm	Periodicity of reading (hours)	Nitrate in ppm	Periodicity of reading (hours)	Nitrate in ppm
0	0.0	48	1.047	24	1.238
2	0.0	50	1.104	26	1.269
4	0.0	52	1.305	28	1.626
28	0.020	76	1.367	52	1.752
30	0.0	78	0.569	54	0.972
32	0.0	80	0.659	56	1.072
56	0.0	104	1.027	80	1.727
58	0.0	106	1.548	82	1.823
60	0.0	108	1.022	84	1.740
84	0.030	132	1.472	108	2.240
86	0.070	134	1.170	110	2.080
88	0.0	136	0.835	112	1.850
		Average per hour	0.147	Average per hour	0.217

The percentage drop in average per hour release of nitrate was 32.26 % in red in relation to black soil.

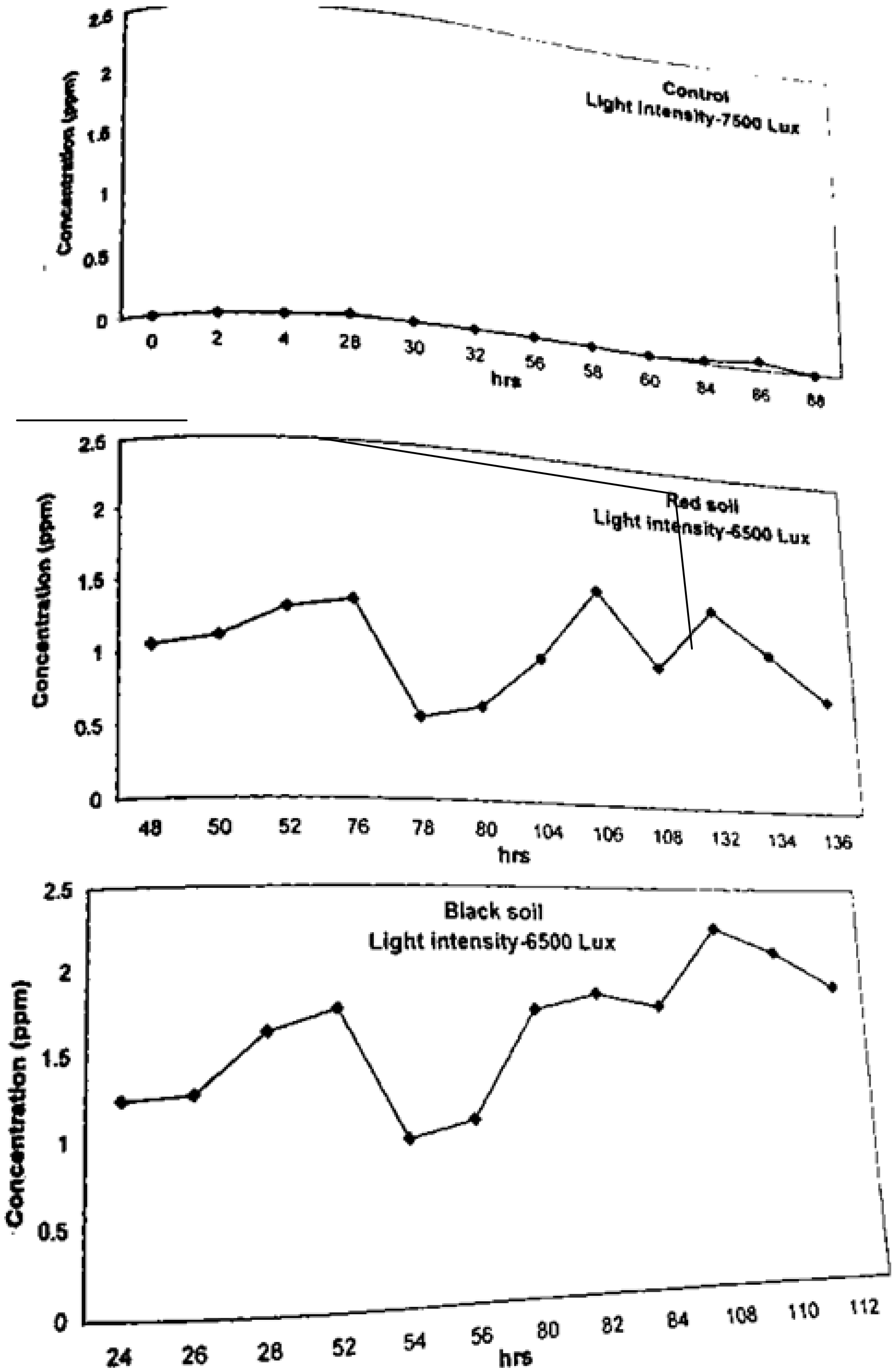


Figure: Effect of light intensity on periodic release of nitrate from red and black soil (200 Watt)

3. Result

Turbation

In the variable of water turbulence affected by aerating water medium through stone diffusers attached to the aquarium aerator, the results of nitrate concentrations were as follows. In the red soil the dissolved nitrate was consistently higher in relation to that in the black soil. The concentrations were higher at 52, 78, 134 and 136 hours of time stages in the red soil. The average per hour release of nitrate in the red soil under the present condition of turbulence is 0.084 ppm. In the case of black soil where the settlement of the particles is 24 hrs earlier than that for red soil, the time periods of higher concentrations were at 28 and 54 hours. For the rest of the period up to112 hours of experimentation, the concentrations were low. The average per hour release of nitrate in the black soil was observed to be 0.051 ppm which is lower than that noted in the red soil. The percentage drop was 39.29% in black soil in relation to red. Though the oscillative patterns are similar in red and black soils, the regression is non-significant but positive. On the other hand the same is non-significant but negative for black soil.

Photo intensity

The 200 watt bulb photic intensity is concerned, the black soil consistently showed higher values in relation to those of red soil, the highest being at 108 hours (2.240 ppm) and the lowest at 0.972 ppm at 54 hours. The control intermittently showed nitrate values as in the previous cases. The oscillative pattern for the red and black soils was more or less similar. The average per hour release of nitrate was 0.217 ppm in black soil while the same was 0.147 ppm in red soil. The percentage drop was 32.26% in red soil in relation to black soil. This is contrary to the earlier observations in lower photic values. The positive marginally significant correlation was observed only for black soil

4. Conclusion

The nitrate, which is a crucial nutrient in the aquatic medium especially in tropical waters like ours, shows higher release from red soil in relation to black except for alkaline pH and high intensity (6500 lux). The occurrence of nitrate at higher levels in the water is indicative of eutrophication. Alkaline pH is supposed to release more nitrate and through the present experiment this is seen primarily in black soil. Similar is the case with the higher intensity of light. The results in the study probably show that for light intensity, indirect increase of temperature through higher photic intensity, the black soil is more responsive for the release of nitrates. This again tends to indicate the role of soil type at the bottom in determining the productive status and progressive eutrophication of a water body.

References

[1] APHA.1989. Standard methods for the Examination of Water and Waste Water. (14th ed.), American Public Health Association, Washington DC.
[2] Riddolls, A.1985. Aspects of nitrogen fixation in Lough Neagh. I. Acetylene reduction and the frequency of Aphanizomenon flosaquae heterocysts Freshwat. Biol.15: 289-297.
[3] Rippey, B.1983. A laboratory study of the silicon release process from a lake sediment (Lough Neagh, Northern Ireland). Arch. Hydrobiol., 96: 417-433.
[4] Sharma and Saini, 2003. Methods in Aquatic Ecology. Ith Ed. Published by Agrotech Publishing Academy, Udaipur (Rajasthan).