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Role of artificial recharge of groundwater causing changes in organic matter of soil: A case study of some villages of Palamu District, Jharkhand

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Abstract- The leaf litters, wood materials, roots and other soil organisms fall on the surface and get mixed to form organic matter after decomposition. It percolates down the land surface as solution along with percolating water during artificial recharge. The impervious rocks check percolation and the concentration of the organic matter in the soil rises upward which changes the soil composition & cause significant changes in the organic matter of soil along with increase in the water level of the area.

Key words: artificial recharge, groundwater, soil, infiltration, organic matter

INTRODUCTION

Rain water is the main source of water on the surface of the Earth. However melting ice mass also constitutes but goes as runoff and finally reaches the major water bodies. The rainfall evaporates out as fly off, part flows as surface runoff and part percolates downward enriching groundwater. The rate of percolation depends upon the porosity and permeability property of the rock. The more porous is the rock the rate of percolation is much higher through interspaces. While percolating it is not only the water but the dissolved mineral content also percolates and on saturation increases a particular element in the water. Part of it absorbed by the top soil cover and thus brings about change in the organic matter.

This case study deals with the study about the role of artificial recharge of ground water in bringing change in organic matter of soil.

Location

The study area geographically falls within the Palamu district of Jharkhand state and is covered in the Toposheet No. F45A1 of Survey of India. The study area forms a part of a hard rock terrain and covers an area of 5246 sq kms. The location can be approached by road only and is about 27 km from Medininagar on North west side the city.

The General Geology of the Area

The Pre Cambrian crystalline rocks, Vindhyan and Gondwanas beside the top soil cover on the three main geological formations available in the district. Besides this some amount of lateritic soil is also present in part of the

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area. Granitoid Gneiss as the Pre Cambrian basement, shales and sandstone of Gondwanas and in some areas the Vindhyan sandstone located far are found in the region of study area.

The northern area of the district where Koel river and adjacent Sone river is available, some amount of alluvial cover of considerable thickness are found. The thickness is variable which depends upon the topography of the area and undulating terrain. Soils are also lateritic in nature which is having high iron content, Al content, low Nitrogen, Potassium and Phosphorus. The soil is less fertile and is prone to acid reaction. Here the occurrences of ground water are confined under phreatic condition. The top soil cover allows the percolation of rainwater.

Artificial Recharge

The percolation of rainwater takes place due to natural and artificial recharge has been used because the intermittent intervals were constructed to check the surface runoff and which allows them to percolate downward recharging the ground water.

Artificial recharge requires permeable surface soil, trenches, ring ridge, ridge- ditch technique to check the surface runoff and thus provides sufficient time to percolate water to form groundwater.

The short term and long term plan is needed for this. However the low cost technology provides much higher result in artificial recharge. Moreover the slope of the area which varies between 3° to 26°C at the surface plays key role. The lesser the slope, the lower will be the runoff and thus in such area the intermittent intervals can be constructed.

Artificial recharge is directly related to porosity and permeability property of the rock of the study area, which was considered during the case study.



Role of Sustainable Resource Management (Chakriya Vikas Pranali) in Artificial recharge

The concept of Cyclic System of Development locally called as Chakriya Vikas Pranali (C.V.P.) envisaged by the noted soil scientist Padmashree Late P.R. Mishra. Initially his experiments of soil and water conservation declared successful at Sukhomajri near Chandigarh in Shiwalik hills. This stopped the siltage of Sukhna Lake of Chandigarh and got appreciation on National level.

Seeing the Forest wood cutting by the villagers for their livelihood he replicated the model in part of Palamu district by teaching villagers (were called Students) with the sharing system for equity among all the share holders. This sharing system was the key success of soil and water conservation scheme as shown below-

- 30% - Land owners, this includes the absentee land lords also
- 30% - Students working round the year on the plot
- 30% - Saving of the cycle which was ploughed back as capital for the next cycle
- 10% - Welfare fund (Kalyan Kosh) meant for emergency and to replicate such models in the nearby regions.

C.V.P. started making ridge, tie - ridges, ridge ditches technique, stone pitching, sand bag filling and other small intervals to check the surface runoff. Besides this small water storage tanks, check dams were also constructed.

This caused the enrichment of ground water to a considerable limit and made the system sustainable by using natural resources.

The core features of C.V.P. are enumerated as below-

- a. Use of private fallow land by pooling them in the system.
- b. Maximum utilization of natural resources particularly rainwater by using the theme- as it falls and where it falls for in situ conservation.
- c. Multi layered cropping system in a single piece of land as root crops, seasonal vegetables, fruit species and forest species which yield income as various levels.
- d. Mobilization of villages for regeneration of natural resources.
- e. Sharing system as discussed above for bringing equity in the society.

Environmental Impact of Artificial Recharge

The effects of Artificial Recharge on the environment can be both the harmful as well as beneficial but it varies from place to place. During the process of artificial recharge some suspended solids and chemicals also leaches downwards along with the water which on precipitation clogged the top layer and reduces the percolation rate drastically. Clogging of soil matrix is a major operation problem of infiltration system for artificial recharge of ground water. Clogging can be of even greater importance in waste water lagoons or constructed wet lands where injection wells used are much more vulnerable to clogging than surface infiltration system. Remediation of clogging in boreholes and wells are much more difficult than in surface infiltration system.

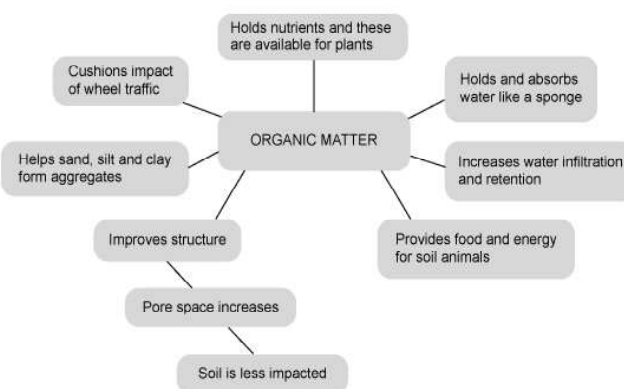
The chemicals and other constituents of soil on reaching to the groundwater along with percolating water and contaminate it badly and thus water quality becomes low. The chemical constituents and temperature of surface are different groundwater. Consequently the issue of ground water quality change. The groundwater quality presented the trend of desalination and general increase in sulphate, iron, manganese contents, organic and nitrogenous compounds after the tap of water injection. However the artificial recharge influence on the ground water quality with the radius <100m for a single well recharge and >1000m for group recharge.

On the other artificial recharge through various methods raises the water level in the area and also becomes green. Through the artificial recharge the soil enriches with organic matter present in the field.

Presence of organic matter in recharge zone

The sources of organic matters are leaf litters, woody materials, root and residue of dead bodies of animals and various soil organisms. When the leaf litters, woody materials fall on the surface of the earth and mixed to form organic matter after decomposition in the presence of water.

During the artificial recharge the organic matter present on the surface of the earth percolates along with percolating rainwater as solution downwards. When it finds impervious layer percolation stopped and the concentration of organic matter rises upward and thus the soil becomes enriched with organic water. The soil rich in organic matter also enhances infiltration of rainwater.



DISCUSSION

The rate of percolation is directly proportional to quantum and days of rainfall as well as the existing geological condition of the area. The percolating water acts as an agent in bringing concentration of organic matter, which at first stage partially dissolved organic matter and then on saturation recrystallised mixing with the top soil cover and causes changes in organic matter of soil.

CONCLUSION

The constituent unit of soil along with the chemicals present on the surface of the earth dissolves and reaches the water table. This increases the concentration and badly affects the groundwater causing lowering of water quality.

This concentration at the top soil changes the organic matter and the richness of a particular element changes the soil composition to a considerable limit. The artificial recharge process acts as catalytic agent in bringing concentration of organic matter in the soil. The soil sample analysis has also shown the positive results.

The detailed study is being carried out on pre and post monsoon seasons and the data in future will follow.

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