Study on Retention of Fertilizers in Soil and its Impacts on Receiving Streams

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Abstract- *Small scale studies were performed to note the retention of fertilizers in soil and its impact on receiving streams. The application of fertilizers can impair both surface and subsurface water. The synthetic fertilizers used in this studies were about 10gm of urea, DAP and potash. The parameters measured in the receiving waters were N, P, K, Na and Cl. The leaching of fertilizers in subsurface water and the runoff of the fertilizers in surface waters were both studied in this article.*

Keywords- Fertilizers, Runoff, Retention

I. INTRODUCTION

The fundamental contributor of green revolution is the application and development of fertilizers for healthy and proper growth of plants. The fertilizer may be chemical or organic that is added to increase the supply of required nutrients into the soil that increases the growth of plants and vegetation in the soil.

The long term effects of fertilizers on the environment are not widely known. Fertilizers are carried away with the rain water into the nearest stream, river or the other water bodies. Fertilizers are the one of the many common water pollutants that can degrade the water quality. The chemical fertilizers although increases yield in the crops, they also have harmful effects on environment. Too much usage of fertilizers in water can alter fertility of soil by increasing acid levels in soil. Hence, there is a high chance of contamination of soil and water bodies.

II. RAINFALL SIMULATOR METHOD

The rainfall simulator method allows the erosion to take place on small plot. The rainfall is artificially supplied, once fallen on the surface of the soil the soil particles gets loosened by the rain droplet. These particles get loosened by the rain droplet. These particles gets jump up first and then fall down again on the slope in slightly lower direction. The soil particles and water are collected at the bottom of the slope. Through research in the laboratory of the soil particles collected, an indication is derived concerning the sensitivity and the composition to the erosion of the soil under research. Through comparing the measured results to the other measured results, the sensitivity to the erosion of the researched soil is setup by the researchers. For instance the temperature of the water is kept constant as possible in order to obtain reliable results.

Fig 1. Collection of water sample by using rainfall simulator method (Source: University of Delaware)

III. MATERILS AND METHODOLOGY

A. Collection of Soil sample

Six soil samples were used in order to assess the fertilizer retention capacity of soil and its impact on receiving streams. The soil types used were Black clay soil, Black sandy soil, Grey soil, Red loamy soil, Red gravel soil and Red sandy soil. The soil samples were collected from the agricultural land in V shape to the depth of 12cm each.

B. Preparation of Artificial Agricultural Land

The artificial agricultural field was prepared by using trays which were each of 3ft in length, 2ft in width and 1ft in depth to collect the surface water. The bottom trays which were used to collect the percolated water were 1ft in length, 1ft in width and 0.5ft in depth. Each tray contained about 96 kg of each soil sample separately.

C. Fertilizers Used

The fertilizers used were Diammonium phosphate, Potash and Urea.10gm of each fertilizers mentioned were sprinkled in trays containing different types of soils.

D. Experimentation

Fig.2 shows the experimental setup. The artificial agricultural field was prepared by using trays which were each of 3ft in length, 2ft in width and 1ft in depth. The fertilizers used were DAP, potash and urea.10gm of each fertilizers mentioned were sprinkled in trays containing different types of soils.

The simplest possible form of spray, but which may be perfectly suitable for some simple applications was used to spray the tap water. The water was sprayed constantly till the water was collected in the trays containing the soil samples. The surface water was collected from the top of the tray and the subsurface water from the bottom of the tray. The runoff of the surface water and sub-surface waters were collected separately for each type of soil.

Fig.2 Experimental Setup

IV. RESULTS AND ANALYSIS

A. Comparison in chemical runoff for Black Clay Soil

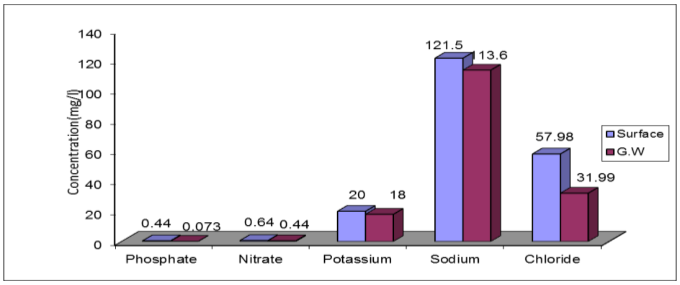

Fig 3. Variation in chemical runoff of surface and ground water on Black Clay Soil

Fig 3 shows the variations in chemical runoff for surface and ground water on black clay soil. The runoff chemical contents such as Phosphate, Nitrate, Potassium, Sodium and Chloride have been decreased in ground water compared to surface water as the permeability of Black Clay Soil is low.

B. Comparison in chemical runoff for Red Gravel Soil

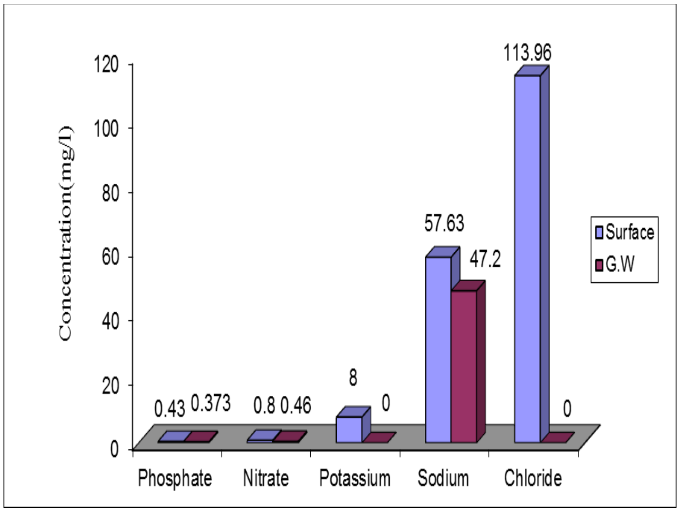

Fig 4. Variation in chemical runoff of surface and ground water on Red Gravel Soil

Fig 4 shows the variations in chemical runoff for surface and ground water on Red Gravel Soil. The runoff chemical contents such as Phosphate, Nitrate, Potassium, Sodium and Chloride have been increased in ground water compared to surface water as the permeability of Red Gravel Soil is high. Potassium and Chloride content is nil in surface water.

The choice is made on the basis of a trade-off between area, speed and power consumption. [2]

In the partial product generation stage, the multiplicand and the multiplier are multiplied bit by bit to generate the partial products. The partial product addition stage is the most important and complicated stage and determines the overall speed of the multiplier. The 3:2, 4:2 and 5:2 compressors have been widely employed in the high speed multipliers to lower the latency of the partial product accumulation stage. The 3:2, 4:2 and 5:2 compressors are ideal for the construction of regularly structured Wallace tree with low level circuit complexity [1, 2]. Though these three compressors have high speed than an array multiplier, there is still a need to increase the speed even more. This leads to use of compressors with higher level i.e., 6:2 compressor and 7:2 compressor for high level circuit complexity. Efforts have been made to increase the compression level to the 8:3 and 9:3 compressors and some more.

C. Comparison in chemical runoff for Black Sandy Soil

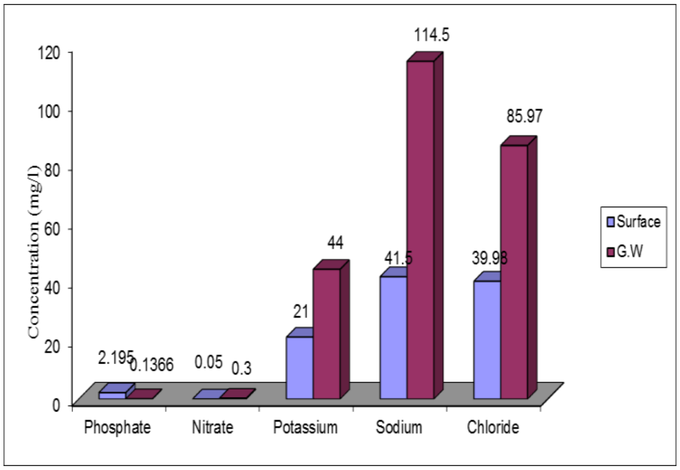

Fig 5. Variation in chemical runoff of surface and ground water on Black Sandy Soil

Fig 5 shows the variations in chemical runoff for surface and ground water on Black Sandy Soil. The runoff chemical contents such as Phosphate, Nitrate, Potassium, Sodium and Chloride have been increased in ground water compared to surface water as the permeability of Black Sandy Soil is high.

D. Comparison in chemical runoff for Red Loam Soil

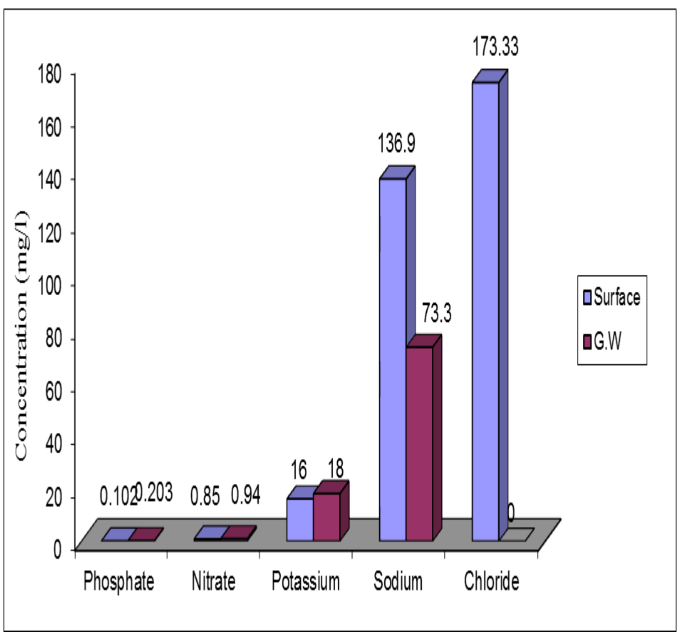

Fig 6. Variation in chemical runoff of surface and ground water on Red Loam Soil

Fig 6 shows the variations in chemical runoff for surface and ground water on Red Loam Soil. The runoff chemical contents such as Phosphate, Nitrate, Potassium, Sodium and Chloride have been decreased in ground water compared to surface water as the permeability of Red Loam Soil is low.

E. Comparison in chemical runoff for Grey Soil

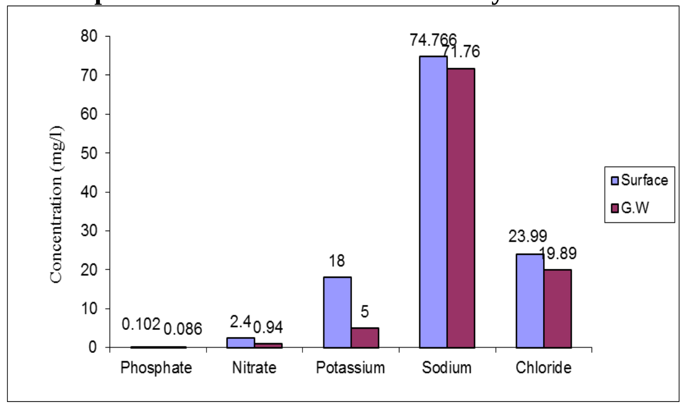

Fig 7. Variation in chemical runoff of surface and ground water on Grey Soil

Fig 7 shows the variations in chemical runoff for surface and ground water on Grey Soil. The runoff chemical contents such as Phosphate, Nitrate, Potassium, Sodium and Chloride have been decreased in ground water compared to surface water as the permeability of Grey Soil is low.

F. Comparison in chemical runoff for Red Sandy Soil

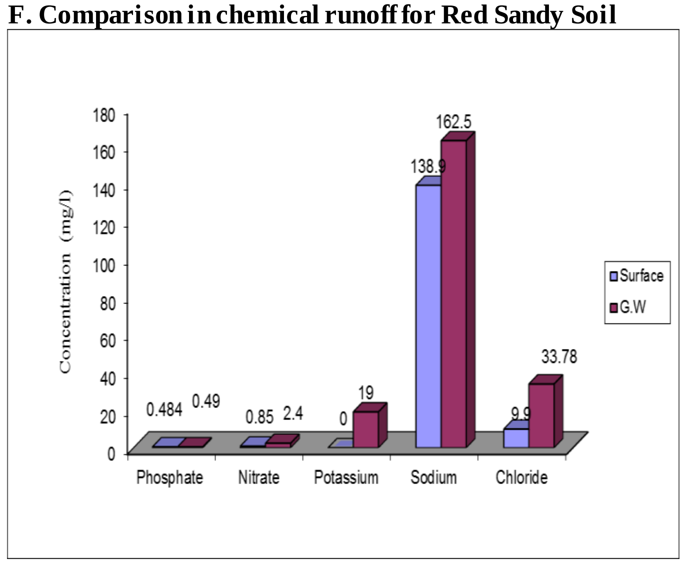

Fig 8. Variation in chemical runoff of surface and ground water on Red Sandy Soil

Fig 8 shows the variations in chemical runoff for surface and ground water on Grey Soil. The runoff chemical contents such as Phosphate, Nitrate, Potassium, Sodium and Chloride have been inecreased in ground water compared to surface water as the permeability of Red Sandy Soil is high.

V. CONCLUSIONS

The runoff of chemical fertilizers for Black Clay Soil, Grey Soil and Red Loam Soil for surface water is high compared to ground water as the soil permeability is less in these soils and the runoff of chemical fertilizers from Black

Sandy Soil, Red Sandy Soil, Red Gravel Soil for surface water is low compared to ground water as the soil permeability is high in these soils.

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