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Variability Assesment Of Seepage And Percolation In Thakurgaon District

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***Abstract*— Study to 'variability assessment of seepage percolation in Thakurgoan district' covers 2 Upazilas, Thakurgaon This study aimed to find out the variation of seepage and percolation loss in total Boro season, topography of the area and the particular soli structure of the area. In order to find out the variability assessment of seepage percolation in Thakurgoan district' half blind and half perforated PVC pipes were installed at Maghkhuria and Khochabari of Thakurgaon district. Average seepage and percolation loss have been found 5.63 mm/day in Thakurgaon district. The soil textures for each field have been tested at the laboratory of Soil Resource Development Institute. It has been found that Seepage and Percolation loss have major impact on topography of the area. The seepage and percolation loss mainly depend on the soil texture, surrounding environment and topography of the study area.**

Keywords— Seepage, percolation, topography, soil structure

I. INTRODUCTION

The greatest challenges of Bangladesh are to ensure food security through optimum utilization of the country's resources, with water as a central resource. About 52% of the total area of the country is now used for agriculture but irrigation is provided in about 68% of the agricultural land. Out of the total irrigated area of 5.37 mha, about 78.4% is irrigated by groundwater and the rest by surface water (BADC, 2013).

Seepage and percolation (S&P) loss of water is a major reason behind the poor efficiency and water productivity in irrigated rice systems. Specifically, water loss through S&P constitutes about 50–85% of total applied water in rice systems (Singh et. al., 2002). S&P is inevitable in irrigated rice production as water is applied to the fields to maintain a certain depth of standing water in the field. The key strategy for increasing water use efficiency in irrigated rice systems is through minimization of excessive field losses, particularly S&P, while maintaining the evapotranspiration (ET) at its potential rate.

The S&P loss is a highly variable component of the total water requirement of rice. S&P loss is site specific and depends on soil texture, water table depth, proximity to drainage outlet and farmer's field water management status (Bhuiyan, 1982). The variation in S&P loss with time was observed by a number of researchers and the findings were more conclusive (Kukal and Aggarwal, 2002; Rashid et. al., 2009).

II. STUDY AREA

This study has been focused on 2 unions of Thakurgaon district having two different types of irrigation system at each area. The two unions were located in the Northwest region of the country. The project area covers different types of land properties of Bangladesh. The Figure-1 shows the study area.

III. TOPOGRAPHY OF THE STUDY AREA

A well-prepared digital elevation model (DEM) is essential for visualizing the floodplain topography and for accurate modelling. A DEM of 300 m resolution has been developed to define the topography of the study area and used in the model. Topographic data for the study area has been extracted from the topographic database developed by FAP-19 based on irrigation planning maps available at IWM.

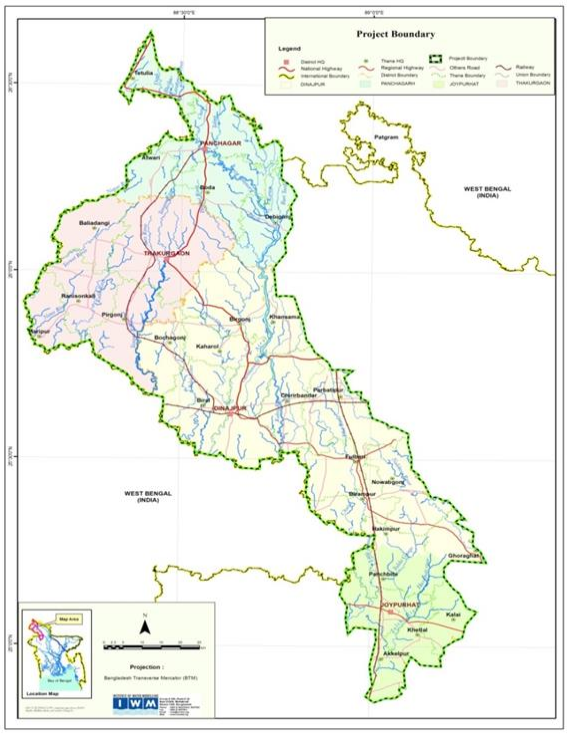
Utilizing these topographic data, a Digital Elevation Model (DEM) Of 300 m resolution has been developed to define the topography (Figure-2) of the study area. The DEM has been updated using the surveyed data.

IV. OBJECTIVE OF RESEARCH

The irrigation system at present, due to change of agro-socio economic situation of the area, High Yield Variety (HYV) Boro rice cultivation is being practiced by the farmers during dry period (Mid December to Mid May). Which require much higher irrigation

Figure 1: Study area

water. With the current cropping pattern and its irrigation demand, the existing water availability during dry period has to be used in a proper way to cover the entire command area.



The objective of the study was to find out the soil structure of the study area, find out the seepage percolation rate and topographical analysis of that area for better irrigation efficiency and irrigation cost.

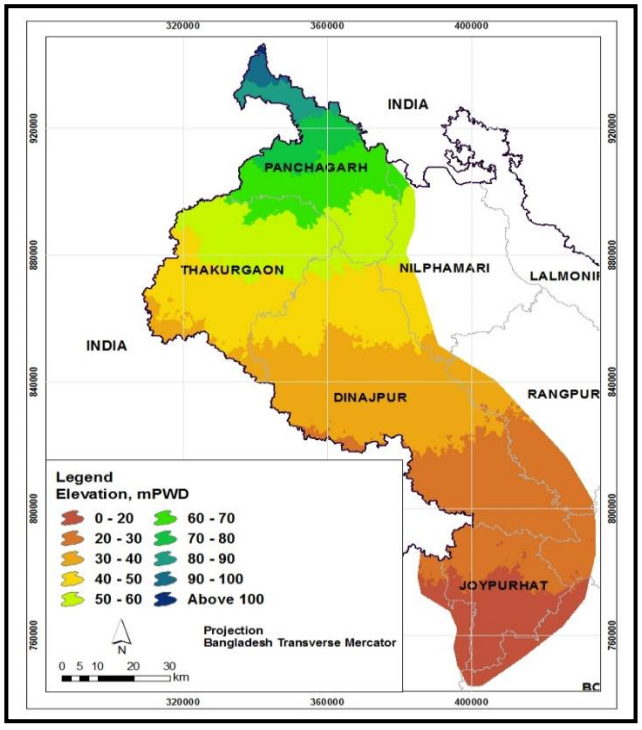


Figure 2: Topography of the study area

V. PROCEDURE

In order to find out the variability assessment of seepage percolation in Thakurgoan district a step by step procedure has been followed starting from data collection for seepage and percolation rate from field experiment data, evaporation rate from government institutions, the whole study was conducted from February 2017 to May 2017.

Figure 3: Sample of PVC pipe to measure water loss

A. Estimation of total water loss

For seepage and percolation loss measurement purpose half perforated and half blind pipes used as shown in Figure1. Those are installed in the rice field indicating a reference level of 30cm as shown Figure-2 .While installing in the field it was put in such a way that the soil surrounding the perforate portion becomes loose otherwise the mud inside the pipe can be clogged and water level cannot meet the reference level accurately. For keeping the reference level steady a fixed indicator brick was used so that due to irrigation, rain or other disaster cannot change that level. To record accurate data every 24 hours at

same time in every day the reference level was recorded shown in Figure-3. The whole pipes were at same length and same diameter and made at a time.

Figure 4: Installation of PVC pipe for measuring water loss

Figure 5: Field Data Collection by the Observer for Seepage and Percolation

B. Measuring Evaporation Loss

The evaporation loss data was collected from evaporation station which works under Bangladesh Water Development Board. Boro season total four months data was collected from the institution.

Calculation of evaporation loss

The evaporation was calculated according to equation (1) which was stated by ……

$$Evapration = Rainfall + (no\ of\ cup\ added - no\ of\ cups\ removed) \times 0.508 \quad (1)$$

C. Calculation of seepage and percolation loss

The seepage and percolation loss were calculation

S & P=Total water loss-Evaporation loss (2)

VI. RESULT ANALYSIS

After analyzing the data sets collected from two union of Thakurgaon district soil properties found silt loam, loam and sandy loam, which result much variation of the water level status after transplanting the crop. The evaporation rate also has greater impact on the water level status.

The soil texture was tested at Soil Resource and Development Institute (SRDI) for analyzing the texture. Figure 6 shows the soil properties of the two unions of Thakurgaon district.

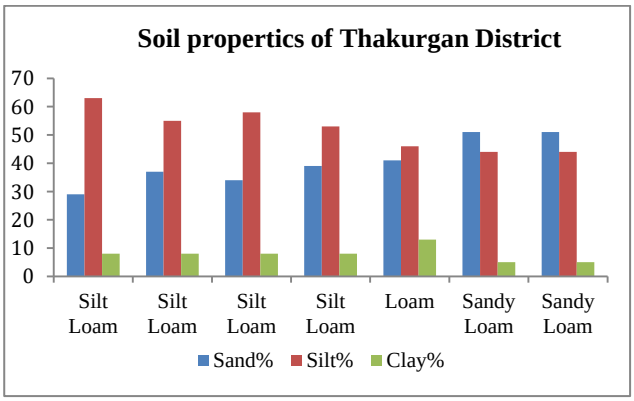


Figure 6: Soil structure of Thakurgaon district

The soil texture found in the subjected fields is silt loam and loam type having higher silt percent and sand percent. The clay percent in the subjected fields are very less resulting higher seepage and percolation rate.

Figure 7 explains the average daily water level variation due to seepage and percolation at the two unions of Thakurgaon district which was recorded at a fixed time in every 24 hours. In the figure some days found higher water level status due to irrigation and sometimes rainfall.

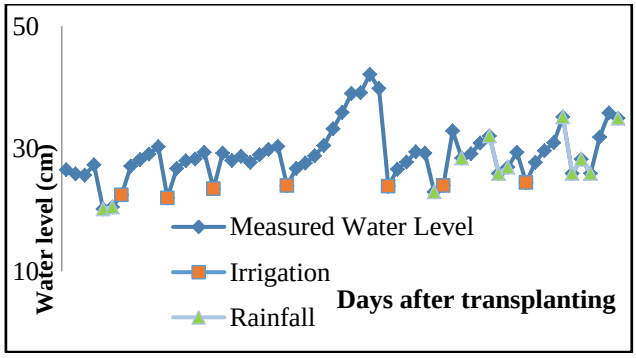


Figure 7: Water Level Status on Paddy Field, Thakurgaon

Evaporation loss very important factor in calculating seepage and percolation loss. Evaporation loss was higher in every month starting from February due to higher weather temperatures in that region. Figure 8 shows the average evaporation rate.

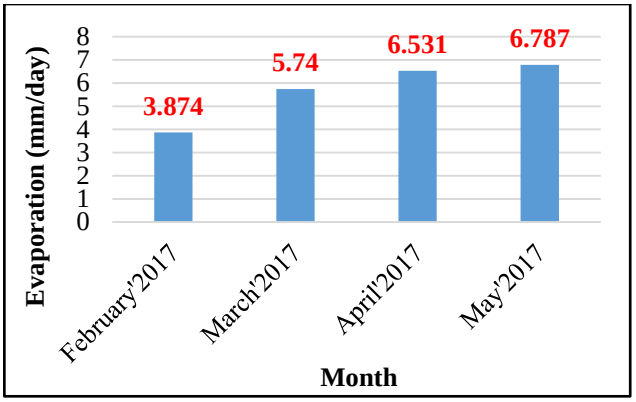


Figure 8: Average Evaporation Rate in Boro Season

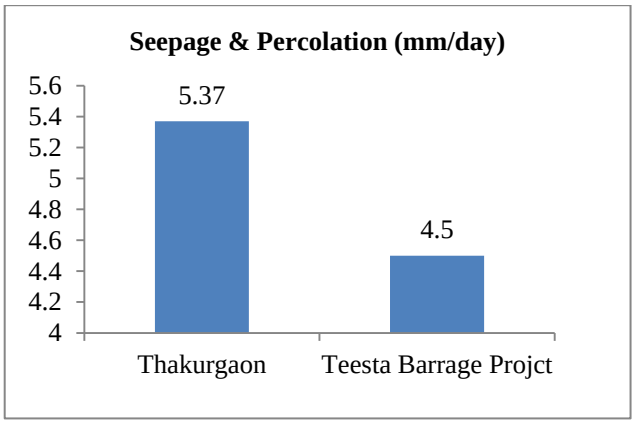


Figure 9: Average seepage and percolation in Thakurgoan

Figure 9 shows the seepage and percolation rate of the subjected two unions selected testing stations average value. The average value found 5.37 mm/day for silty loam soil whereas Teesta Barrage Project seepage and percolation rate was found 4.5 mm/day. The slight variation comes due to topography of the study area.

VII. CONCLUSION

The average seepage and percolation loss in two unions of Thakurgaon district computed by perforated pipe method. The main conclusion can be summarized as following

1. The average seepage and percolation rate of the subjected two testing station was very close due to similar soil structure and same topographic region.
2. Teesta Barrage Project similar type analysis was done by Institute of Water Modeling (IWM) in 2003. The seepage and percolation rate come 4.5 mm/day. The variation come due to soil type and elevation level.
3. Although seepage and percolation rate can be measured by variable head method or different empirical formula, the analysis was conducted using perforated pipe. The same type analysis can be done using variable head method for more accurate result.

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