
Temporal and Spatial Variation of Irrigation Water Quality in a Tank Cascade System in Thanamalwila, Sri Lanka

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A tank cascade is a hydro-ecological system consists of interconnected series of tanks located in a micro catchment. This system plays a major role in irrigation as an efficient water conveyance network in the dry zone of Sri Lanka. Due to the interconnected nature of these systems, there is a risk of accumulating a high level of agricultural pollutants such as inorganic fertilizers, pesticides, other agro-chemicals and sediments in lower (tail) tanks. These pollutants can harm crop production, aquaculture, the environment and ultimately human health. Hence, a study was conducted to assess and compare temporal and spatial water quality parameters in selected tanks of a small cascade system in the Kirindi oya basin in Thanamalwila Four tanks namely Sinhalayagama tank, Maha tank, Jambugas aara tank and Bagamuwa tank from upper, middle and the lower part of the cascade were selected to assess the spatial variability of nutrient dynamic from head to tail. Hydro-chemical parameters such as pH, electrical conductivity (EC), nitrate nitrogen (NO_3^- -N), ammonium nitrogen (NH_4^+ -N), phosphates (PO_4^{3-}), and alkalinity, were tested before and after the monsoonal rainfalls. In the dry spell, the pH of the tank water was higher indicating increased alkalinity level than in the wet season. The spatial variability maps showed that pH level of the tank water has increased from head to tail of the cascade system. The variation of salinity increment along the cascade system was clearly noticeable during the dry period. Bagamuwa tank which is in the tail of the cascade system had the highest EC values since it was greater than the maximum permissible level of 2250 $\mu\text{S}/\text{cm}$, indicating quality of the water is unsuitable in dry spell. Further, NO_3^- -N and NH_4^+ -N in the TCS were higher probably due to the excess leaching and accumulation of fertilizer and concentrating by evaporation regardless the rainfall variation. In the case of alkalinity, all the tanks except Jambugas aara tank had higher value than the recommended value of 100 mg/L CaCO_3 . The Bagamuwa tank and the Jambugas aara tank showed an exceptional highest phosphate concentration in the dry spell exceeding the recommended level of 0-2 mg/L. Most parameters showed an increasing trend along the TCS due to runoff and leaching of the chemicals used in agricultural activities in the wet season and concentrating in the dry season due to high evaporation causing increment of nutrients beyond the recommended level, showing the unsuitability of the water for irrigation. Therefore, proper fertilizer management is essential to avoid any adverse effect of excessive chemical parameters in irrigation water. Further, site-specific fertilizer recommendations would be a better option to reduce nitrogen and phosphorous enrichment in the tank water of the cascade system.

Keywords: Irrigation water, Salinity, Spatial variation, Tank cascade system