ID 125

Effect of soil physicochemical factors on the growth of algae as a mat on soils in paddy fields; A case study in Hambantota district, Sri Lanka

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Abstract
The growth of algae as a mat on paddy soil in some fields of the Southern part of Sri Lanka, especially in Hambantota district is a challenge for rice cultivation. Rice seedlings entangled in algal mats result empty patches in the field. Determination of the effect of soil properties on luxuriant growth of algae is significant for planning controlling strategies as soil properties are highly influential on the biodiversity and the ecological cycle of life on soil in the paddy field ecosystem. The study aimed to determine the effect of major soil physicochemical factors on the development of algae as a mat on the paddy soil in Hambantota district. The results of the preliminary study conducted in the selected fields from five different locations (Godigamuwa, Netolpitiya, Thissamaharamaya, Weeravila, and Bandagiriya) in Hambantota district showed the presence of significantly ($p < 0.05$) higher biomass (105.06 ± 26.68 g m^{-2}) of algae in Godigamuwa at the early seedling stage (7 days old) compared to all other tested fields. Therefore, Godigamuwa was selected for further studies and algal and soil samples (n=3) were collected randomly from the fields at the tillering phase. Soil salinity, pH, conductivity, organic matter content (OM), gravimetric water content (GWC), available PO_4^{3-}, NO_3^-, and algal biomass were determined using the standard methods. Principal Component Analysis (PCA) and correlation analysis (CA) revealed the inter-correlation between analyzed soil physicochemical properties and algal biomass. Algal biomasses range from 142 g m^{-2} to 411 g m^{-2} and *Oscillatoria* sp. was identified as the dominant algal species inhabited in the algae mat. All the pH values were slightly acidic and the available soil PO_4^{3-} and NO_3^- concentrations were ranged between 0.5-0.18 mg kg^{-1} and 2.36-6.39 mg kg^{-1}, respectively. Algal biomass showed a significant positive correlation with NO_3^- (r= 0.518, $p < 0.05$) which significantly correlated with the salinity (r=0.477, $p < 0.05$) and conductivity (r=0.433, $p < 0.05$). Soil pH, OM, GWC, and available PO_4^{3-} have no significant relationship with the algal biomass. The present study concludes that the development of algae as a mat depends mainly on available NO_3^- content, salinity, and conductivity in paddy soil.

Keywords: Algae mat, Algal biomass, Paddy soil, Physicochemical properties

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