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Development of a Grow-Bed for Constructed Floating Wetlands: A Feasibility Study in Kandy Urban Lake in Sri Lanka

Bandara, W.D.G.N.[1]*, Wijetunga, S.[1], Jinadasa, K.B.S.N.[2], Mowjood, M.I.M.[3]

[1]Department of Agricultural Engineering and Environmental Technology, University of Ruhuna, Matara, Sri Lanka
[2]Department of Civil Engineering, University of Peradeniya, Peradeniya, Sri Lanka
[3]Department of Agricultural Engineering, University of Peradeniya, Peradeniya, Sri Lanka
*gihaninb@gmail.com

Abstract

Constructed Floating Wetlands (CFWs) have been used in Sri Lanka for over a decade to revitalize urban lakes. Design and fabrication of floating beds is an important task for the better performance of CFWs. Coconut Coir-pith (CCP) has been used as a media due to its availability and affordability in Sri Lanka. However, the erosion of CCP due to tidal waves in urban lakes is a challenge for the maintenance of CFWs. As an initial step, a geotextile reinforcement was introduced as a grow-bed to CFWs, align with other design criteria, and evaluated its effect on plant growth and nutrient uptake. The buoyant square-rafts (0.8×0.8 m^2) were made using 50 mm diameter PVC pipes. The CCP grow-beds were wrapped by geotextile covers (0.05×0.7×0.7 m^3). Polypropylene (PP) and Polyester (PET) geotextiles were used as treatments by Completely Randomized Design in triplicates. Grow-beds with only CCP were used as control. *Canna indica* was planted at the density of 4 plants/m^2. Plant heights, number of leaves, root growth and flowering were recorded over 70 days. After harvesting, dry masses and nutrient contents of plant tissue were measured. Data was statistically analysed using One-way ANOVA and Tukey tests. Total Nitrogen (TN) and Total Phosphorus (TP) contents of a plant (g), as determined by its dry mass, were significantly higher in plants in both PP (4.97±0.19 g, 1.61±0.21 g) and PET (4.50±0.33 g, 1.89±0.39 g). A significant positive relationship was revealed between plant dry masses and TP (g) ($p<0.05$) in both PP (R^2=0.77) and PET (R^2=0.82). Translocation Factors (TF), for TN and TP in both PP and PET plants were higher while significantly higher for TN in PET (4.34±0.38). Conclusively, the developed CCP-geotextile grow-beds were able to show an increased growth and nutrient uptake of plants. These results can be attributed to the favourability of geotextiles for attached-growth microbes which enhance the plant-function, while emphasizing the need for further advanced research.

***Keywords**:* Constructed floating wetlands, Coconut coir pith, Polypropylene geotextiles, Polyester geotextiles, Nutrient uptake