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Root architecture of typical bank vegetation and its contribution for river bank stability

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Abstract

The presence of riparian vegetation on river bank sides increases the soil reinforcement at the river banks and therefore reduces the river bank erosion. This contribution of vegetation on river bank stability is mainly owing to the specific root architecture which influence for the mechanical and hydraulic properties of soil – root interrelationship. Therefore, this study focused on the architectural characteristics of root systems of three selected shrub species: Lagenandra ovata, Spathiphyllum cannifolium and Colocasia esculenta and ultimately rank those species according to the ability of soil reinforcement by establishing soil-root relationship. The natural river bank area with well growing of selected shrub species was selected as study area. Laboratory tests were conducted to measure root tensile strength and to estimate the root density distribution with depth (Root Area Ratio, RAR). And also, the power law relationship between tensile strength and root diameter was obtained. Ultimately, additional soil shear resistance by roots was theoretically calculated with the help of Calculated RAR and root tensile strength values. Based on the results of root tensile strength (power law relationships), all the considered shrub species were significantly correlated ($R2>0.5$) with power law relationships. In addition, the strongest roots with the maximum a value (3.924) and the lowest b value (decay coefficient) (0.31) was obtained from Lagenandra ovata. Concerning the results of root distribution, the significantly ($p<0.05$) highest values for RAR at each depth level were recorded for the same species. In other way, the highest value of RAR indicates the highest reinforcement of soil by roots. This statement has been proven by the theoretical calculation of additional soil shear resistence by roots which have highest values for Lagenandra ovata. So, Lagenandra ovata can be ranked at the first place of soil reinforcement owing to its specific root architecture comparing with other considered species.

Key words: Root architecture, soil reinforcement, root area ratio, root tensile strength, soil shear resistance