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Experiment on Artificial Recharge of Groundwater Implemented Project: Effect on the Infiltration Velocity by Vegetation Mulch

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Abstract : This study was conducted at the Wanglung Farm in Pingtung County to test the groundwater seepage influences on the implemented project for artificial groundwater recharge. The study was divided into three phases. The first phase, conducted on natural groundwater that was recharged through the local climate and growing conditions, observed the natural form of vegetation species. The original plants were flooded, and after 60 days it was observed that of the original plants only Goosegrass (Eleusine indica) and Black heart (Polygonum lapathifolium Linn.) remained. Direct infiltration tests were carried out, and calculations for the effect of vegetation on infiltration velocity of the recharge pool were noted. The second phase was an indoor test. Bahia grass and wild amaranth were selected as vegetation roots. After growth, the distribution of different grassroots was observed in order to facilitate a comparison permeability coefficient calculated by the amount of penetration and to explore the relationship between density and the efficiency to groundwater recharge. The third phase was the root tomography analysis, further observation of the development of plant roots using computed tomography technology. Computed Tomography, also known as (CT), is a diagnostic imaging examination, normally used in the medical field. In the first phase of the feasibility study, most non-aquatic plants wilted and died within seven days. In seven days, the remaining plants were used for experimental infiltration analysis. Results showed that in eight hours of infiltration test, Eleusine indica stems averaged 0.466 m/day and wild amaranth averaged 0.014 m/day. The second phase of the experiment was conducted on the remains of the plant a week in it had died and rotted, and the infiltration experiment was performed under these conditions. The results showed eight hours in end of the infiltration test, Eleusine indica stems averaged 0.033 m/day, and wild amaranth averaged 0.098 m/day. Non-aquatic plants died within two weeks, and their rotted remains clogged the pores of bottom soil particles, causing obstruction of recharge pool infiltration. Experiment results showed that eight hours in the test the average infiltration velocity for Eleusine indica stems was 0.0229 m/day and wild amaranth averaged 0.0117 m/day. Since the rotted roots of the plants blocked the pores of the soil in the recharge pool, which resulted in the obstruction of the artificial infiltration pond and showed an immediate impact on recharge efficiency. In order to observe the development of plant roots, the third phase used computed tomography imaging. Iodine developer was injected into the Black heart, allowing its cross-sectional images to be shown on CT and to be used to observe root development.

Keywords : artificial recharge of groundwater, computed tomography, infiltration velocity, vegetation root system
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