Characterization of Bio-Hydrogels for Enhanced Soil Water Retention in Upland Fruit Cultivation

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ABSTRACT

This study characterized the soil water retention performance of natural polymer-based bio-hydrogels prepared using three different liquid sources: tap water, coconut water, and seawater. The bio-hydrogels were prepared through a cross-linking process and evaluated under simulated upland fruit cultivation conditions over a three-week experimental period. Soil moisture content was determined gravimetrically from the difference between the wet mass and dry mass of the soil samples after three weeks and was used as the primary indicator of hydrogel performance. Soil pH, soil temperature, and plant stem diameter were monitored as supplementary indicators of soil and plant responses. One-way analysis of variance (ANOVA) revealed a statistically significant difference in soil moisture content among the experimental treatments ($F = 65.0621$, $p < 0.001$), resulting in the rejection of the null hypothesis. The findings indicate that the use of bio-hydrogels prepared from different liquid sources affected the amount of water retained in the soil over the experimental period. Overall, the results demonstrate the potential of natural polymer-based bio-hydrogels as a sustainable approach to improving soil water availability in upland fruit cultivation.

Keywords: Bio-hydrogels/ Natural polymers/ Tap water/ Coconut water/ Seawater/ Soil moisture content/ Upland fruit cultivation