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SYNTHESIS OF ORGANIC HYDROGELS AND THEIR EFFECTS ON SOIL PROPERTIES AND SEED GERMINATION

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ABSTRACT

Hydrogels are potential tools to address issues namely water scarcity and nutrient leaching. This study evaluated biodegradable hydrogels synthesized from peanut shells, Palmyra leaves, or coconut leaves, combined with seaweed (*Kappaphycus alvarezii*), to improve water retention, minimize nutrient leaching, and enhance seed germination. The experimental design was a two-factor (hydrogel types; derived from either peanut shells, Palmyra leaves, and hydrogel concentrations; 0% (T1), 0.5% (T2), 1% (T3), 2% (T4), and 3% (T5) factorial with three replicates**.** To assess the impact of three types of hydrogels on seed germination at 2% hydrogel concentration three distinct moisture levels (50% (T1), 75% (T2), and 100% (T3) were tested with each type of hydrogel. Results showed that hydrogel concentration significantly influenced the outcomes, whereas no significant difference was found among the hydrogel types. The 3% hydrogel treatment (T5) significantly improved water retention, reducing moisture loss in the soil to 23.5 ± 0.14 % (vs. 40.2 ± 0.02% in T1). Nutrient leaching also decreased: nitrate leaching dropped to 0.06 ±0.01 mg in T5 (3% peanut shell hydrogel) compared to 0.84±0.05 mg in T1, while ammonium leaching fell to 0.07 ± 0.007 mg in T5 (3% Palmyra hydrogel) from 1.10 ± 0.03 mg in T1. Potassium and phosphorus losses were also minimized, enhancing nutrient availability near the root zone. Seed germination rates improved, with 90% germination observed in peanut shell and palmyrah hydrogels (T3, 100% moisture level) versus 56% in T1. Beyond improving water and nutrient retention and germination, hydrogels utilize agricultural waste and support environmental sustainability.

Keywords: biodegradable-hydrogel, water-retention, nutrient-leaching, seed-germination