

**Phosphorus Availability in Differently-Aged Growing Media within a
Lebak Swamp Floating Agriculture System**



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**PROGRAM STUDI ILMU TANAH
FAKULTAS PERTANIAN
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BANJARBARU
2026**

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Lebak Swamp Floating Agriculture System**

Oleh

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**Skripsi sebagai salah satu syarat untuk memperoleh
gelar Sarjana Pertanian pada
Fakultas Pertanian Universitas Lambung Mangkurat**

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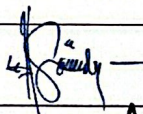
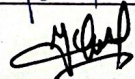
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Phosphorus Availability in Differently-Aged Growing Media within a Lebak Swamp Floating Agriculture System

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ABSTRACT

Floating agriculture, which utilizes local vegetation as a growing medium, is an adaptive innovation that enables year-round crop cultivation in the waterlogged conditions of lowland swamp ecosystems. However, the long-term capacity of these organic media to supply phosphorus (P), a critical nutrient, remains inadequately quantified. This study evaluated the phosphorus-supplying capacity of growing media of different ages (1 and 4 years) derived from identical vegetation sources. Media samples were collected from a 0–20 cm depth in two distinct cultivation systems: one year old media used for mustard greens (*Brassica juncea* L.) and four year old media used for eggplant (*Solanum melongena* L.). Analysis of chemical parameters (pH, available P, total P, and organic C) revealed that although the one year old media exhibited a higher pH (4.73–6.84) than the four year old media (4.34–6.05), available phosphorus showed no significant difference between them (1-year: 5.62–28.90 mg kg⁻¹; 4-year: 6.00–24.46 mg kg⁻¹). This indicates that the availability of phosphorus in these organic substrates is less strongly governed by pH than in mineral soils, which is in contrast to established mechanisms. Furthermore, the four year old media contained significantly higher levels of total P (158–1451 mg kg⁻¹) and organic C (29.7–5.6 g kg⁻¹) than the one year old media (total P: 137–703 mg kg⁻¹; organic C: 4.7–29.7 g kg⁻¹). These findings demonstrate that local vegetation-based growing media in floating agriculture systems possess a sustainable capacity for phosphorus supply, supporting the long-term viability of this cultivation approach in lowland swamp environments.

Keywords: floating farming system, lowland swamp, microbial decomposition, phosphatase, planting media age

INTRODUCTION

Indonesia possesses significant agricultural potential in its swamplands, which cover approximately 9.5 million hectares, with approximately 4.5 million hectares suitable for development (Ministry of Agriculture Republic of Indonesia 2020). However, the utilization of this resource is severely constrained by extreme hydrological fluctuations, where water levels can rise by 1–3 m during the rainy season, thereby submerging conventional crops and disrupting soil nutrient cycles (Fahmid *et al.* 2022; Noor & Sosiawan 2019). These conditions necessitate innovative cultivation technologies that can circumvent waterlogging problems while harnessing the inherent fertility of the swamp ecosystem. By adopting such targeted technological approaches, these swamplands, once perceived as a major constraint,

can be transformed into a promising alternative food source, ultimately bolstering national food security.

The floating agriculture system represents a proven adaptive innovation designed to mitigate the challenges of high water levels in lowland swamp ecosystems. In Indonesian swamps, water depths often exceed 100 cm for up to six months per year, and various aquatic vegetation, such as water hyacinth (*Eichhornia crassipes*), mimosa (*Neptunia oleracea*), and water lettuce (*Salvinia molesta*), thrive unchecked, typically being regarded as invasive plants. The floating farming system, historically implemented in Bangladesh for over two centuries with documented sustainability and stable productivity, enables continuous crop cultivation throughout the year, unaffected by water-level fluctuations that can exceed 1–3 m during rainy seasons (Bala *et al.* 2020; Irfanullah *et al.* 2008). The use of floating rafts constructed from this aquatic vegetation offers a dual solution: overcoming the limitations of cultivation in permanently inundated swamps while simultaneously addressing the proliferation of invasive plants. The technology utilizes buoyant beds assembled from locally available organic materials, such as water hyacinth and other aquatic plants, which are then layered with organic growing media. Successfully adapted by Indonesian farmers for horticultural production in swamp

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