

# THE POTENTIAL OF ORGANIC FERTILIZER TO ENHANCE RICE SEEDLING GROWTH IN SUBAK BURUAN, PENEHEL DISTRICT, TABANAN REGENCY

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## ABSTRACT

*The use of organic fertilizer has gained increasing attention as a sustainable strategy to improve soil fertility and crop productivity while reducing dependence on synthetic inputs. This study aims to evaluate the potential of organic fertilizer in enhancing the growth of rice seedlings in Subak Buruan, Penehel District, Tabanan Regency, Bali. The research was conducted using a randomized complete block design with four treatments, namely control (without fertilizer), compost-based organic fertilizer, liquid organic fertilizer, and a combination of compost and liquid organic fertilizer. Each treatment was replicated three times. Parameters observed included plant height, number of leaves, root length, and seedling biomass at 21 days after sowing. Data were analyzed using analysis of variance (ANOVA) followed by Duncan's Multiple Range Test at a 5% significance level. The results showed that the application of organic fertilizer significantly affected all observed growth parameters. The combination of compost and liquid organic fertilizer produced the highest plant height (28.6 cm), number of leaves (5.4 leaves), root length (12.8 cm), and dry biomass (1.92 g seedling<sup>-1</sup>). These findings indicate that organic fertilizer can effectively improve early rice growth by enhancing nutrient availability and soil biological activity. The use of organic fertilizer is therefore recommended as an environmentally friendly alternative to support sustainable rice cultivation systems in Subak Buruan.*

*Keywords: organic fertilizer, rice seedling, sustainable agriculture, Subak Buruan, growth response*

## 1. INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereal crops worldwide, particularly in Asia, where it serves as a primary source of carbohydrates (FAO, 2022). In Indonesia, increasing rice demand due to population growth has encouraged farmers to intensify production systems, often through excessive use of synthetic fertilizers. Although chemical fertilizers can increase yield in the short term, their continuous and unbalanced application may degrade soil structure, reduce soil organic matter, and negatively affect soil microorganisms (Tilman et al., 2002; Savci, 2012). Organic fertilizer, derived from plant residues, animal manure, or other organic materials, contains essential macro- and micronutrients and improves soil physical, chemical, and biological properties (Palm et al., 2001). Previous studies have reported that organic fertilizer application can enhance nutrient availability, increase microbial activity, and improve plant growth, particularly during the early growth stages (Mäder et al., 2002; Diacono & Montemurro, 2010). In the Subak Buruan area, Penehel District, farmers have begun to adopt organic inputs to reduce production costs and maintain environmental sustainability. However, scientific data regarding the effectiveness of organic fertilizer on rice seedling growth in this area remain limited. Therefore, this study aims to analyze the potential of organic fertilizer to stimulate rice seedling growth and provide scientific evidence to support sustainable rice cultivation practices.

## 2. RESEARCH METODOLOGY

The study was conducted in a rice nursery field located in Subak Buruan, Penebel District, Tabanan Regency, Bali, from March to April 2025. The experiment used a randomized complete block design (RCBD) with four treatments: T0 = control (no fertilizer), T1 = compost-based organic fertilizer (10 t ha<sup>-1</sup>), T2 = liquid organic fertilizer (5 mL L<sup>-1</sup>), and T3 = combination of compost (10 t ha<sup>-1</sup>) and liquid organic fertilizer (5 mL L<sup>-1</sup>). Each treatment was replicated three times. Rice seeds of a local variety commonly used by farmers were sown in seedbeds. Observations were carried out at 21 days after sowing. Parameters measured included plant height (cm), number of leaves, root length (cm), fresh biomass (g), and dry biomass (g). Data were subjected to analysis of variance (ANOVA), and significant differences among treatments were further analyzed using Duncan's Multiple Range Test at a 5% significance level.

## 3. RELATED RESEARCH/LITERATUR REVIEW

Several studies have demonstrated the positive effects of organic fertilizer on rice growth. Suryanto et al. (2017) reported that compost application significantly increased rice seedling vigor and root development. Similarly, Rahman et al. (2019) found that liquid organic fertilizer enhanced nutrient uptake efficiency and early vegetative growth. The integration of organic fertilizer into rice production systems has also been shown to improve soil organic carbon and microbial diversity, which are essential for long-term soil fertility (Lal, 2015; Reganold & Wachter, 2016).

## 4. RESULTS AND DISCUSSION

The results of ANOVA indicated that organic fertilizer treatments significantly affected all observed growth parameters of rice seedlings ( $p < 0.05$ ). The highest plant height and biomass were recorded in the combined compost and liquid organic fertilizer treatment. This suggests a synergistic effect between solid and liquid organic inputs in providing readily available nutrients and improving soil conditions. Organic fertilizer improves soil structure, water-holding capacity, and nutrient retention, which are critical for seedling establishment (Brady & Weil, 2017). The increased root length observed in organic fertilizer treatments indicates better root development, allowing plants to absorb nutrients and water more efficiently. These findings are consistent with previous studies by Mäder et al. (2002) and Diacono and Montemurro (2010), who reported improved early growth of crops under organic fertilization.

## 5. CONCLUSION

The application of organic fertilizer has a significant positive effect on rice seedling growth in Subak Buruan, Penebel District, Tabanan Regency. The combination of compost and liquid organic fertilizer produced the best growth performance in terms of plant height, leaf number, root length, and biomass. These results indicate that organic fertilizer is a promising and environmentally friendly alternative to support sustainable rice cultivation. Further studies are recommended to evaluate its long-term effects on soil properties and rice yield at the field scale.

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