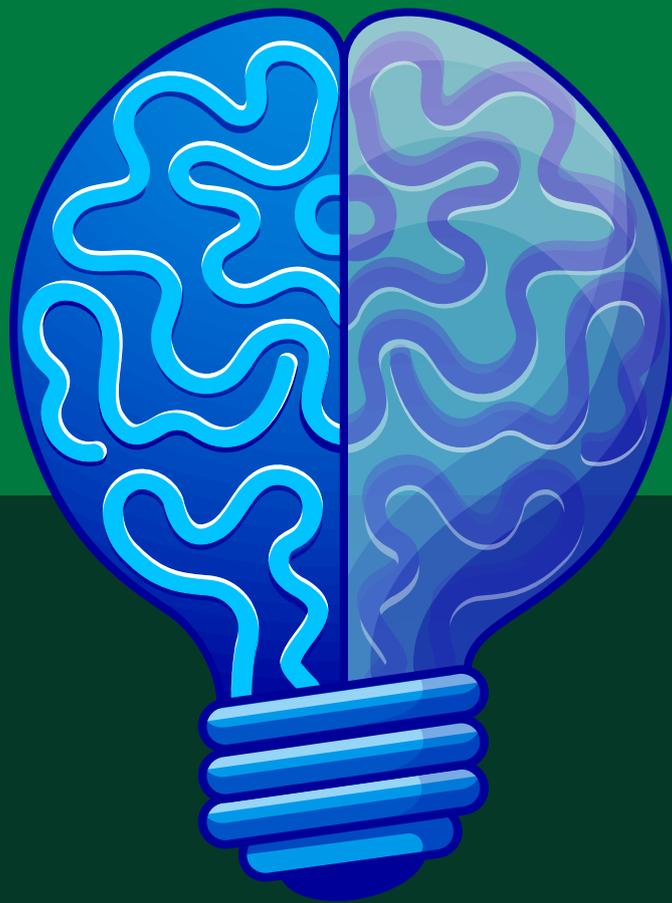


FACULTY OF  
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UNIVERSITI TEKNOLOGI MARA  
PERAK BRANCH

# SCIENTIFIC PROJECT COLLOQUIUM 2025



BIOLOGY ~ CHEMISTRY ~ PHYSICS

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## **Preface**

The Scientific Project Colloquium offers a platform for publishing Diploma Science final year projects (FYP). The objective is to effectively distribute research findings throughout all scientific disciplines. The primary objective of including final year projects into the course curriculum is to encourage students to put their theoretical knowledge into practical applications.

We would like to express our gratitude to our primary establishment, the Faculty of Applied Sciences and Universiti Teknologi MARA, Perak Branch, for their invaluable assistance.

Lastly, we would like to express our gratitude to all of the authors for the tremendous help in preparing the articles, without which this undertaking would not have been completed.

## **Editors**

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# PRELIMINARY STUDY ON THE USE OF WASHED RICE WATER AS A NATURAL FERTILIZER FOR GERMINATION AND GROWTH OF WATER SPINACH

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**Abstract:** Washed rice water (WRW), the starchy liquid left after washing rice, is rich in essential nutrients such as nitrogen, phosphorus, potassium, and beneficial microbes. This study evaluates the effectiveness of WRW as a sustainable and eco-friendly alternative to chemical fertilizers in promoting seed germination and early plant development. Water spinach (*Ipomoea aquatica*) seeds were pre-soaked and planted in black soil, with three treatment groups; tap water (control), fresh rice water, and aged (three days) rice water. Each treatment was replicated, and plants were watered every two days over 30 days. Growth parameters including germination rate, plant height, and number of leaves were measured. The results show that aged rice water achieved a 90% germination rate, along with the greatest leaf production and plant height, compared to fresh rice water and the control. This suggests that aged rice water could serve as an affordable and sustainable substitute for synthetic fertilizers, making it particularly advantageous for small-scale farmers and home gardeners. The study contributes to sustainable agricultural practices by promoting WRW as a low-cost, environmentally friendly fertilizer for improving crop yields and plant health.

**Keywords:** *Washed rice water, Aged rice water, Water spinach, Seed germination, Plant growth*

## INTRODUCTION

Agriculture remains a fundamental pillar of global food security and economic development, providing sustenance, employment, and income for millions worldwide. In Malaysia, agriculture remains a key contributor to the national economy, accounting for approximately 8% of the country's gross domestic product (GDP) in 2022 (DOSM, 2023). While its relative share of GDP has declined over the decades due to industrialization and service-sector growth, agriculture continues to play a critical role in rural development, food production, and trade. Chemical or synthetic fertilizers have played a crucial role in boosting global food production. However, long-term reliance on mineral fertilizers often alters soil chemistry and biology in ways that undermine sustainability. Continuous nitrogen fertilization has been shown to acidify soils, lowering pH and causing nutrient imbalances that reduce productivity over time (Howe, 2024). Indirectly, the use of chemical fertilizer also driven health risks where groundwater contaminated with nitrates from excessive fertilization has been linked to methemoglobinemia and possible carcinogenic effects (Madjar et al., 2024). Natural fertilizers including farmyard manure, compost, crop residues, green manures, biofertilizers, and other organic amendments are increasingly recognized as sustainable alternatives or complements to chemical fertilizers. Das et al. (2022) showed that compost and manure applications increase soil carbon levels, improve aggregation, and stabilize pH which can promote better root growth and water retention, which are critical under drought conditions.

With growing emphasis on sustainable agriculture, both small-scale gardeners and farmers are adopting environmentally friendly practices to improve soil fertility and crop performance. One promising approach is the use of washed rice water (WRW), a household byproduct often discarded as waste but known to contain valuable plant nutrients. Rice is available in multiple forms, including rough rice, brown rice, parboiled rice, conventionally milled white rice, pre-cooked rice, quick-frozen rice, and products such as puffed, crisped, or expanded rice (Abbas et al., 2011). The mineral profile of rice is influenced by factors such as varietal differences, fertilization practices, cultivation conditions, processing and cooking methods, as well as the characteristics of the soil in which it is cultivated (Abbas et al., 2011; Roy et al., 2011). The objective of this study is to investigate the effects of WRW including fresh and aged rice water on seed germination rates and subsequent plant growth. WRW provides essential macronutrients such as nitrogen, phosphorus, and potassium, along with trace minerals that support plant growth and microbial activity. Although short-term studies highlight its potential as a low-cost biofertilizer, the long-term agronomic and ecological impacts of WRW application are still not fully understood (Nabayi et al., 2021). Additionally, this study is significant for fully utilizing resources, particularly discarded materials like rice water. By exploring its nutrient content and potential for plant growth, the research also aims to reduce waste and promote sustainability.

## METHODOLOGY

### Preparation of Seeds and Soil

Water spinach (*Ipomoea aquatica*) seeds and black soil, serving as the growing medium, were obtained from the local market. The seeds were randomly selected and pre-soaked in tap water for six hours before planting.

### Preparation of Treatment Solutions

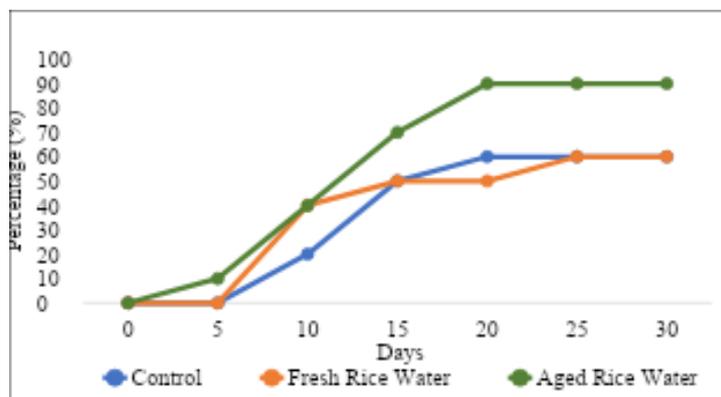
Two types of rice water were prepared as treatment solution which are fresh rice water and aged rice water. Fresh rice water was obtained by rinsing one cup of uncooked rice in two cups of water for 10 minutes, after which the water was immediately strained to extract the nutrients. Aged rice water was prepared using the same procedure and the strained water was stored in a 500 mL closed container at room temperature for three days to allow natural fermentation.

### Evaluation of the Treatment Solutions

Six pots were prepared, each containing 10 seeds planted in the same type of growing medium, and divided into three treatment groups, with two pots in each group. The control group will be watered with tap water, the fresh rice water group will receive freshly made rice water and the aged rice water group will be given rice water stored for three days. Each treatment was made into a duplicate. All pots were put under direct sunlight at the same time every day and watered with 100 mL of their respective solutions every two days from the time of planting. Watering was done in the morning to minimize evaporation loss and allow plants to utilize the moisture effectively throughout the day. Once seedlings emerged, the water amount was increased gradually to 200 mL every two days to support growth. The pots were observed daily for 30 days. An outdoor setting with steady sunlight and few fluctuations in the environment was used for this study. Apart from that, in the preparation of aged rice water, the 500 mL closed container containing the aged rice water will be kept at room temperature for three days before use. The effectiveness of treatment solutions was assessed every 5 days based on germination rate and plant growth by plant height and number of leaves.

## FINDINGS

The study evaluated the potential of rice water as a natural fertilizer through three treatments: control, fresh rice water, and aged rice water. Plant performance was assessed based on germination rates, plant height, and leaf number, recorded at five-day intervals over a 30-day period. Each treatment group was treated with its respective solution every two days. Germination rates refer to the proportion of seed that germinate under the tested condition (Ghaleb et al., 2022). Figure 1.0 illustrates the germination rates of water spinach seeds throughout the study.

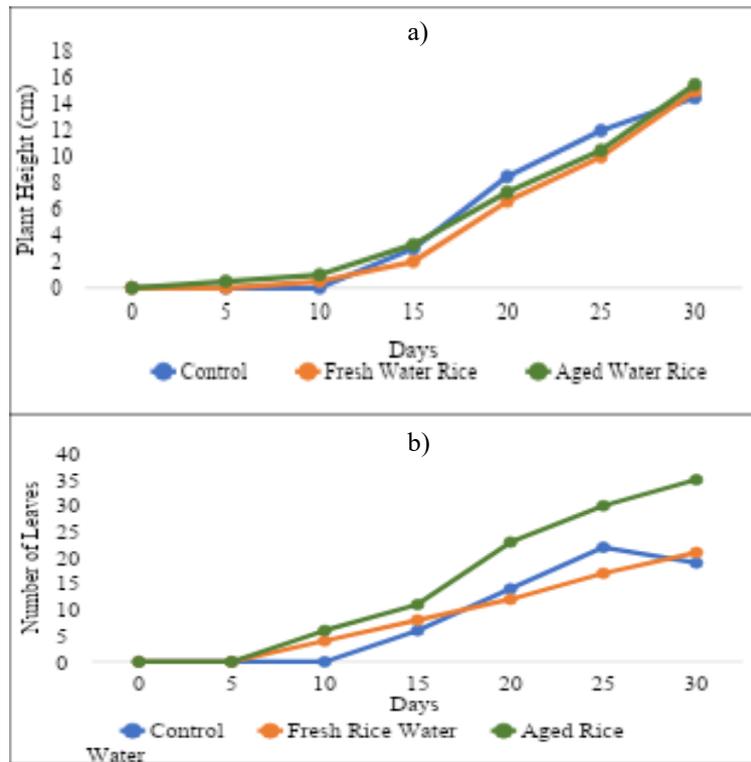


**Figure 1** Germination rates for three different treatments group

In general, the germination rates increase over time across for all treatments, with aged rice water showing highest germinated seed at 90% compared to control and fresh rice water at 60%. Aged rice water showed earliest seed germinated among the treatment groups at day 5. Rice water contains nutrients like carbohydrates, proteins, and minerals, along with small amounts of growth-promoting compounds which can support seed germination and early seedling growth (Sharma et al., 2020). Additionally, the presence of organic acids produced during fermentation of rice water could contribute to an improved soil environment by enhancing nutrient solubility and availability (Nabayi et al., 2023).

Plant growth is commonly evaluated using a combination of morphological parameters, such as plant height, number of leaves, stem diameter, and root length, as well as biomass measurements including fresh and dry weight of shoots and roots (Taiz et al., 2015). In this study the plant growth were assessed based on plant height and

number of leaves. Figures 2a) and 2b) present the plant height and number of leaves of water spinach recorded over a 30-day observation period respectively.



**Figure 2** Plant growth a) plant height b) number of leaves

Figure 2a illustrates the plant height (cm) observed over a 30-day period, where plants treated with aged rice water achieved the greatest height of 15.5 cm compared to the other two treatments. Notably, only the aged rice water treatment showed measurable growth by day 5, while no growth was recorded in the other treatments at that stage. On the other hand, Figure 2b shows the number of leaves produced, where rice water treatments resulted in leaf formation after 10 days. Plants treated with fresh rice water developed four leaves, while those treated with aged rice water produced six leaves. In contrast, the control group did not exhibit any leaf development in 10 days. At 30 days after treatment, water spinach treated with aged rice water exhibited the highest leaf count (35 leaves), compared to those treated with fresh rice water (21 leaves) and the control group (19 leaves).

The results of this study demonstrate that aged rice water markedly enhanced seed germination and plant growth compared to both fresh rice water and the control. Plants receiving aged rice water exhibited the highest germination rate along with superior growth performance. Fermentation converts complex organic compounds into simpler, more readily available forms. For rice water, this process can release amino acids, micronutrients, and beneficial microorganisms that promote seed germination. According to Nabayi et al. (2021), fermented washed rice water enhances populations of plant growth-promoting bacteria, which support both germination and overall plant vigor. These microbes may secrete enzymes and hormones, such as gibberellins, that play a key role in breaking seed dormancy and stimulating faster germination.

## CONCLUSIONS

This research examined the possible uses and advantages of WRW on germination rate and plant growth. Both fresh and aged rice water improved germination rate and plant growth in water spinach compared to the control, with aged rice water showing the most pronounced effect. Given its nutrient-rich composition, WRW represents a sustainable resource with multiple applications, including as an agricultural fertilizer, a natural cleaning agent, and a component in cosmetic formulations. Its reuse also contributes to reducing food waste and promoting environmental sustainability. Nonetheless, further research is needed to optimize its applications through detailed analyses and well-structured experiments, including investigations of microbial activity, pH, and temperature effects. Overall, the findings advance current knowledge of WRW's potential and encourage further investigation for practical use in diverse sectors.

## COMPLIANCE OF ETHICAL STANDARDS

*Not applicable.*

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Prof. Madya Dr. Nur Hisham Ibrahim  
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Sekian, terima kasih.

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*Setuju.*

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