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# Enhanced Rice Germination Using of Bio-humic Solution from Cacao Pod Compost with Seed Coating Method

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# Enhanced Rice Germination Using of Bio-humic Solution from Cacao Pod Compost with Seed Coating Method

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**Abstract.** The purpose of this study was to identify the optimal bioactivator for rice seed germination. Based on a randomized block design, a factorial design was used to set up the study experimentally. There were two treatments in the study: One of the factors was the availability of seed coating, which could be found in two variants: S1 and S2. Soaking in the bioactivator, which includes soaking the seeds in water or control (B1), Pleurotus sp (B2), and a biohumic solution (B3), is the second factor. The findings demonstrated that the Ciliwung variety of rice seeds germinated more readily after being coated with bio-humic material.

## 1. Introduction

Increasing the quality and quantity of rice production is one of the factors using high-quality seeds. Seed quality consists of genetic, physical, and physiological quality. Genetic quality is a superior trait that the parent inherits. The physical quality is seen in the seeds' morphological structure, size, weight, and appearance. Physiological quality includes seed viability and vigor, while pathological quality indicates the presence of seed-borne disease infection or seed health [1]. Various methods are used to improve seed quality, including seed coating, or known as seed coating.

Seed coating is a process of wrapping seeds using certain substances, aiming to improve the performance of a seed when it germinates. The seeds are protected from the environment during storage and marketing to maintain the moisture content of the seeds. Seed coating can uniform seed size, scan seed storage, reduce the adverse effects of storage conditions, and extend a seed's shelf life [2]. Seed coating of seeds using bioactivators is starting to be done nowadays. In this research, seed coating was carried out using the fungus Pleurotus sp. The rapid development of life sciences and agriculture has influenced the creation of agricultural development technology by utilizing biological agents, such as bacteria (Plant Growth Promoting Rhizobacteria/PGPR) and fungi. Decaying fungi also produce plant growth hormones. Research [3] showed that isolates of rotting fungi isolated from cocoa plants produce IAA hormones with concentrations of up to 2.794 μg/l.

Meanwhile, using humic acids to increase plant growth and productivity has become a significant concern for researchers in recent decades. Humic acid is a complex molecule consisting of various kinds of organic matter derived from residues decomposed by plants and animals. Most of the humic acids are obtained from the extraction of leonardite or lignite materials [4].

Several studies have shown the potential of humic acid to help improve soil health, significantly increasing carbon storage in soils with poor C-organic content [5] [6] [7] and the growth of soil microorganisms [8] [9]. It prompted research on increasing germination by coating seeds that were given a bio activator solution from Pleurotus sp and biohumic.

## 2. Materials and methods

The research was carried out at the Integrated Laboratory of the Faculty of Agriculture, Animal Husbandry and Fisheries, Universitas Muhammadiyah Parepare, from June to July 2023.

The materials used were rice seeds variety of Ciliwung obtained from farmers, humic acid from the extract of cocoa pod husk compost, bentonite, kaolinite, carboxyl methyl cellulose (CMC), *Pleurotus sp* supernatant, petri dishes, and tissue paper.

### *2.1 Research design*

The research was arranged using a factorial design on the basis of a randomized block design, with the following treatments:
S1 = Treatment without seed coating
S2 = Treatment with seed coating
B1 = Soaking the seeds in water
B2 = Soaking the seeds with Pleurotus sp
B3 = Soaking the seeds in a biohumic solution.
There were 6 treatment combinations which were divided into 4 replications so that there were 24 experimental units, each unit consisting of 72 observation units.

### *2.2. Preparation of bio-activator solutions*

The bio activator solution was prepared according to the treatment, namely by mixing each 0.05 ml of Biohumic with 30 ml of distilled water and 1.5 ml of Pleurotus sp supernatant with 30 ml of distilled water. Each solution was stored in a separate container and labeled B1 for distilled water, B2 for Pleurotus sp solution, and B3 for bio humic solution.

### *2.3. Seed coating treatment*

Rice seeds of 50 grams each were soaked in water and bioactivator treatment for 24 hours. The seeds that sank in the solution were used as research material, while those that floated were ignored. The seeds were then divided into 2 according to the treatment: with and without seed coating. Seed coating was made by mixing 10 g kaolinite, 10 g bentonite, and 0.5 g CMC until homogeneous. The seeds that have been soaked in the bioactivation solution are rolled in the seed-coating mixture until the seeds are completely covered. The seeds were then placed in a petri dish that had been covered with tissue paper that had been moistened with water. The seeds were arranged according to the research design and observed for 10 days.

## 3. Results and discussion

The bio-activator is in the form of bio-humic, which is produced from fermented cocoa pod extract compost using superior fungi, namely Pleurotus sp. The study's results [10] showed the highest humic acid concentration in cocoa pod husk compost fermented with *Coprinus sp*, followed by Pleurotus sp. However, in this study, the cocoa pod skin was fermented using *Pleurotus sp* because it was easier to obtain than *Pleurotus sp*. The results of the analysis of bio-humic nutrient content can be seen in Table 1.

Table 1 shown clearly that the nutrient content found in bio-humic. Biohumic contains macro and micronutrients needed by plants. The fully decomposed (humified), dark brown remains of plant or animal organic matter are humic substances in soils. They outperform clays regarding their capacity for cation and anion exchange, making them the most chemically active compounds in soils. They are long-lasting, essential parts of natural soil systems that can be destroyed by some agricultural practices in less than fifty years and last for hundreds to thousands of years [11]. Humate can be obtained from composting known organic materials by measuring the absorbance of a humic acid sample by scanning a standard humic acid solution to obtain the maximum wavelength and absorbance. It was done on each sample with five concentration variations. Repetition is carried out by making a test solution from the beginning of the treatment to validating the analytical method to be used. The results resulted in a regression equation $y = 0.1626x$ and $y = 0.1453x$ and humic acid concentrations of 5.5 ppm and 2.0 ppm [12].

**Tabel 1**. Biohumic from cacao extract content used in this study

| Parameters | Level content | Metodhs |
|---|---|---|
| N-total (%) | 1.07 | Kjeldahl |
| $P_2O_5$ (%) | 1.55 | Spectrofotometric |
| $K_2O$ (%) | 1.62 | AAS |
| C-Organic (%) | 8.56 | Chumies |
| pH | 4.09 | Electrometric |
| N-Organic (%) | 0.98 | Kjeldahl |
| Fe, ppm | 380 | AAS |
| Mn, ppm | 117 | AAS |
| Cu, ppm | 26.18 | AAS |
| Zn, ppm | 39.84 | AAS |
| Cr, ppm | 6.6 | AAS |
| Ni, ppm | 6.11 | AAS |

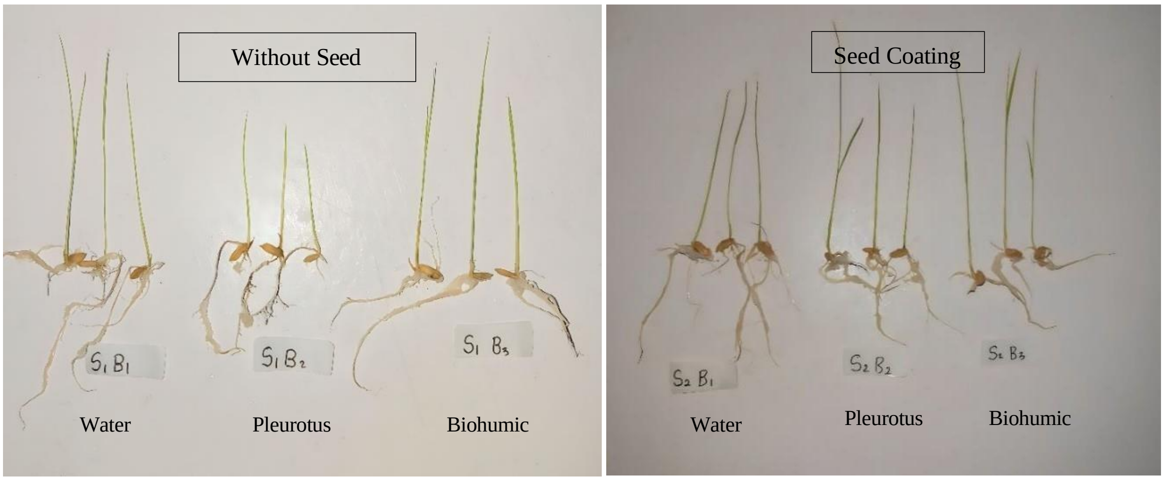


**Figure 1.** Performance of germinated rice seeds on various bioactivators on the 10th day in coating and without seed coating.

Fig.1 shown the performance of rice germination using a bioactivator on the 10th day of germination. In the treatment without seed coating, the rice seeds had longer radicles (root candidates) than those in the seed coating treatment. However, the roots in the treatment without seed coating were less sturdy and more potent than those treated with seed coating. Seed coating treatment with rhizobacteria after 24 weeks of storage maintained germination (79.3-88.5%), compared to seed treatment with metalaxyl fungicide [13]. Germination is a metabolic process in seeds to produce germination components, namely plumule and radicle [14].

Research [15] showed that the application of seed coating had a positive effect on the seeds of the Inpari 32 variety. Figure 2 shows that the radicle length treated with a bio-activator seed coating was higher than without, except for bio-humic. However, applying bio-humic and Pleurotus sp to the seed coating produced the same radicle length, i.e., 4.66 cm 10 days after germination. The bio-humic used in this study was made in organic fertilizer formulations, while Pleurotus sp was still supernatant. *Pleurotus* is a superior fungus with enormous potential to be used as a biological agent for growth, just like other microbes such as bacteria. The results showed that seed coating with bacteria increases plant growth and protects plants against pathogens that can potentially harm plants [16].

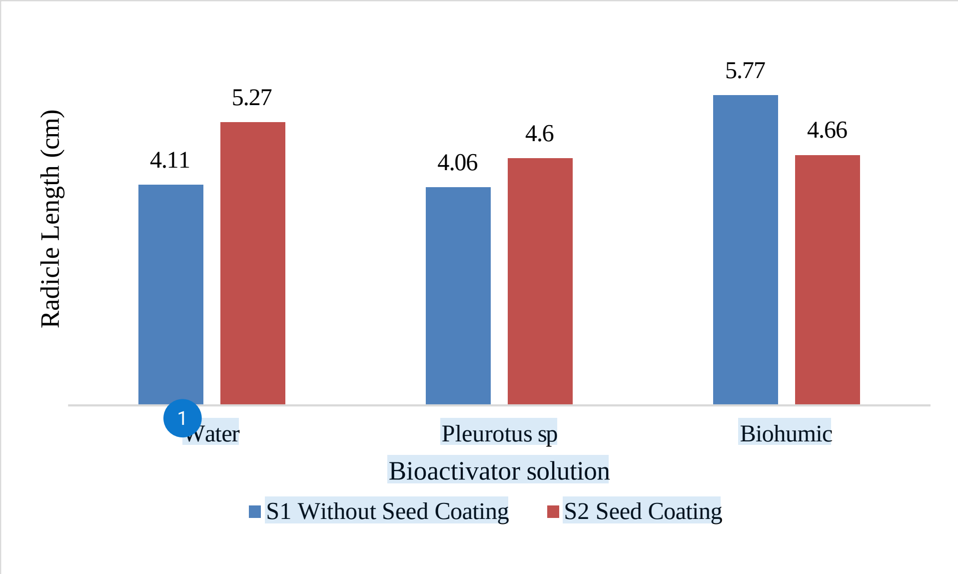


**Figure 2.** Radicle length of rice seeds soaked in bioactivator solution using the seed coating method on the 10th day

The plumule (potential stems) length of Ciliwung variety seeds was highest in the using bio-humic, both seed coating and without seed coating, respectively 8.11 cm and 6.23 cm. This value was much higher than other treatments, namely seed coating with Pleurotus sp (6.04 cm) and control with water immersion (5.34 cm). It is shown in Figure 3.

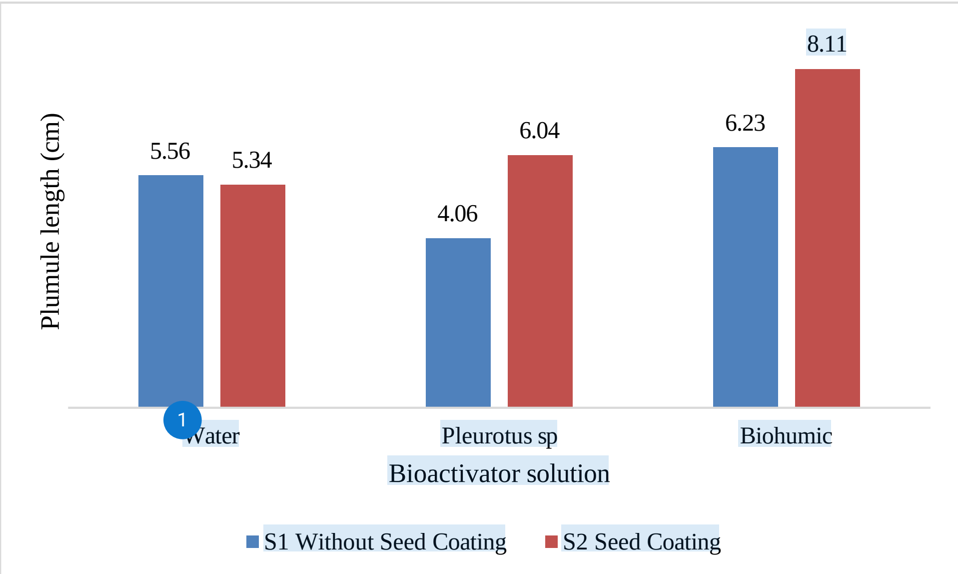


**Figure 3.** Plumule length of rice seeds soaked in bioactivator solution using the seed coating method on the 10th day.

Applying humic can increase the grain yield to 4253 kg/ha. However, humic acid will be more effective when combined with NPK fertilizer [17]. Biohumic potential is enormous to be used as a seed coating material so that the seeds have nutrients and protective substances when the seeds begin to germinate. Research [18] showed that in the growth chamber experiment, 17 days after sowing, the coated as opposed to uncoated wheat seeds significantly produced more seedlings with dry biomass in the form of leaves, shoots, and roots (by 10.0%, 28.6%, 23.1 %, and 64.2%, respectively). These results indicate that applying bio humic as a seed coating to seeds can produce better growth and production for rice plants.

## 4. Conclusion

Soaking seeds using bio-humic showed the best growth in rice seeds of the Ciliwung variety with or without seed coating compared with water and *Pleurotus sp*. supernatant. Seed coating with bio-humic increased the germination of rice seeds, with a radicule length of 4.66 cm and a plumula of 8.11 cm. It is recommended to do coating with bio humic to increase the growth and production of rice Ciliwung varieties.

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