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Sprout Test of Seven Types of Sumatran and Javan Rice with the Addition of Liquid Organic Fertilizer

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ABSTRACT

Rice productivity in Indonesia has declined due to a decrease in land area between 2018 and 2019. Another issue with rice seed dormancy is a reduction in productivity. Liquid organic fertilizer (LOF) is one way to overcome seed dormancy. The purpose of this study is to investigate the effect of soaking rice seeds in LOF on germination (viability), normal vigor of growing seeds (vigor), and germination rate. This study took place in the greenhouse and laboratory of the Department of Silviculture, Faculty of Forestry and Environment, IPB, from September to October 2022. Immersion procedures, planting, and data analysis were all steps in monitoring rice germination studies on four types of West Sumatra rice, one variety of West Java rice, and two varieties of rice from the Sukamandi Rice Research Centre. Soaking rice seeds in LOF affects their germination capacity and rate. Pandan Wangi had the maximum germination capacity and average seed count on filter paper medium, while Inpara 8 had the highest germination capacity and average seed count on vermicompost media with a 1:3 immersion. Anak Daro and Cikawasen had the fastest germination rates on filter paper media, whereas Pandan Wangi did the best on vermicompost media.

Keywords: Liquid organic fertilizer, local rice, seed dormancy

INTRODUCTION

Rice is Indonesia's primary food supply, as well as a source of income for farmers. Indonesia has a rich diversity of rice germplasm. The Indonesian government has developed the Main Strategy for Strengthening Agricultural Development for Food Sovereignty to increase rice productivity, including increasing the availability and utilization of land, improving agricultural infrastructure and facilities, developing and expanding seed and seedling logistics, strengthening farmer institutions, developing and strengthening financing, developing and strengthening bioindustry and bioenergy. Increasing rice seed output has required a variety of activities, including the distribution of superior rice seeds to attain national food self-sufficiency (Ministry of Agriculture 2015). According to Akbar *et al*. (2017), superior seeds require seed procurement, which includes growing, harvesting, and distribution to marketing.

Consistent with Syarifuddin *et al*. (2019), rice productivity in Indonesia is increasing on various islands, including Sumatra Island, which had the highest production volume between 2011 and 2016. West Sumatra has the highest rice production (49.62 cwt/ha), even though its land area is decreasing year after year. However, there was a fall from 2018 to 2020 as the land area decreased (Syauqi and Murni 2022). The issues that arise are also caused by seed dormancy in rice, which is affected by the morphology, physiology, and physical qualities of the seeds. Dormancy can be broken through many methods, including high-temperature heating and chemical solution soaking (Yuningsih and Wahyuni 2016). Elevated temperature heating, however, cannot increase seed germination in palm (Rumahorbo *et al*. 2020), nor does chemical solution soaking, both of which potentially damage seed viability. Gusman *et al*. (2019) discovered that soaking *Mucuna bracteata* seeds in H_2SO_4 resulted in poor viability.

Liquid organic fertilizer (LOF) is a way to break dormancy without disrupting growth. LOF is a solution derived from the decomposition of organic materials such as plant, animal, and human wastes that contain multiple nutrient elements (Yudistira *et al*. 2022). The advantage of this organic fertilizer is that it can correct nutrient deficits. Even when applied often, LOF does not harm the soil or plants. LOF contain air-borne N-fixing microorganisms, P and K solvents, and growth-

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stimulating microbes. Microbes give additional benefits such as protecting roots from pests and diseases, increasing root system development, stimulating meristem tissue mitosis, heavy metal antidotes, and soil bioregulators (Sriyanto *et al*. 2019). West Sumatra produces many native rice types, including Junjuang, Bujang Marantau, Anak Daro, and Pandan Wangi. Some local varieties necessitate rice seed dormancy-breaking treatment to boost rapid yield and ensure safe growth. Based on this background, efforts must be made to boost rice productivity by a dormancy-breaking strategy that does not harm growth. One initiative that can be undertaken is to examine the germination of rice cultivars in West Sumatra with LOF. The purpose of this study is to investigate the impact of seed soaking in LOF on germination capacity (viability), normal seed growth strength (vigor), and rice seed germination rate.

METHODS

Time and Place of Research

This community service program was implemented at the Silviculture Department's greenhouse and laboratory, Faculty of Forestry and Environment, IPB University, from September to October 2022.

Tools and Materials

The tools utilized include portray, sprayers, analytical scales, and trays. This activity's materials include filter paper, distilled water, vermicompost, water, Biohara+ type Liquid Organic Fertilizer (LOF), local rice seeds from four West Sumatra varieties (Junjung, Bujang Marantau, Anak Daro, and Pandan Wangi), one West Java rice variety (Cikawasen), and two varieties from the Center for Rice Research (BB Padi), Sukamandi.

Activity Stages

Rice soaking techniques, rice planting, and data analysis were the steps of implementing activities in the observation of rice germination tests.

Rice Seed Soaking Technique. Soaking rice seeds was the first stage in determining germination. Seeds were soaked in plain water as a control and LOF type Biohara+ at volume ratios of 1:3, 1:6, and 1:9 (v/v). Soaking in a 1:3 ratio involved combining 10 mL of LOF with 30 mL plain water. This was also done in the ratios of 1:6 and 1:9. Rice seeds from seven distinct types were steeped in each container with 25 seeds for 24 h.

Rice Seed Planting Technique. Soaking rice seeds for 24 h before planting them. The seeds were planted using filter paper as a planting medium in a 14.5 cm diameter Petri dish and vermicompost in a 4.6 cm × 4.6 cm portray. Germination was observed for two weeks by tracking the growth of the seeds each day. This was based on SNI 01-6233.3-2015 (Lesilolo *et al*. 2012). Watering was done every afternoon until the planting media was moist. Watering employed LOF at the same dose in three soakings (1:3, 1:6, and 1:9), whereas the control used pure water. Planting in the cup involved as many as 20 seeds per cup per variety, properly organized, and in the potray, as many as 1 seed each hole and up to five replications. Germination was stored in the germinator cup, and planting took place in the IPB Silviculture Greenhouse's pot tray.

Data Analysis.

The following parameters were used to process data from the rice seed germination test on seven varieties: plant length, germination percentage, growth uniformity, and germination rate. Plant length was calculated by measuring the lengths of each plant's roots and stems and adding them together. The formula for germination percentage, uniformity, and growth rate incorporates the percentage of germination are as follows (Lesilolo *et al*. 2012).

$$\text{Germination capacity} = \frac{\text{number of germinated seeds}}{\text{numer planted}} \times 100\%$$

The simultaneity of growth (Prabhandaru and Saputro 2017).

$$\text{Growth simultaneity} = \frac{\text{number of strong normal sprouts}}{\text{totsl seeds analyzed}} \times 100\%$$

Growth rate (Lesilolo *et al.* 2012).

$$\text{Growth rate} = \frac{\text{N1T1} + \text{N2T2} + \cdots + \text{NXTX}}{\text{JB}} \times 100\%$$

where:
N = number of seeds that germinate in a unit of time
T = time between initial testing and final testing at a certain interval
JB = number of seeds that germinate

RESULTS AND DISCUSSION

A germination test was performed on rice seeds from seven kinds to determine their viability and vigor. Seed viability is the ability of seeds to sprout as a growth symptom, whereas vigor is the ability of seeds to grow physiologically properly even under unfavorable growing conditions (Prabhandaru and Saputro 2017). Figure 1 depicts the germination test results, which revealed normal seeds, aberrant seeds, dead seeds, and fresh seeds that did not sprout. Normal seeds have strong and long primary roots, green plumules, and perfectly developed hypocotyls. This differs from aberrant seeds, which develop primary roots but produce rotting plumules. Dead seeds rot before sprouting, whereas fresh seeds that do not develop do not germinate until the conclusion of the test but continue to grow normally. Seeds germinated in vermicompost growing media grow more fertilely than seeds germinated on filter paper. Vermicompost's nutrient-rich composition aids rice growth. Lokha *et al*. (2021) reported that vermicompost can affect plant growth, with the highest dose being 700 g.

The results of soaking the seven types created varying height ratios, as shown in Figure 2. In comparison to the control (a), the 1:3 soaking treatment (b), 1:6 ratio (c), and 1:9 ratio (d) all influenced the rice's final height. Overall, the 1:6 ratio resulted in the same ultimate height but healthier and darker green plant strength, but the 1:3 and 1:9 ratios produced slower final height growth.

According to the results of the control test (plain water soaking), practically all types had a value more than 80%. Based on SNI 01-6233.3-2015, this percentage remains within the standard limits of SNI provisions (Table 1), except for the Anak Daro variety, which has a germination capacity less than the minimum limit. According to Prabhandaru and Saputro (2017), 80% of the rice remains within the conventional treatment limits.

Figure 3 shows that the germination capacity of 7 varieties varied depending on the planting media used. Rice seeds seeded in vermicompost planting media

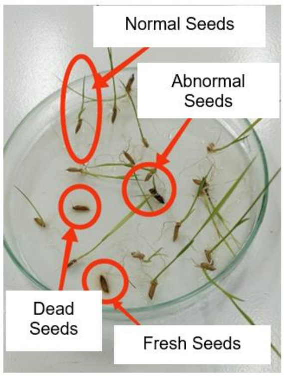

Figure 1 Seed germination testing produces normal seeds, abnormal seeds, dead seeds, and fresh seeds.

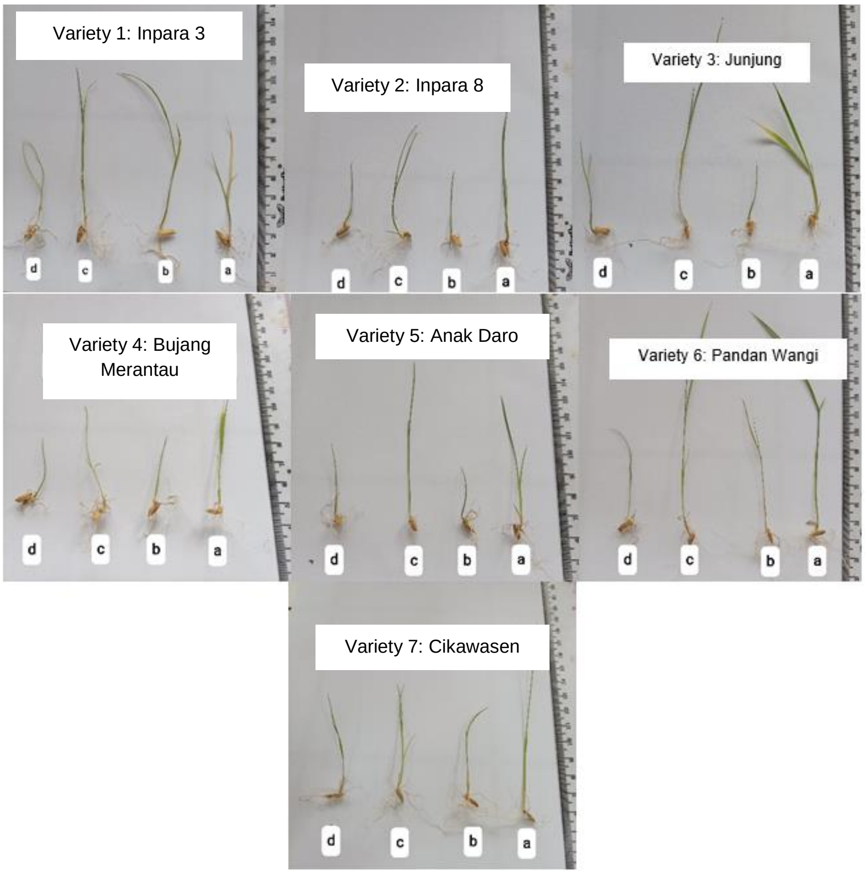

Figure 2 Comparison of soaking results for each variety: (a) Control, (b) 1:3 ratio, (c) 1:6 ratio, (d) 1:9 ratio.

Table 1 Germination capcity on 7 varieties with 4 soaking treatments

Variety	Cup				Version			
	Control	1:3 ratio	1:6 ratio	1:9 ratio	Control	1:3 ratio	1:6 ratio	1:9 ratio
Inpara 3	85	80	90	90	80	80	60	0
Inpara 8	95	95	80	90	60	80	60	20
Junjuang	100	100	100	90	100	20	80	20
Bujang Marantau	100	100	100	95	100	100	60	0
Anak Daro	50	100	75	90	80	60	60	0
Pandan Wangi	95	95	100	90	80	60	80	20
Cikawasen	90	95	95	90	80	60	80	20

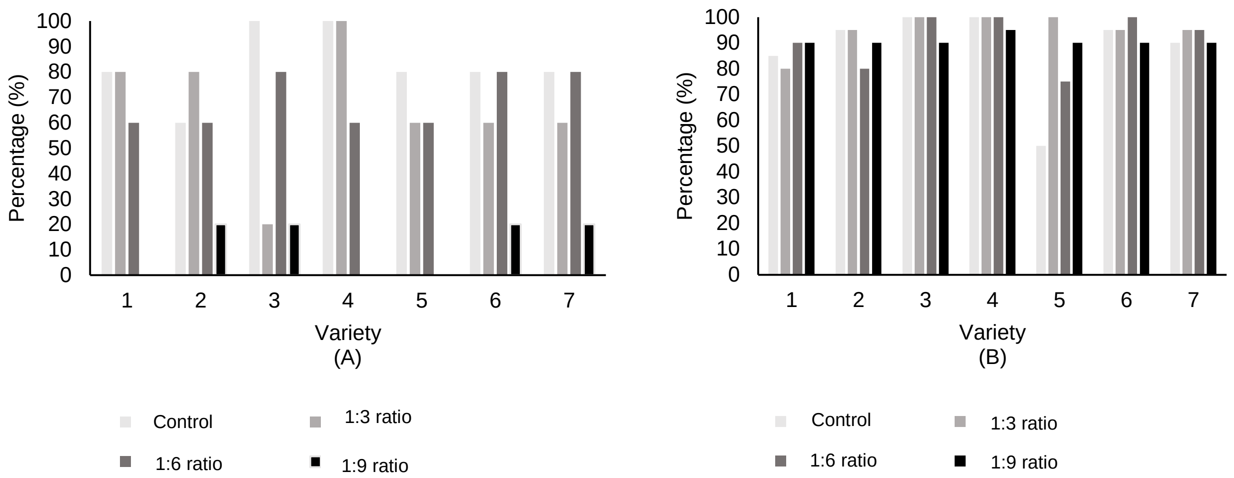

Figure 3 Germination capacity of 7 rice varieties (Inpara 3, Inpara 8, Junjung, Bujang Merantau, Anak Daro, Pandan Wangi, and Cikawasen) with 4 soaking treatments, a) planting on vermicompost, b) planting on filter paper in a cup. The X-axis represents rice varieties and the Y-axis shows the percentage of seeds that successfully germinated.

yielded 1:3, 1:6, and 1:9 immersion treatments, with average percentages comparable to the control. Varieties 1 (Inpara 3) and 4 (Bujang Marantau) showed no significant difference between the control and the effect of immersion, while varieties 3, 5, 6, and 7 exhibited better germination capacity in the control than in all immersion treatments. Soaking 1:3 seedlings in variety 2 (Inpara 8) resulted in a significantly higher germination percentage than the control. Variety 2 (Inpara 8) had 80% germination capacity in a 1:3 immersion, compared to 60% for the control. Immersion can interrupt seed dormancy in certain types. Unfavorable environmental factors, such as water and nutritional requirements, can have an impact on rice seed growth. Less wet vermicompost substrate can affect rice seed development. Rachmawati and Retnaningrum (2013) noted that rice cultivars had varying water availability.

Rice germination on filter paper substrate produces a high percentage value, averaging 80%. Several rice cultivars, including variety 5 (Anak Daro) and variety 7 (Cikawasen), alter rice germination capacity when soaked in 1:3 LOF. Soaking with 1:6 LOF has an effect on rice varieties 1 (Inpara 3), 5 (Anak Daro), and 6 (Pandan Wangi), but soaking with 1:9 has an effect on the germination capacity of rice variants 1 (Inpara 3) and 5. Soaking in variety 5 (Anak Daro) significantly improves germination capacity in all three soaking procedures. This demonstrates the favorable impact of variety 5 requiring soaking treatment. According to Widarawati *et al*. (2022), seed priming, which involves soaking in a liquid organic fertilizer solution, can help improve the quality of germinated seeds.

Aside from germination capacity, the germination rate was also assessed. The rice germination rate was measured to estimate how many days it takes for radicles or plumules to emerge throughout a given period (14 d). Rice germinates more slowly on vermicompost media than on filter paper in a Petri dish. This could be attributed to the effects of various settings. Rice planted in a dish was preserved in a germinator, which has more readily available and consistent climatic conditions, whereas rice grown in vermicompost was placed in a greenhouse. According to Lesilolo *et al*. (2012), when storing and sowing seeds, environmental parameters such as humidity, temperature, light, and others must be considered. Figure 4 shows the seed germination rate. According to the results of the germination rate, LOF soaking influences the number of days required for germination. Soaking with LOF resulted in an average number of days longer for germination, except for variety 6 (Pandan Wangi), which produced faster germination than the control. Soaking in a 1:6 ratio yielded the

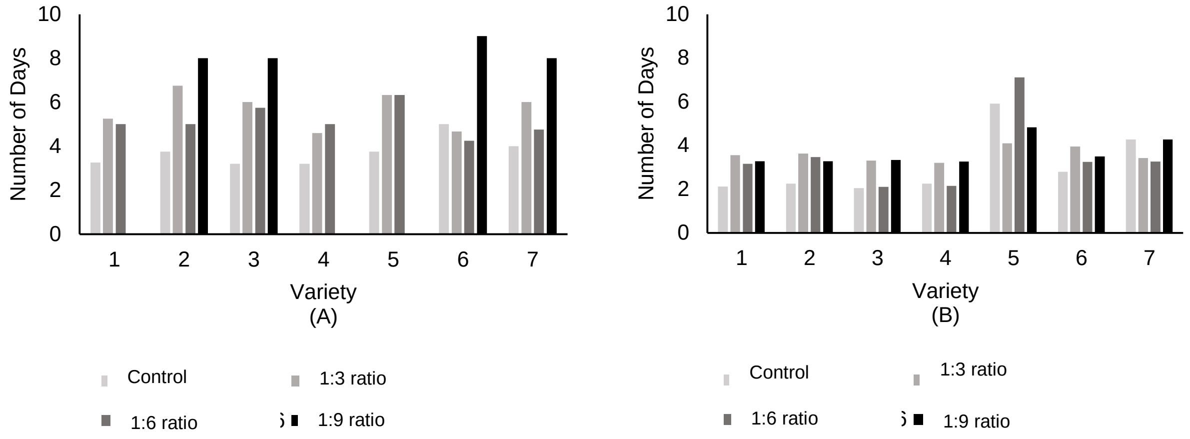

Figure 4 Germination rate of 7 rice varieties (Inpara 3, Inpara 8, Junjung, Bujang Merantau, Anak Daro, Pandan Wangi, and Cikawasen) with 4 soaking treatments: a) planting on vermicompost, and b) planting on filter paper in a cup. The X-axis (abscissa) shows the type of rice variety (1-7), while the Y-axis (ordinate) shows the number of days required for seeds to germinate.

fastest value for variety 6 (Pandan Wangi). This demonstrates that variety 6 germination process has a large and optimal effect when soaked with LOF 1:6. As a result, the Pandan Wangi cultivar requires soaking to speed up the germination process. According to Sari *et al*. (2018), Pandan Wangi rice created an effect of soaking concentration and soaking time, which had a substantial effect on rice seed germination. Soaking with LOF 1:9 resulted in a slower germination rate than the control. This demonstrates that soaking with a LOF concentration of 1:9 has no significant effect on rice seed germination.

The germination rate in Figure 4 (B) shows the same average value ranging from 2 to 4 days, except for the Anak Daro variety, which has a reaction rate value of more than 5 d across all soaking treatments. Anak Daro is a local variety considered superior in Padang. Kurniasih *et al*. (2008) classify the Anak Daro type as a superior variation because it is resistant to water and salt stress. In addition to variety 5 (Anak Daro), which had a substantial effect, variety 7 (Cikawasen) increased germination rate compared to the control. Cikawasen is one of the best varieties in Ciamis, West Java.

CONCLUSION

Soaking rice seeds in liquid organic fertilizer (LOF) affects their germination capacity and rate. Pandan Wangi had the maximum germination capacity and number of normal seeds on filter paper medium, whereas Inpara 8 had the highest on vermicompost media with a soaking ratio of 1:3. Anak Daro and Cikawasen had the fastest germination rates on filter paper media, while Pandan Wangi did the same on vermicompost media.

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