JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 7 NO. 3 September 2025

DOI :https://doi.org/10.36378/juatika.v5i2.4953
eissn 2656-1727
pissn 2684-785X
pages : 953 – 959

RESEARCH ARTICLE Open Access

Persistence and Breaking Dormancy of Sintanur Variety Rice Seed

Aldi Kamal Wijaya[1,*], Yoni Andari[2], Setyono[2], Punjung Medaraji Suwarno[1], Ridwan Diaguna[1]

Abstract

Research on breaking seed dormancy in rice is essential for understanding dormancy-breaking methods and their persistence, as dormancy behavior varies among rice varieties. This study aimed to examine the persistence of dormancy and effective dormancy-breaking methods in *Oryza sativa* L. cv. Sintanur. The research used two seed lots of the Sintanur variety—new and old lots—arranged in a split-plot design with two factors: dormancy-breaking treatments (control, 24-hour hydration, 48-hour hydration, KNO_3 solution, and GA_3) and storage periods (0, 1, 2, 3, and 4 weeks after harvest). The results showed that seeds of the Sintanur rice variety exhibited dormancy with persistence up to 3 weeks. The interaction between dormancy-breaking treatments and storage period significantly affected germination percentage, normal seedling growth, and seedling dry weight. Treatment with 10 ppm GA_3 for 48 hours effectively broke seed dormancy in the Sintanur variety starting from 1 week after harvest.

Keywords: After Ripening, Invigoration, Storage Period, Germination, Viability, Vigor

1. Introduction

A crucial component of successful rice production is quality seeds. However, the availability of superior rice seeds in Indonesia is often insufficient in quantity and at the right time for farmers. One of the constrain in providing seeds is the nature of the seeds themselves, most of which are dormant, preventing them from germinating when planted. Primary dormancy in rice seeds can persist for several weeks after harvest and can be affected by environmental conditions during storage (Sohn et al. 2021). Various dormancy-breaking methods have been developed to address this issue, including soaking in hot water, the use of chemicals such as KNO_3 , and treatment with gibberellic acid (GA_3) (Shiratsuchi et al. 2017). The effectiveness of these methods can vary depending on the rice variety and seed storage conditions (Mutinda et al. 2021). These methods aim to accelerate seed germination and increase germination rate. Soaking in water or the use of chemicals such as KNO_3 and GA_3 has been shown to be effective in breaking seed dormancy, but their effectiveness can vary depending on the variety and storage conditions. Therefore, research on the persistence of seed dormancy is crucial to determine the duration of seed dormancy and how it is broken.

Dormancy persistence is the storage period at room temperature required to break seed dormancy, which often varies depending on the variety and storage conditions. Dormancy persistence in lowland rice seeds shows considerable variation. Sutariati et al. (2017) observed that local upland rice cultivars from Southeast Sulawesi exhibited varying dormancy persistence, ranging from 8 to 16 weeks after harvest. Dormancy was considered to end after seeds stored at room temperature reached 85% germination or more. Therefore, to improve seed quality, it is important to understand the effects of environment and treatment on seed germination. This study aims to examine the persistence and methods for breaking dormancy in Sintanur variety rice seeds. This study is expected to serve as a reference in finding appropriate, more efficient methods for accelerating germination and increasing seed viability, thus enhancing planting success.

2. Material and Methods

Research was carried out at the CV Laboratory. Agribiotech Yogyakarta, coordinates 7°46'05.3"S 110°21'11.7"E, ±120 m above sea level, from November to December 2024. The tools used were digital scales, tweezers, mortar and pestle, microcentrifuge, micropipette,

*Correspondence: aldikamal@apps.ipb.ac.id
1) Institut Pertanian Bogor - Jl Meranti, Kampus IPB Darmaga, Bogor 16680, Indonesia
2) Universitas Djuanda - Jl. Tol Jagorawi No.1 Ciawi, Bogor 16720, Indonesia

blue tip, yellow tip, white tip, and a 1.5 mL tube. The materials used were one pure isolate of *Ganoderma sp*. fungus from the collection of the Biotechnology Laboratory, Faculty of Agriculture, University of Lampung (code 1), one pure isolate of *Ganoderma sp*. fungus from the collection of the Plant Pests and Diseases Laboratory, Faculty of Agriculture, Gadjah Mada University (code 2), and one pure isolate of *Ganoderma sp*. purchased from an online store (code 3). The research implementation included DNA extraction from *Ganoderma sp*. fungus, conducting Polymerase Chain Reaction (PCR) using ITS1 and ITS4 primers, and sequencing the PCR products with ITS1 and ITS4 primers.

This research was conducted at the Seed Laboratory of Vocational School, IPB University (6°35'15.3"S 106°48'32.1"E) from August – December 2021. The materials used in this study were 2 lots of rice seeds with different harvest ages obtained from IP2TP Muara Bogor. The experimental design used in this study was a split-plot design, with a two-factor randomized block design. The first factor was the dormancy breaking treatment as the main plot consisting of 7 treatments, namely: no treatment (control), 24-hour hydration, 48-hour hydration, 3% KNO_3 24 hours, 3% KNO_3 48 hours, 10 ppm GA_3 24 hours, 10 ppm GA_3 48 hours. The second factor is the storage period (weeks after harvest) as a subplot consisting of 5 treatment levels, namely: Storage period 0 msp, 1 msp, 2 msp, 3 msp, 4 msp. Each treatment was repeated four times, so that the resulting treatment combination was 7 x 5 treatment combinations. Data from the experimental results will be analyzed using analysis of variance (F-test). If the treatment has a significant effect, it will be continued with the DMRT (Duncan's Multiple Range Test) at the 5% level. Data analysis was carried out by using the MS Excel 2016 program and the Minitab v18 data processing program. The flowchart of the research was shown on Figure 1.

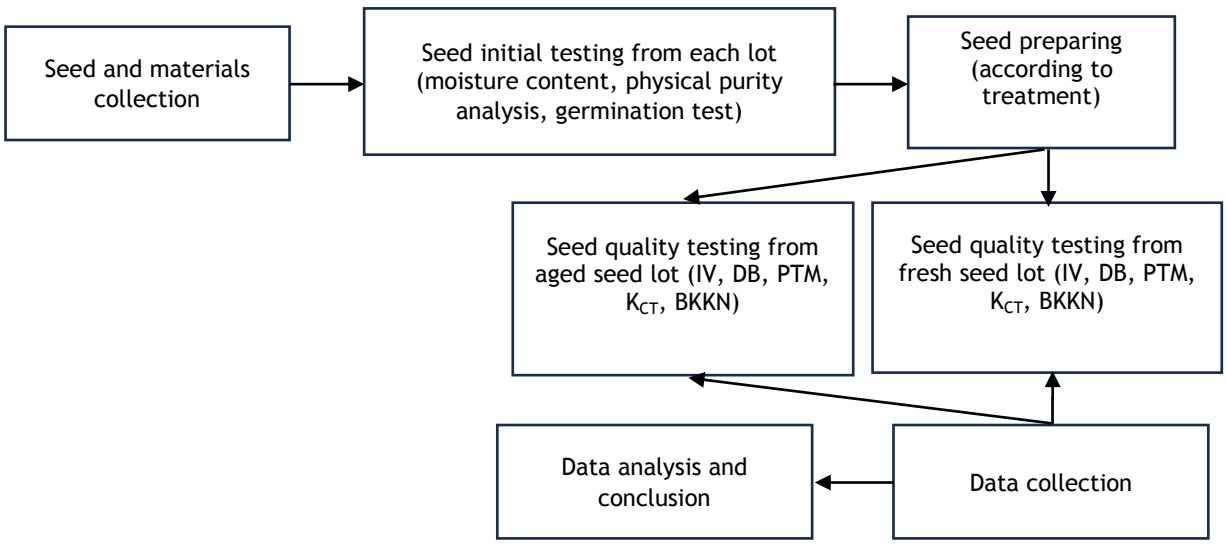

Figure 1. Dormancy Breaking Experiment Flowchart

Each lot of rice seeds was weighed at 700 g, considered as a shipping sample, and then divided into 5 parts according to the storage period treatment level. Approximately 70 g of seeds from each part were taken as working samples used for water content determination, physical purity analysis, and germination testing. Water content determination was carried out using a high-temperature oven method at 130-133°C for 1 hour (Kepmentan 2018). The percentage of water content can be calculated using the following formula:

$$\%\ \text{moisture content} = \frac{(M2 - M3)}{(M2 - M1)}\ \text{x}\ 100\%$$

Note:

M1 = Weight of the cup and lid

M2 = Weight of the cup, lid and contents before placing in the oven

M3 = Weight of the cup, lid and contents after being removed from the oven

Seeds with water content that has met the standard are treated and planted as a storage period of 0 msp, while the rest for periods 1, 2, 3 and 4 weeks are put in airtight plastic, then stored at room temperature. At each storage period, each lot is germinated using the Between Paper Test method and germinated in APB IPB 73-2A / B, which is then observed according to the specified time.

2.1. Observed variables

The variables observed in this study include components of seed viability and vigor.

2.1.1. Germination Rate (%)

Observations on the germination Rate (DB) of rice seeds were conducted on the 5th and 14th days after sowing (Kepmentan 2018). DB can be calculated using the formula:

$$\%\ \text{Germination Rate} = \frac{\text{NS I} + \text{NS II}}{number\ of\ seeds\ tested}\ \text{x}\ 100\%$$

Notes:
NS I : Normal seedlings on first count
NS II : Normal seedlings on final count

2.1.2. Vigor Index (%)

The vigor index (%) is calculated based on the number of normal seedlings grow on the first count (FC), namely 5 days after planting (DAP). The VI percentage is measured using the formula:

$$\text{Vigor Index (\%)} = \frac{\text{Number of normal seedlings (FC)}}{number\ of\ seeds\ tested} \text{ x } 100\%$$

2.1.3. Maximum Growth Potential (%)

Maximum Growth Potential (MGP) observed on the final count using the following formula:

$$\text{MGP (\%)} = \frac{\text{number of normal seedlings + number of abnormal seedlings}}{number\ of\ seeds\ tested} \text{ x } 100\%$$

2.1.4. Growth Rate (KCT)

Growth rate (K_{CT}) observations were carried out on normal seedlings from day 1 to day 14 after planting.

$$\text{Growth Rate (\%)} = \sum_{i=1}^{7} \frac{\text{\% Normal seedlings (i)}}{\text{observation hours (i/24)}} \text{ x } 100\%$$

2.1.5. Dry Weight of Normal Seedlings (BKKN)

Observations were made by taking samples of normal seedlings and drying them in an oven at 80°C for 24 hours. The dry weight of the normal seedlings was then measured using an analytical balance.

3. Results and Discussion

3.1. Seed Initial Testing

Sintanur rice seeds obtained from the Muara Bogor Rice Center underwent initial testing, including determining their moisture content and analyzing their physical purity, to ensure they met the standards for certified seed distribution (Figure 2). Seed moisture and purity testing is necessary to provide information on the potential physical and physiological quality of the seeds during harvesting, processing, damage (wounds), and to predict long-term success. The maximum moisture content for rice seeds is 13%, while the minimum purity of the seeds is 98% (Kepmentan 2020). Based on Table 1, the two seed lots used meet the rice seed quality requirements as stipulated in the Ministry of Agriculture Decree.

Seed viability is the seed's vitality, metabolic activity, and the presence of enzymes that can catalyze metabolic reactions necessary for germination and seedling growth (Ali & Elozeiri 2017). Parameters used to estimate seed viability are potential viability and vigor. Potential viability is the seed's ability to grow normally and produce normally under optimum conditions, while vigor is the seed's ability to grow normally and produce normally under suboptimal conditions (Reed et al. 2022). Benchmarks that can be used to estimate potential viability are germination capacity (DB), maximum growth potential (PTM), and normal seedling dry weight (BKKN). Meanwhile, benchmarks that can be used to estimate seed vigor are growth rate (K_{CT}) and vigor index (IV).

The results of the study showed that the interaction between dormancy breaking treatment and storage period in new lot rice seeds significantly affected the potential viability and vigor of the seeds (Table 2). The DMRT test results showed that seed germination during the storage period of 0 msp (before storage) in all dormancy breaking treatments had a very low DB value, which was less than 50%, this indicated that the newly harvested seeds were still experiencing dormancy (after ripening). However, the GA3 10 ppm treatment for 24 hours and 48 hours was significantly different and could provide higher DB values compared to other treatments, namely 39.5% and 38% respectively in the 0 msp period. In the storage periods of 1, 2, 3, and 4 msp, there was an increase in DB values as the storage period increased. The GA3 10 ppm 48 hour treatment was significantly effective in breaking dormancy since the storage period of 1 msp compared to other dormancy breaking treatments with a DB value of 86.5% (1 msp).

Table 1. Initial testing on 2 lots of Sintanur rice seeds variety

Parameter	Aged Seed Lot	Fresh Seed Lot
Moisture Content (%)	9.64	10.70
Seed Purity (%)	98.00	99.60
Inert Materials (%)	1.05	0.35
Seeds of Other Plants (%)	0.05	0.05

Figure 2. Seed physical purity analysis, (A) pure seed, and (B) inert material

Table 2. Viability and vigor of fresh lot seeds of Sintanur variety in various combinations of dormancy breaking treatments and storage periods

Treatments of Dormancy Breaking	Storage Periode (week after harvest)				
	0	1	2	3	4
IV (%)					
Control	2.50±0.12op	0.50±0.02p	7.00±0.35nop	6.00±0.3nop	7.00±0.35nop
24 h hydration	17.50±0.87k-o	23.50±1.17j-m	39.00±1.95ih	59.50±2.97d-g	67.00±3.35b-f
48 h hydration	10.50±0.52m-p	32.50±1.62ijk	48.00±2.40gh	73.50±3.67a-d	79.50±3.97ab
KNO_3 3 % 24 h	3.50±0.17op	14.00±0.70l-o	26.50±1.32i-l	57.00±2.85efg	55.50±2.77fg
KNO_3 3 % 48 h	2.00±0.10op	9.00±0.45m-p	38.00±1.90hij	68.50±3.42a-f	80.50±4.02ab
GA_3 10 ppm 24 h	16.00±0.80l-o	49.00±2.45gh	72.00±3.60a-e	78.50±3.92abc	78.00±3.90abc
GA_3 10 ppm 48 h	21.50±1.07k-n	59.50±2.97d-g	63.00±3.15c-g	84.00±4.20a	82.50±4.12ab
K_{CT} (%NS/etmal)					
Control	6.86±0.34kl	7.31±0.37kl	12.79±0.64ij	13.98±0.70hi	14.75±0.74d
24 h hydration	6.85±0.34kl	15.11±0.76ghi	19.56±0.98def	19.06±0.95ef	22.59±1.13bcd
48 h hydration	5.88±0.29l	16.17±0.81fgh	20.81±1.04cde	24.65±1.23ab	24.0±1.20abc
KNO_3 3 % 24 h	7.38±0.36kl	8.75±0.44kl	18.18±0.91efg	18.63±0.93ef	19.29±0.96def
KNO_3 3 % 48 h	8.01±0.40kl	14.97±0.75ghi	17.20±0.86fgh	21.69±1.08b-e	18.54±0.93ef
GA_3 10 ppm 24 h	9.88±0.49kj	9.06±0.45kl	19.41±0.97def	24.39±1.22ab	21.50±1.08b-e
GA_3 10 ppm 48 h	8.99±0.45kl	9.73±0.49kj	20.70±1.04cde	24.52±1.23ab	26.49±1.32a
DB (%)					
Control	26.50±1.33l	42.00±2.10j	79.00±3.95g	90.50±4.53b-e	92.50±4.63a-d
24 h hydration	31.00±1.55l	66.50±3.30h	89.00±4.45c-f	94.50±4.73abc	98.50±4.93a
48 h hydration	31.00±1.55l	71.50±3.58h	93.50±4.68a-d	95.00±4.75abc	96.50±4.83abc
KNO_3 3 % 24 h	32.00±1.60kl	83.00±4.15fg	94.00±4.70a-d	93.00±4.65a-d	96.00±4.80abc
KNO_3 3 % 48 h	25.50±1.28l	54.00±2.70i	90.50±4.53b-e	92.00±4.60a-d	97.00±4.85ab
GA_3 10 ppm 24 h	39.50±1.98j	84.50±4.23efg	95.50±4.78abc	94.50±4.90abc	92.50±4.63a-d
GA_3 10 ppm 48 h	38.00±1.90jk	86.50±4.33def	95.00±4.75abc	98.00±4.70ab	97.00±4.85ab
PTM (%)					
Control	31.50±1.58j	56.50±2.83h	87.00±4.35e	94.00±4.70a-e	96.50±4.83abc
24 h hydration	34.00±1.70j	71.50±3.58f	92.00±4.60a-e	97.50±4.88a	99.00±4.95a
48 h hydration	33.50±1.68j	75.00±3.75f	95.50±4.78abc	97.50±4.88a	98.00±4.90a
KNO_3 3 % 24 h	36.00±1.80j	89.50±4.48b-e	96.50±4.83abc	94.00±4.70a-e	97.00±4.85ab
KNO_3 3 % 48 h	32.00±1.60j	65.00±3.25g	94.00±4.70a-e	95.00±4.75a-d	98.00±4.90a
GA_3 10 ppm 24 h	44.00±2.20i	87.50±4.38de	97.50±4.88a	97.00±4.85ab	95.50±4.78a-d
GA_3 10 ppm 48 h	38.50±1.93ij	89.00±4.45cde	97.50±4.88a	99.50±4.98a	98.50±4.93a
BKKN (g)					
Control	0.124±0.01jk	0.127±0.01jk	0.233±0.01gh	0.288±0.01ef	0.265±0.01fg
24 h hydration	0.074±0.00l	0.179±0.01i	0.285±0.01ef	0.350±0.02abc	0.313±0.02de
48 h hydration	0.112±0.01k	0.186±0.01i	0.283±0.01ef	0.353±0.02abc	0.343±0.02bcd
KNO_3 3 % 24 h	0.124±0.01jk	0.218±0.01h	0.333±0.02cd	0.380±0.02a	0.383±0.02a
KNO_3 3 % 48 h	0.110±0.01k	0.146±0.01j	0.275±0.01f	0.365±0.02abc	0.360±0.02abc
GA_3 10 ppm 24 h	0.120±0.01jk	0.222±0.01h	0.279±0.01ef	0.378±0.02ab	0.383±0.02a
GA_3 10 ppm 48 h	0.105±0.01k	0.218±0.01h	0.265±0.01fg	0.373±0.02ab	0.358±0.02abc

Note: Numbers followed by the same letter are not significantly different, according to Duncan's Multiple Range Test (DMRT) with a significance level of $\alpha = 5\%$

Maximum growth potential significantly reached 80% in the 1 msp period for the 3% KNO3 24-hour treatment, 10 ppm GA3 24-hour treatment, and 10 ppm GA3 48-hour treatment. However, after 2 msp, all treatments provided maximum growth potential values above 80%, with the highest value obtained from the 10 ppm GA3 48-hour treatment, although not significantly different from the other treatments. Meanwhile, in the dry weight benchmark of normal seedlings (Figure 3), all treatments effectively provided higher BKKN values than the control. However, the BKKN values for each treatment did not differ significantly from the beginning to the end of the storage period.

In estimating seed vigor values, all treatments provided significantly better vigor index values from the beginning to the end of the storage period compared to the control. The best vigor index value was given by the GA3 10 ppm 48-hour treatment, which was consistently higher from the beginning to the end of the storage period compared to other treatments. Vigor index values above 80% were obtained in the 3-week seedling week (WSP) period from the GA3 10 ppm 48-hour treatment. Similarly, in terms of

seed germination rate, all treatments generally provided better KCT values than the control. The best KCT values were obtained from the GA3 10 ppm 48-hour treatment and 48-hour hydration from 1 to 4 WSP.

Table 3. Viability and vigor of aged lot seeds of Sintanur variety in various combinations of dormancy breaking treatments and storage periods

Treatments of Dormancy Breaking	Storage Periode (week after harvest)				
	0	1	2	3	4
IV (%)					
Control	68.00±3.40e	46.00±2.30g	56.00±2.80f	57.50±2.88f	56.00±2.80f
24 h hydration	91.50±4.58abc	79.50±3.98d	92.50±4.63ab	94.00±4.70ab	92.00±4.60abc
48 h hydration	93.50±4.68ab	87.50±4.38a-d	96.50±4.83ab	96.00±4.80ab	93.50±4.68ab
KNO_3 3 % 24 h	91.00±4.55abc	82.50±4.13cd	86.50±4.33bcd	92.50±4.63ab	91.50±4.58abc
KNO_3 3 % 48 h	91.50±4.58a	64.00±3.20ef	90.00±4.50abc	91.00±4.55abc	97.00±4.85a
GA $_3$10 ppm 24 h	93.00±4.65ab	91.00±4.55abc	96.50±4.83ab	96.00±4.80ab	96.00±4.80ab
GA_3 10 ppm 48 h	95.00±4.75abc	96.50±4.83ab	96.00±4.80ab	92.50±4.63ab	91.50±4.58abc
K_{CT} (%KN/etmal)					
Control	16.52±0.83mn	19.38±0.97kl	20.05±1.00jkl	22.05±1.10g-k	15.32±0.77n
24 h hydration	23.01±1.15f-i	21.23±1.06h-l	29.81±1.49ab	25.02±1.25def	22.33±1.12f-j
48 h hydration	25.83±1.29de	20.50±1.03i-l	30.62±1.53ab	25.17±1.26def	18.64±0.93lm
KNO_3 3 % 24 h	23.89±1.19e-h	21.57±1.08h-k	29.84±1.49ab	24.04±1.20d-h	21.46±1.07h-k
KNO_3 3 % 48 h	21.96±1.10g-k	20.94±1.05i-l	24.61±1.23d-g	24.81±1.24d-g	20.32±1.02i-l
GA $_3$10 ppm 24 h	26.05±1.30de	22.71±1.14f-j	28.96±1.45bc	26.43±1.32cde	22.93±1.15f-j
GA_3 10 ppm 48 h	26.73±1.34cd	22.88±1.14f-j	31.94±1.60a	26.37±1.32cde	22.61±1.13f-j
DB (%)					
Control	92.00±4.60c-f	92.00±4.60c-f	91.00±4.55ef	89.00±4.45f	91.50±4.58def
24 h hydration	91.50±4.57def	95.00±4.75a-e	92.50±4.63b-e	94.00±4.70a-f	92.00±4.60c-f
48 h hydration	93.50±4.67a-f	94.00±4.70a-f	96.50±4.83a-d	96.00±4.80a-e	93.50±4.68a-f
KNO_3 3 % 24 h	91.00±4.55ef	95.50±4.78a-e	96.50±4.83a-d	92.50±4.63b-e	91.50±4.58def
KNO_3 3 % 48 h	91.50±4.57def	93.00±4.65a-f	96.00±4.80a-e	91.00±4.55ef	97.00±4.85abc
GA $_3$10 ppm 24 h	93.00±4.65a-f	91.00±4.55ef	98.00±4.90a	96.00±4.80a-e	97.00±4.85a-e
GA_3 10 ppm 48 h	95.00±4.75a-e	97.50±4.88ab	96.00±4.80a-e	92.50±4.63b-e	91.50±4.58def
PTM (%)					
Control	94.50±4.73b-e	95.00±4.75a-e	93.50±4.68de	95.00±4.75a-e	94.50±4.73b-e
24 h hydration	95.00±4.75a-e	98.50±4.93abc	94.00±4.70cde	95.50±4.78a-e	94.50±4.73b-e
48 h hydration	96.00±4.80a-e	97.00±4.85a-e	97.50±4.88a-e	97.00±4.85a-e	96.50±4.83a-e
KNO_3 3 % 24 h	94.50±4.73b-e	98.00±4.90a-d	97.50±4.88a-e	95.00±4.75a-e	94.50±4.73b-e
KNO_3 3 % 48 h	94.50±4.73b-e	94.00±4.70cde	99.50±4.98a	93.00±4.65e	99.00±4.95ab
GA $_3$10 ppm 24 h	96.00±4.80a-e	97.00±4.85a-e	99.50±4.98a	97.00±4.85a-e	97.00±4.85a-e
GA_3 10 ppm 48 h	98.00±4.90a-d	98.50±4.93abc	97.50±4.88a-e	94.50±4.73b-e	93.50±4.68de
BKKN (g)					
Control	0.147±0.01p	0.122±0.01p	0.127±0.01p	0.245±0.01lmn	0.325±0.02def
24 h hydration	0.237±0.01l-o	0.214±0.01no	0.282±0.01h-k	0.307±0.01fgh	0.353±0.02cde
48 h hydration	0.254±0.01klm	0.235±0.01l-o	0.283±0.01h-k	0.317±0.01fgh	0.363±0.02abc
KNO_3 3 % 24 h	0.232±0.01mno	0.204±0.01o	0.237±0.01l-o	0.297±0.01f-i	0.355±0.02bcd
KNO_3 3 % 48 h	0.225±0.01mno	0.209±0.01no	0.257±0.01j-m	0.285±0.01g-k	0.393±0.02a
GA $_3$10 ppm 24 h	0.269±0.01i-l	0.244±0.01mno	0.293±0.01f-j	0.315±0.02fgh	0.390±0.02a
GA_3 10 ppm 48 h	0.271±0.01i-l	0.223±0.01mno	0.303±0.02f-i	0.320±0.02efg	0.388±0.02ab

Note: Numbers followed by the same letter are not significantly different, according to Duncan's Multiple Range Test (DMRT) with a significance level of $\alpha = 5\%$

The potential viability of seeds in old lots has shown excellent results through high DB and PTM values (>85%) in all treatments, even in controls starting from 0 msp, although not significantly different (Table 3). These results indicate that seeds in old lots have gone through their natural dormancy period, which is 1 month after harvest. However, the treatment of KNO3 3% for 48 hours and GA3 10 ppm for 24 hours provided higher DB and PTM values compared to other treatments although not significantly different, and significantly different from the control.

Aged rice seed lots have shown good vigor through vigor index values in all treatments that are significantly different from the control starting from 0 msp. This means that all dormancy breaking treatments effectively increase the vigor index value by >90% starting from 3 msp, while

the vigor index value in the control only reaches a maximum of 56% at 4 msp. Seed germination rates in all treatments are significantly different from the control, so dormancy breaking treatments effectively increase seed germination rates in old lots. The highest growth rates were significantly obtained at 2 msp, namely in the 24-hour and 48-hour hydration treatments, 3% KNO3 for 24 hours, and 10 ppm GA3 for 24 hours and 48 hours.

Figure 3. Normal seedlings of rice seed

Dormancy persistence is the storage period at room temperature required to break seed dormancy. Dormancy persistence is classified into three groups: varieties with long persistence (more than 8 weeks), medium persistence (4-8 weeks), and short persistence (less than 4 weeks). Seeds are considered dormant based on the time required to reach a minimum germination rate of 85%.

Two lots of Sintanur rice seeds had different seed dormancy persistence, fresh lot rice seeds had 3 weeks dormancy persistence (DB 90.5%) while the old lot did not have dormancy persistence because the DB had reached >85% at 0 msp (without going through the storage period, namely DB 92%). Differences in seed persistence are influenced by several factors including species, variety, planting season, harvest location and seed development stage (Kameswara et al. 2017). Nugraha and Soejadi (1991) added that seed dormancy persistence can also be influenced by the dormancy breaking method used. Treatment by soaking seeds in 10 ppm GA3 for 48 hours can effectively break the dormancy of new lot rice seeds during the storage period 1 week after harvest, while in old lot rice seeds all dormancy breaking methods can be used to increase seed germination because they have passed the dormancy period. This is suspected to be the seeds of the old lot breaking dormancy naturally due to dry storage after 1 month of harvest.

Gibberellin treatment on new rice seeds is effective in increasing seed viability. This is thought to be because the gibberellin contained in the seeds (endogenous) is not yet able to process germination, so the addition of gibberellic acid is needed. Tuan et al. (2018) stated that treatment with a high concentration of gibberellin is effective in overcoming dormancy and accelerating seed germination. This is consistent with the results of research by Cavusoglu & Sulusoglu (2015). which showed that GA3 treatment resulted in higher germination results compared to untreated plants. Tuan et al. (2018) stated that gibberellin plays an important role in seed germination and the mobilization of food reserves contained in the endosperm during early embryo growth.

In this study, in addition to the dormancy breaking treatment factor, the storage period factor also significantly increased seed viability and vigor as the seed storage period increased. This was evident from the increase in variable values directly proportional to the increase in seed storage period. In new lot seeds, the storage period factors of 0, 1, 2, 3, and 4 weeks after planting gave different responses each period to the variables DB, IV, KCT, PTM, and BKKN. A storage period of 4 weeks after planting in new lot rice seeds could provide higher yields for all observed variables compared to seeds without a storage period (0 weeks after planting), while in old lot rice seeds, the observed variables experienced fluctuations in yield each storage period, but the best increase in seed viability and vigor was shown by a storage period of 2 weeks after planting. Further research is needed to study molecular mechanisms underlying dormancy and dormancy breaking in rice seeds, as well as to develop more effective and efficient methods for increasing rice seed germination.

4. Conclusion

The Sintanur variety rice seeds exhibited dormancy (after ripening), with persistence for 3 weeks. The interaction between the breaking treatment and storage period significantly affected the DB, PTM, and BKKN variables. Based on germination testing, the seed soaking method with GA3 10 ppm for 48 hours effectively broke the Sintanur variety rice seeds dormancy from the first week of storage.

References

Ali, A. S., & Elozeiri, A. A. (2017). Metabolic processes during seed germination. *Advances in Seed Biology*, *2017*, 141–166.

Cavusoglu, A., & Sulusoglu, M. (2015). Effects of gibberellic acid (GA_3), indole-3-acetic acid (IAA) and water treatments on seed germination of *Melia azedarach* L. *(Lengkapi nama jurnal jika tersedia — data pada sumber Anda belum mencantumkan nama jurnal)*.

Kameswara Rao, N., Dulloo, M. E., & Engels, J. M. (2017). A review of factors that influence the production of quality seed for long-term conservation in genebanks. *Genetic Resources and Crop Evolution*, *64*(5), 1061–1074.

Mutinda, Y. A., Muthomi, J. W., Kimani, J. M., Cheminigw'wa, G. N., & Olubayo, F. M. (2021). Viability and dormancy of rice seeds after storage and pre-treatment with dry heat and chemical agents. *(Lengkapi nama jurnal, volume, dan halaman — data belum lengkap)*.

Reed, R. C., Bradford, K. J., & Khanday, I. (2022). Seed germination

and vigor: Ensuring crop sustainability in a changing climate. *Heredity*, *128*(6), 450–459.

Shiratsuchi, H., Ohdaira, Y., Yamaguchi, H., & Fukuda, A. (2017). Breaking the dormancy of rice seeds with various dormancy levels using steam and high temperature treatments in a steam nursery cabinet. *Plant Production Science*, *20*(2), 183–192.

Sohn, S. I., Pandian, S., Kumar, T. S., Zoclanclounon, Y. A. B., Muthuramalingam, P., Shilpha, J., ... & Ramesh, M. (2021). Seed dormancy and pre-harvest sprouting in rice—An updated overview. *International Journal of Molecular Sciences*, *22*(21), 11804.

Sutariati, G. A. K., Arif, N., & Rakian, T. C. (2017). Persistency and seed breaking dormancy on local upland rice of Southeast Sulawesi, Indonesia. *Pakistan Journal of Biological Sciences*, *20*(11), 563–570.

Tuan, P. A., Kumar, R., Rehal, P. K., Toora, P. K., & Ayele, B. T. (2018). Molecular mechanisms underlying abscisic acid/gibberellin balance in the control of seed dormancy and germination in cereals. *Frontiers in Plant Science*, *9*, 668.