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Article

Germination Pattern and Quality Resilience of West Bangka Local Rice Seeds During Storage in Various Media

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ABSTRACT

Local rice seeds from Bangka have great potential for food security. Seeds stored in the wrong place can experience a decrease in quality. This study aims to assess the germination pattern and quality resilience of local Bangka rice seeds under different storage methods. The research was conducted from February to September 2024 at the Seed Laboratory and Plant Breeding, Bangka Belitung University. The study used a completely randomized design (CRD) with a split plot pattern. The first factor consists of six accessions of local rice from Bangka (Mukot, Jawa, Ungu, Pulut Hitam, Balok Merah, and Mayang Hutan). The second factor comprises seven storage methods (cans, 40-micron plastic, 120-micron plastic, plastic bags, plastic containers, nursery trays, and panicles). This study shows significant differences in the germination patterns of local Bangka rice seeds stored in various media for 0, 2, 4, and 6 months. The Jawa access had the highest germination rate (78.8%) with an optimal storage time of 4 months, while storing seeds using panicles gave the best results (82.3%) compared to other media. The Balok Merah access excelled in maintaining seed quality. The local Bangka rice access, namely Jawa and Balok Merah, stored using the panicle storage method, can be applied by farmers and the community to maintain seed quality.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the main commodities in Indonesia's agricultural sector that has an important role in providing food for the community (Ningrat et al., 2021). Bangka local rice is a rice that comes from Bangka Belitung Province. local rice is a type of rice that has excellent genetic potential in terms of resistance to pests and diseases and in adaptability to various environmental conditions (Mustikarini et al., 2020). Bangka local rice has important value in the context of conservation and management of genetic resources as well as increasing food security in Indonesia.

Local rice is considered as part of the genetic wealth that is important to be maintained and developed to improve food security and preserve agricultural biodiversity (Suhardi et al., 2013). The quality of Bangka local rice seeds that is maintained and continues to develop can contribute to the agricultural sector and the regional economy (Sukmawati et al., 2019). The genetic diversity of local rice also provides great benefits in dealing with climate change and changing environmental conditions.

The improvement of local rice accessions needs to be continuously developed to increase the diversity of existing accessions, thus producing quality seeds (Limbongan & Djufry 2015). The challenges in maintaining the quality of local rice seeds from Bangka vary greatly, especially in storage. Inappropriate storage methods can lead to physiological deterioration of the seeds, which ultimately results in a decline in germination ability (Yuniarti et al., 2013). Several factors affecting seed deterioration include humidity, temperature (Pramono et al., 2019), and storage duration (Triani 2021).

Rice seed storage is an important step in ensuring the continuity of rice production in the future. One of the challenges faced in seed storage is maintaining seed quality, such as germination, viability, and vigor, especially in long-term storage (Prantiono et al., 2021). Improper seed storage can result in rapid deterioration of quality and have an impact on agricultural productivity. Sari & Faisal (2017), The use of inappropriate storage media can contribute to the decline in quality. Rice seeds stored in open rooms can deteriorate due to fluctuations in temperature and humidity. Seeds stored in less than ideal conditions tend to experience a decrease in germination, although in general local rice seeds have good resistance (Roberts, 2000). This characteristic is not only related to the durability of plants when growing, but can also affect the quality of stored seeds, because seeds from healthy plants tend to have better quality (Sukmawati et al., 2019).

Therefore, it is important to choose the right storage medium to maintain the quality of rice seeds for a longer time. Maharani et al. (2020), storage at low temperatures (e.g. -5°C) can extend the shelf life of seeds and maintain quality. Rice seed storage can be done with various media, such as panicles, nursery tubs, plastics, cans, sacks, and jars. Each storage medium has different characteristics, which can affect humidity and temperature during storage. Storage variations affect the germination process, as smaller seeds may require more careful care in terms of humidity and temperature to maintain their germination power (Jamil et al., 2007). This condition requires a good germination pattern.

Seed germination patterns are an important process in the plant life cycle, involving a variety of internal and external factors that affect the ability of seeds to grow into new plants. Sprout growth involves the division and enlargement of cells at the point of growth, which is characterized by the appearance of radicle (roots) and plumula (leaves) from seeds (Megasari et al., 2022). The initial process by which the seeds absorb water, which is necessary to start metabolism. The moisture content in the seeds usually increases from about 10-13% to reach 30% or more during imbibement (Undang et al., 2022).

Local rice seeds stored in inappropriate conditions, for example with high humidity levels or large temperature fluctuations, can lose their viability faster than seeds stored in the right way. Ellis et al. (2010), as well as air circulation, which in turn will affect the quality of the seeds. In addition, the duration of storage is also an important factor that affects the quality durability of seeds. In the storage of local rice seeds in Bangka. Suparto et al. (2021), the results of the study showed that the germination power of rice seeds decreased with increasing storage time. Marini & Mustikarini (2024), the storage time of 2 month shows that the storage method with panicles has a higher moisture content than storage without panicles in local rice in Bangka accession to Mayang Hutan. The study of the influence of various storage media on germination patterns and the durability of seed quality during several months of storage is important to discuss.

This study aims to evaluate the germination patterns and quality resistance of local Bangka rice seeds stored in various media, namely panicles, seedbeds, 40-micron plastic, 120-micron plastic, cans, sacks, and bottles, for 0, 2, 4, and 6 months. Previous research indicated that storing seeds with panicles still showed good vigor and viability in several accessions of local rice from West Bangka District for 8 weeks, especially the Balok Merah accession. The results of this study are expected to provide recommendations on the most effective storage media to maintain long term seed quality, thereby supporting the sustainability of production and distribution of high-quality local Bangka rice seeds.

MATERIALS AND METHODS

The research period is February - September 2024. The research location is at the Seed and Plant Nursery Laboratory, Bangka Belitung University. This study uses a completely randomized design (CRD) in a split-plot arrangement. The first factor consists of 6 local rice accessions from Bangka (Mukot, Jawa, Ungu, Pulut Hitam, Balok Merah, and Mayang Hutan). The second factor consists of 7 storage media (cans, 40-micron plastic, 120-micron plastic, plastic sacks, plastic containers, seed trays, and with panicles). Repeated 4 times. The tools used in this study are tweezers, label paper, clear plastic with a thickness of 40 and 120 microns, cans, plastic jars, plastic sacks, analytical scales, seedling tubs, germinators, sprayers, ovens, thermogrometers, cellphone cameras, duct tape and stationery. The materials used are 6 accessions of Bangka local gogo rice consisting of Mukot, Jawa, Ungu, Pulut Hitam, Balok Merah, and Mayang Hutan. Other materials consist of alcoholic water, rubber, merang paper and mica plastic. The research procedure starts from initial observation, seed storage, temperature and humidity observation and ends with germination test.

Observed characters

1. Maximum Growth Potential (MGP) (%)
   MGP (%) = $\frac{\Sigma \text{ germinated seeds}}{\Sigma \text{ seed sample totol}}$ X 100%
2. Germination Power (GP) (%)
   GP (%) = $\frac{\Sigma\, KN\ Count\ I + \Sigma\, KN\ Count\ II}{\Sigma \text{ seed sample totol}}$ X 100%
   notes: KN is Normal sprout
3. Germination Rate (days)
   Germination Rate = $\frac{N1T1+N2T2+\cdots+NxTx}{seed\ sample\ totol}$
   notes:
   N is Number of seeds germinated
   T is The amount of time between the initial test and the final test at a given interval of a observation (N1T1 to N7T7)
4. Seed Water Content (%)
   Seed Water Content = $\frac{Wi-wf}{Wi}\ x\ 100\%$
   notes: Wi is Initial weight (g)
   Wf is Final weight (g)
5. Vigor Index (%)
   Vigor Index = $\frac{\Sigma \text{normal germinated seeds first count}}{\Sigma \text{ seed sample totol}}$ x 100%
6. Evenness Growing (%)
   Evenness Growing = $\frac{\Sigma\, KN \text{ day 6}}{\Sigma \text{ seed sample totol}}$ x 100%
   notes: KN is Normal sprout
7. Weight Measurement of normal sprout dry weight is done 7 HSS.

This measurement was carried out by weighing the dry weight of normal sprouts without grain after being in the oven at 60^{o}C for 3 x 24 hours (ISTA, 2010). The dry weight of normal sprouts that have been in the oven is weighed using an analytical scale. Normal Sprout Drying (g).

Data Analysis

The data analysis in this study used the F test (Fisher Test) at 95% and 99% confidence levels (Buhaira et al., 2014) and continued with Duncan's Multiple Range Test (DMRT) with 95% and 99% confidence levels to obtain the best treatment of all treatments. Testing was conducted using the DSAASTAT program.

RESULTS AND DISCUSSION

The germination test on six accessions of local Bangka rice seeds using seven storage methods showed varying results. The results obtained provide an overview of the effectiveness of each accession and storage method in maintaining seed quality, which is expected to contribute to the development of optimal storage techniques for local Bangka rice seeds (Table 1). Table 1 shows a significant influence of accession and storage media on test characters. The F calculated value in the table indicates maximum potential growth characteristics and germination power, showing a very significant effect. The research indicates that accession and storage methods affect seed quality, depending on the duration of storage. Initial storage indicates that accession affects genetic characteristics that support uniform germination and growth. Zhou et al. (2020)

mention that seed longevity is determined by intrinsic genetic factors and extrinsic storage conditions. Hussain et al. (2018) state that the selection of accessions can affect the adaptability and productivity of plants.

Rice seed germination is the first stage in the life cycle of rice plants that determines the success of rice cultivation as a whole. Germination involves a series of physiological and biochemical changes in the seed that allow the growth of young plants. These stages consist of imbibation (water absorption), enzyme activation, root formation, and cotyledon (first leaf) growth thus forming the germination pattern of the plant.

Accession has a very real effect on the character of germination power at the shelf life of 0, 2, 4, and 6 months. The data on the germination pattern of rice seeds in each accession showed that Jawa accession had better germination power compared to other accessions in all shelf life. Storage media has a very real effect on the germination power character at all shelf life. The data on the germination patterns of rice seeds in each storage method showed that the storage medium with panicles provided the best germination yield with consistent germination stability at all storage ages.

Table 1. Analysis of variance on the effects of accessions and storage methods.

Character	Storage Time	Accessions		Storage Method		CV (%)
		F-Hit	Pr>F	F-Hit	Pr>F	
Maximum Growth Potential (%)	0	2.83	0.04*	42.08	4.22**	2.62
	2	15.50	5.60**	3.13	0.00**	5.69
	4	29.71	4.25**	8.66	1.05**	4.46
	6	13.92	1.18**	15.81	5.68**	5.54
Germination Power (%)	0	5.39	0.00**	41.65	4.51**	11.03
	2	3.36	0.25*	3.61	0.00**	16.58
	4	13.96	1.15**	18.09	1.94**	0.43
	6	5.67	0.00**	4.67	0.00**	14.70
Germination Rate (days)	0	3.84	0.01*	1.00	0.33tn	0.35
	2	1.92	0.13tn	5.94	2.12**	12.88
	4	0.96	0.46tn	1.15	0.33tn	32.15
	6	1.17	0.35tn	0.99	0.43tn	42.36
Moisture Content (%)	0	1.77	0.25tn	1.42	2.27tn	19.81
	2	1.18	0.41tn	10.75	7.76**	34.70
	4	0.14	0.97tn	3.95	0.00**	24.94
	6	2.75	0.12tn	1.42	0.23tn	30.79
Vigor Index (%)	0	5.98	0.00**	1.20	0.28tn	24.71
	2	3.01	0.03*	2.79	0.01**	19.02
	4	3.97	0.01*	8.73	9.41**	24.41
	6	5.57	0.00**	3.14	0.00**	17.52
Evenness Growing (%)	0	8.32	0.00**	13.38	0.00**	35.31
	2	7.68	0.00**	4.98	0.00**	17.85
	4	8.14	0.00**	9.82	1.25**	13.50
	6	5.01	0.00**	3.61	0.00**	15.62
Normal Sprout Dry Weight (g)	0	1.47	0.28tn	22.63	0.00**	7.60
	2	15.42	5.79**	11.11	1.24**	19.77
	4	29.59	4.39**	23.64	1.08**	17.22
	6	3.92	0.01*	5.13	0.00**	28.80

Note: Pr>F = Probability value, ** = has a very significant effect, * = has a significant effect, tn = has no significant effect, CV = coefficient of variation

Germination Pattern of Bangka Local Rice Accession in Various Storage Media

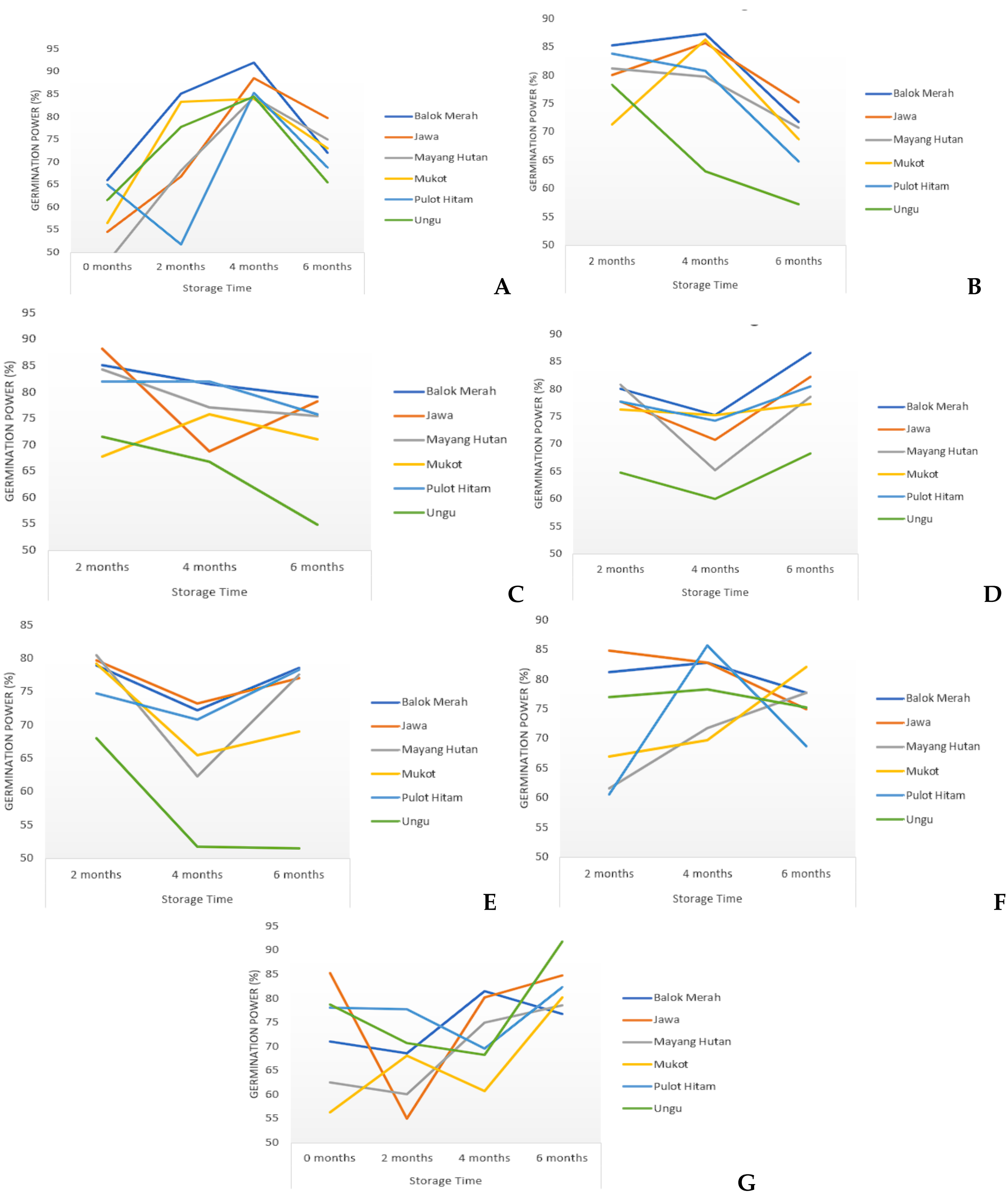

Figure 1. Germination pattern of Bangka local rice accession in various storage media (A=seedling tubes, B=40-micron plastic, C=120-micron plastic, D=plastic sacks, E=cans, F=plastic jars, G=burlap sacks).

The observation results showed that rice seeds with a shelf life of 0, 2, 4 and 6 months had begun to germinate on the 3rd day after sowing. The percentage of seed germination power is 43.7% - 86.4%. The percentage of germination power is relatively low when compared to the literature on the general percentage of rice seed germination which reaches 90% (Figure 1).

Rahayu (2011), rice seeds stored in airtight cans for 7 months have stable germination power with seeds infected with fungi quite low. Sari (2017), the quality of rice seeds is better maintained stored in aluminum foil and ethylene plastic packaging compared to plastic sacks and burlap sacks. The use of burlap sacks and plastic causes rapid deterioration in the quality of rice seeds, so that the viability and vigor of the seeds decreases.

The storage room temperature during the study was an average of 28°C. Ochandio et al. (2017) stated that the storage temperature of seeds affects the respiration rate. Wang et al. (2022), in their research, mentioned about temperature stress on rice seeds stating that optimal temperature conditions (28-30°C) are very important for activating enzymes in the seeds. Too low or too high temperatures can disrupt metabolism and slow down or even halt the germination process. Ali et al. (2022) mentioned that the optimal moisture for germination of rice seeds is between 65-85%.

Optimization of environmental conditions, including stable temperature and humidity, can increase the success rate of rice seed germination, especially in areas exposed to climate change (Ali & Khan 2021). In agreement with Indartano (2011), storage temperature affects seed viability. Excessively high temperatures can damage the protein structure in seeds, while low temperatures can slow down the metabolic rate and hinder the imbibition process. Optimal storage conditions, such as low temperatures and controlled environmental humidity, can affect the growth rate and increase the dry weight of the sprouts. According to Copeland and McDonald (2001), the right temperature and humidity can maintain the viability of the seeds well.

Table 2. Average characters on accession treatment during storage

Character	Storage Time (months)	Accession					
		Balok Merah	Jawa	Mayang Hutan	Mukot	Pulut Hitam	Ungu
Maximum Growth Potential (%)	0	95.12a	94.37b	89.62f	90.75e	92.12d	92.49c
	2	96.75a	93.32e	93.71c	87.75f	94.14b	88.92e
	4	94.50a	94.00b	90.60c	87.89e	90.35d	85.42f
	6	91.25a	91.07a	89.25b	87.28d	87.64c	81.71e
Germination Rate (days)	0	3.20ab	3.14b	3.24ab	2.92c	3.33a	3.09b
	2	3.12a	3.25a	3.36a	3.32a	3.24a	3.47a
	4	3.59a	3.58a	5.20a	3.52a	3.50a	3.63a
	6	3.55a	3.42a	4.93a	3.51a	3.53a	3.58a
Moisture Content (%)	0	14.02a	14.50a	12.97a	12.15a	11.52a	11.05a
	2	11.92a	14.66a	15.80a	12.11a	15.0a	12.01a
	4	13.17a	12.00a	12.42a	12.46a	12.32a	12.60a
	6	12.83a	13.16a	13.57a	11.78a	13.64a	16.07a
Vigor Index (%)	0	4.12d	3.50d	7.12c	7.75c	12.12a	8.87b
	2	73.64a	69.46b	67.78c	64.39e	67.31d	67.28d
	4	58.96c	64.32a	54.17e	53.07f	60.07b	55.39d
	6	72.57a	72.03b	69.28c	67.21d	69.46c	62.07e
Evenness Growing (%)	0	28.62c	26.37d	19.75e	28.62c	51.12a	34.5b
	2	78.67a	74.32b	72.32c	68.53f	70.64d	70.21f
	4	75.78a	75.21b	70.28d	69.07e	74.32c	63.42f
	6	75.85b	76.39a	72.64c	72.39c	72.03d	64.67e
Normal Sprout Dry Weight (g)	0	0.33a	0.32a	0.18a	0.21a	0.30a	0.28a
	2	0.60a	0.54b	0.47cd	0.42e	0.48c	0.45d
	4	0.57a	0.41d	0.44c	0.36e	0.50b	0.40d
	6	0.43a	0.41ab	0.41ab	0.34d	0.40bc	0.38c

Notes: Numbers followed by the same letter on the same line show no real difference based on the DMRT test of 95% and 99% confidence level.

Quality Resilience of Bangka Local Rice Harvest Seeds at Various Ages and Storage Media

The average character showed that the accession of Pulut hitam Rice was more than other accessions in the germination rate, vigor index and growth rate at 0 months. The Balok Merah accession showed better results than other accessions in the characteristics of maximum growth potential, vigor index and growth capacity at a shelf life of 2 months. The accession of Pulut Hitam showed better results than other accessions in the characteristics of maximum growth potential, growth deprivation, and dry weight of normal sprouts at a shelf life of 4 months. The accession of Pulut Hitam is better than other accessions in the characteristics of maximum growth potential, vigor index and dry weight of normal sprouts at a shelf life of 6 months. The average data of Bangka local rice accession treatment to the storage method during 0, 2, 4 and 6 months storage is presented in Table 2.

The results of further test analysis showed that the storage medium with panicles was better than the storage medium without panicles (seedling tub) on the characteristics of maximum growth potential, growth synchronicity, growth speed and dry weight of normal sprouts at a shelf life of 0 months. The storage medium with plastic 120-micron is better than other storage media against the vigor index character, growth simultaneity and dry weight of normal sprouts at a shelf life of 2 months. Storage media with seedling tubs (without panicles) is better than other storage media in terms of characteristics of maximum growth potential, vigor index, growth simultaneity and normal sprout dry weight at a shelf life of 4 months. The storage medium with plastic 120-micron is better than other storage media against the characteristics of maximum growth potential, growth speed and dry weight of normal sprouts at a shelf life of 6 months. The average data on the treatment of Bangka local rice accession during 0-month storage is presented in the figure. 8 and a shelf life of 2, 4 and 6 months are presented in Figure 2 and Table 3.

The results of the Duncan's Multiple Range Test (DMRT) at 99% level showed that storage with panicles produced a higher average germination power value after being stored for six months with a germination power of 82.35%. The way seeds are stored varies greatly depending on various factors such as the type and number of seeds, packaging techniques, storage duration, and temperature and humidity conditions of the storage room. The success of seed storage is highly dependent on the ability of the packaging to maintain the moisture content and viability of the seeds during the storage period.

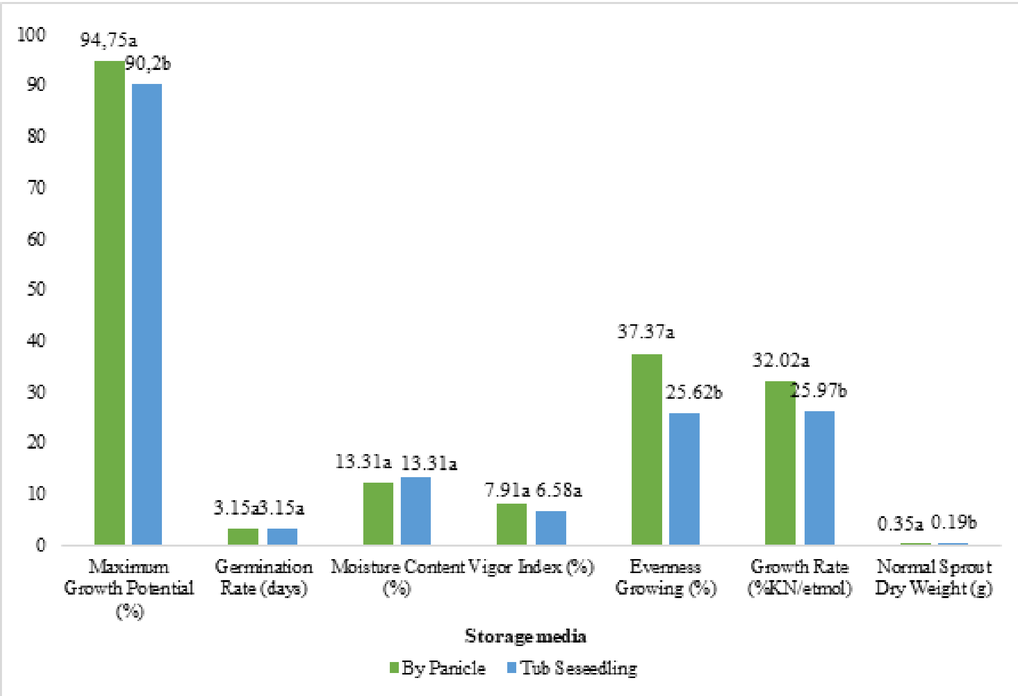

Figure 2. Average character in the treatment of storage media with panicles and seedling tubs

Table 3. Average characters on the storage media treatment during storage

Character	Storage Time (months)	Storage Media						
		Panicle	Cans	Plastic Sacks	120 Micron Plastic	40 Micron Plastic	Seedling Tubc	Plastic Jars
Maximum Growth Potential (%)	2	90.20e	93.79b	93.12c	89.79f	91.62d	93.91b	94.58a
	4	89.54e	86.45f	90.54d	91.45b	91.00c	94.54a	89.70e
	6	94.37a	86.79d	89.83b	83.91e	82.66f	89.25c	89.41c
Germination Rate (days)	2	3.00a	3.58a	3.31a	3.49a	3.41a	3.07a	3.29a
	4	4.01a	4.00a	4.27a	3.81a	3.70a	3.49a	3.59a
	6	3.49a	3.44a	4.06a	3.75a	3.55a	3.67a	4.32a
Moisture Content (%)	2	23.37a	12.38c	12.05c	114.61b	10.03e	10.91d	12.38c
	4	11.79c	11.25d	14.08b	13.83b	14.79a	11.95c	9.79e
	6	12.72a	12.25a	14.97a	16.02a	12.41a	12.88a	13.25a
Vigor Index (%)	2	60.79g	70.16c	69.33d	73.37a	72.50b	67.33e	64.70f
	4	57.45c	50.29f	51.87f	59.29b	59.16b	75.5a	52.41d
	6	72.87b	67.08d	73.33a	67.54c	65.16e	62.37f	73.04ab
Evenness Growing (%)	2	61.16f	75.54b	74.16c	78.04a	77.70a	70.00e	70.54d
	4	69.25e	63.12g	65.83f	72.00d	74.41b	82.00a	72.83b
	6	79.62a	68.83f	75.87b	70.62d	67.50g	69.62e	74.25c
Growth Rate (%KN/etmol)	2	2.93a	3.35a	3.43a	3.39a	3.72a	2.375a	3.64a
	4	7.54e	7.83d	9.12c	8.00d	10.64b	5.49f	13.10a
	6	4.75b	2.43d	2.77c	2.41d	1.45e	4.97a	1.52e
Normal Sprout Dry Weight (g)	2	0.37d	0.55a	0.48b	0.53a	0.55a	0.45c	0.53a
	4	0.41c	0.36d	0.34d	0.48b	0.54a	0.52a	0.47b
	6	0.47a	0.34c	0.42b	0.36c	0.39b	0.46a	0.35c

Notes: Numbers followed by the same letter on the same line show no real difference based on the DMRT test of 95% and 99% confidence level.

Purba et al. (2013), seed storage packaging has a real effect on seed moisture content, growth potential and germination percentage. Genotype differences are factors from within that affect seed characteristics, including the level of seed dormancy (Hasbianto &Tresniawa, 2013).Table 3 shows that storage media significantly affects growth characteristics. Storage media with flower pots and cans provide the best results in terms of maximum growth potential and germination capacity. Seed germination capacity and the dry weight of normal seedlings become benchmarks for seed viability (Widajati et al. 2013). In contrast, storage media such as 40-micron plastic and sacks show lower results, especially after longer storage periods. Bradford et al. (2020) mentioned that conventional seed packaging materials including polypropylene, jute, and porous fabric bags are ineffective in preventing seeds from moisture absorption and damage. This underscores the importance of choosing appropriate methods to maintain seed quality during storage. In agreement with Wang et al. (2019), good storage media can maintain moisture and prevent mechanical damage to seeds.

Rahayu (2011), revealed that airtight storage containers can maintain the germination power of rice seeds for up to 70 days, while open containers cause quality degradation due to temperature and humidity fluctuations. Dewi (2015), added that a good storage container can inhibit the decline in seed quality. Proper storage of rice seeds is essential to maintain seed quality and viability. Research on Bangka local rice seed storage methods, such as Mayang Hutan, Pulut Hitam, Balok Merah, Mukot, Ungu, and Jawa, shows that the storage method with panicles tends to give better results. This is due to the additional physical protection provided by panicles, which helps to keep the moisture around the grains low and controlled.

Storage with controlled humidity is an important factor in maintaining the viability of seeds during long-term storage (Bewley and Black 1994). Research shows that too high humidity can cause mold growth and a significant decrease in seed quality. Storage with panicles allows for a delay in the threshing process until the seeds are completely dry, which reduces the risk of physical damage and loss of seed quality. Seeds that are well drained before storage have a lower moisture level, which helps in maintaining the viability of the seeds. In research on panicles, it can help reduce cracks in rice grains which can affect the ability of seeds to germinate properly (Ellis et al.,1985).

Seed quality greatly affects seed growth and vigor (Ningsih et al., 2018). According to Singh et al. (2015), the purpose of conducting a germination power test is to determine the level of likelihood of seeds capable of germinating from a group or unit of seed weight. The maximum growth potential is the percentage of all seeds that are alive or showing living symptoms, both norrmal and abnormal sprouts. Lesilolo & Moriolkossu (2014), stated that the speed of seed growth depends on the energy utilized by each seed which is the result of overhauling the food reserves contained in the endosperm.

Sadjad et al. (1999), seed growth speed is a benchmark component of seed growth strength, in strong seeds will grow faster with good appearance even in diverse environments. The seed growth rate is the ability of the seed to carry out normal germination in a short time (%/day). Sadjad et al. (1999), the germination ability of a seed is related to the amount of food reserves it contains. Prawinata et al. (1992), who explained that seeds that have high vigor are able to produce high dry weight of normal sprouts under optimal and sub-optimal conditions. Elba et al. (2015), which states that the dry weight of normal sprouts with high yields illustrates the efficient utilization of food reserves in seeds. Ilyas (2012), research, the high dry weight of normal sprouts indicates that the seeds carry out an effective metabolic process, so that they are able to grow into strong normal sprouts with a complete structure, so that they have a larger sprout size and a higher dry weight.

Ali et al. (2021), the optimum humidity for rice seed germination is between 65-85 the optimum temperature (28-30°C) is essential to activate the enzyme. Temperatures that are too low or high can disrupt metabolism and slow down or even stop the germination process. Gupta & Ghosh (2019), hydropriming or soaking seeds in water before sowing can improve germination by accelerating the emergence of roots and cotyledons. Mohanty & Pradhan (2020), techniques such as seed priming can increase germination and accelerate this transition, even in unfavorable environmental conditions. Tanaka & Uchino (2024), emphasized that seeds that are well stored and do not suffer mechanical damage will have better germination potential. Wang et al. (2022), also revealed that extreme temperatures, either too high or too low, can inhibit the germination process.

CONCLUSION

This study shows significant differences in the germination patterns of local Bangka rice seeds stored in various media for 0, 2, 4, and 6 months. The Jawa access had the highest germination rate (78.8%) with an optimal storage time of 4 months, while storing seeds using panicles gave the best results (82.3%) compared to other media. The Balok Merah access excelled in maintaining seed quality. The local Bangka rice access, namely Jawa and Balok Merah, stored using the panicle storage method, can be applied by farmers and the community to maintain seed quality.

AUTHORS CONTRIBUTIONS

The first author is responsible for research planning and design, data collection, and analysis of results. The first author also wrote most of the chapters in this paper. The second and third authors contributed as supervisors and provided direction and guidance throughout the research process until the formation of this work. All authors collaborate on the final revision to ensure the suitability and overall quality of this scientific work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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