Akta Agrosia, 2024, 27(1):14-18
https://ejournal.unib.ac.id/Agrosia

Akta Agrosia

# Viability and Vigor Test of Local Rice Seeds in Kuantan Singingi

**Gusti Marlina[1,2], Auzar Syarif[1], Gustian[1], Yusniwati[1]***
[1]Agricultural Science Study Program, Faculty of Agriculture, Andalas University, Padang, Indonesia.
[2]Agrotechnology Study Program, Universitas Islam Kuantan Singingi, Kuantan Singingi, Indonesia

Doi: 10.31186/aa.27.1.14-18

**ARTICLE INFO (10 pt)**

*Keywords:*
Kuantan Singingi,
local seeds,
viability,
vigor

*Article history*:
Received: Apr 25, 2024
Accepted: Jun 22, 2024

*Corresponding author:
Email: yusniwati@agr.unand.ac.id

## ABSTRACT

Seeds are a valuable plant material for agriculture. The Kuantan Singingi district has many local rice seeds that can be developed, but these have not yet passed standard testing. This study aimed to determine the physical and physiological qualities of the seeds of two local rice genotypes in Kuantan Singingi Regency. This research was conducted in a completely randomized design (CRD), which was repeated four times. The factor tested consisted of two rice genotypes: the white and yellow genotypes. The parameters observed were the percentage of the First Count Test (FCT) of germination capacity (GP), Maximum Growth Potential (MGP), Root and Shoot Growth Test (RSGT), and Seedling Growth Rate Test (SGRT). The collected data were analyzed by ANOVA at the 5% level and further tested by the LSD test. The results showed that FCT (%), GP (%), and Vigor (%) provide high figures according to SNI. Meanwhile, the IVT of all seeds on day 2 germinated. Based on the data from the RSGT and SGRT, all seed growth was normal.

## INTRODUCTION

Seeds are a critical component of agriculture, particularly in rice production. Increasing production is closely related to the quality of the seeds used. Good-quality rice seeds, both physically and physiologically, are essential, as indicated by successful test results. In addition, the genetic purity of seeds is crucial for maximizing plant production.

Seeds, defined as seeds or other plant parts used for agricultural purposes and development, serve an essential agronomic function (Asril et al., 2023). Generally, rice seeds in Kuantan Singingi Regency possess good genetic and physical qualities. However, they often fail to grow well physiologically due to unsupportive factors. Hence, testing is crucial for obtaining physiologically high-quality seeds.

Good physiological quality of seeds is a reflection of viability values (such as germination capacity) and vigor values (such as growth speed, growth simultaneity, and storability). Viability is a measure that shows that seeds contain structures and substances, including enzyme systems, that provide the ability to germinate under suitable conditions, whereas vigor is the condition of the seed that determines its potential to grow quickly, uniformly, and normally under various field conditions. (Wahyuni et al., 2021).

ISSN: 1410-3354 / e-ISSN:2615-7136

*Cited this as*: Gusti Marlina, Auzar Syarif, Gustian, Yusniwati. 2024. Viability and Vigor Test of Local Rice Seeds in Kuantan Singingi. Akta Agrosia 27(1):14–18 Doi: 10.31186/aa.27.1.14-18

One of the major problems in Kuantan Singingi Regency is the use of only existing harvest seeds. Basically, seeds are initially scattered seeds that are planted and then harvested. Then, the harvest is what is used as reseed, but has the potential to be developed (Marlina et al., 2023). So some farmers scream when sowing because many seeds don't grow. According to the Directorate General of Food Crops Agriculture (1991), the SNI value determined for the quality of seeds in labeled packaging is 70%–80%, including rice seeds.

Based on this problem, germination testing is required. The aim of the Germination/ Growth Power test is to determine the maximum germination potential of a seed lot, which can then be used to compare the quality of seeds from different lots and estimate the value of planting in the field. Meanwhile, the minimum standard for Germination/Growing Power is 80%, and the maximum standard for Germination/Growing Power is 100%. Seed germination involves the emergence and development of important structures in the embryo, which facilitates the development of a plant.

The aim of this research was to determine the germination capacity of seeds under optimal and suboptimal conditions for several local rice genotypes in Kuantan Singingi Regency.

## MATERIALS AND METHODS

The research was carried out at the Seed Technology Laboratory, Agrotechnology Study Program, Department of Agricultural Cultivation, Faculty of Agriculture, Andalas University, in June 2023. Plant materials included two rice seed genotypes from Kuantan Singingi Regency: the white singgam (SP) and yellow rice genotype (KUP). Germination materials were stencil paper, sterile soil, and clean water. The tools used are flat germinators and inclined germinators, and seedbeds. The research was designed using a completely randomized design (CRD) and repeated four times. The factor tested consists of two rice genotypes: the White Singgam genotype (SP) and the long-lived yellow rice genotype (KUP). The parameters observed were Maximum Growth Potential (MGP), Root and Shoot Growth Test (RSGT), and Seedling Growth Rate Test (SGRT). Data analysis was performed by analysis of variance (ANOVA) at the 5% level and further tests by the least significant difference test at the 5% level.

Research materials for 200 rice seeds from each genotype were prepared. Stencil paper (measuring 21 cm by 30 cm), 7 kg of oven-ready soil, and a jumbo-sized seed bag were prepared in the laboratory. The seeds were arranged in 50 rows on stencil paper. Then, the papers were folded neatly, sprayed, and placed into a flat seed germinator. The plumule and radicle of sprouts were measured, and then stencil paper containing the seeds was inserted at an angle with the germinator. The seeds were then planted in soil media in a seedbed to measure growth rate and uniformity.

Percentage of First Count Test/FCT (%) observed on the 5th day after germination (Azmi et al., 2022). FCT was calculated using the following formula:

Germination Percentage (GP) (%) observed on the 5th and 14th days after germination.

$$FCT = \frac{\Sigma \text{ Seeds germinate normally.}}{\Sigma \text{ Germinated seeds}} \times 100\%$$

The percentage of germination powers was calculated using the following formula:

$$GP = \frac{\Sigma \text{ Seeds germinate normally.}}{\Sigma \text{ Germinated seeds}} \times 100\%$$

IVT Germination Speed (days) was observed one day after the seeds germinated until 14 days or until no more seeds germinated (Azmi et al., 2022). Radicle and plumular Growth (RSGT) (cm) was observed on the 14th day after germination. Seed vigor tests (%) were conducted on the 7th day using the criteria for strong, not strong, and dead sprouts. The seed vigor was calculated using the following formula:

Sprout Dry Weight (SGRT) (grams) was measured 5 days after germination. SGRT was

$$Vigor = \frac{\Sigma \text{ Seeds germinate .}}{\Sigma \text{ Germinated seeds}} \times 100\%$$

calculated from the initial weight and final weight of oven-dried sprouts.

## RESULTS AND DISCUSSION

### *Percentage of first count test*

The FCT (first count test) assesses the strength of seed growth, speed, and uniformity of seed germination. The highest percentage of FCT (92%) was found in the long-lived yellow rice genotype, whereas the highest percentage was found in the White Singgam genotype (88%) (Table 1). This occurs because the seeds used have different storage periods. The longer the seeds were stored, the less their germination capacity increased because the germination hormones were no longer able to stimulate germination. According to Ichsan (2006), the IR 64 variety tends to have better growth potential (74.66%) than other varieties. Azmi et al. (2022) also reported that treatment with 16 h of immersion resulted in 86.00% FCT. Similarly, Agustina et al. (2018) reported that treatment by soaking seeds with LMO (local microorganisms) from the roots of Putri Malu for 4, 8, 12, 16, 24, and 28 h resulted in non-significantly different FCT of 98.00 to 98.66%. The average value and the average number of germinated seeds were not significantly different between the treatment groups. However, the number of seeds that germinated was only 65.0%, which was significantly different from the control or without LMO (local microorganisms). Sari et. al. (2013) reported that coating treatment significantly influenced the germination capacity and vigor index. Based on benchmarks for germination, seeds stored without pods or coating still demonstrate high potential for viability.

Table 1. Percentage of FCT, Germination Power (%), and Vigor (%) of the two rice seed genotypes in the Kuantan Singingi District.

| Genotype Type | FCT (%) | GP (%) | Vigor (%) |
|---|---|---|---|
| White Sigam | 88.00 | 89.00 | 10.00 |
| Yellow rice | 92.00 | 92.50 | 6.00 |

Notes: Percentage of FCT=first count tests, GP=Germination Power

### *Germination Percentage*

Data on the germination capacity of the seeds of several types of local rice from Kuantan Singingi Regency are presented in Table 1. The long-term yellow rice genotype showed high germination rate (92.50%, while the germination capacity for the White Sigam genotype was 89.00%. The germination capacity of local rice in Kuantan Singingi was thought to be due to differences in storage time. The longer the seeds are stored, the germination capacity decreases. In addition, the container where a seed is stored can also affect seed germination. Timotiwu et al. (2022) explained the differences between new and old soybean seeds in terms of the percentage of radicle emergence on the first day, percentage of normal sprouts, germination speed, and vigor index.

Other opinions also say (Tefa, 2017) that high water content reduces the viability and vigor of rice seeds during storage. In addition, Ichsan (2006) also believes that growth potential and germination tend to increase through normal temperature treatments, reaching 70.40%. In addition, Ningsih et al. (2018) described that the seeds tested can germinate well (germination capacity above the SNI's standard).

### *Seed Vigor*

Data from the rice seed vigor test showed that the local Kuantan Singingi genotype had the best vigor for the White sigma genotype (10.00%, while for the Long-lived yellow rice genotype, it was only 6.00%. Good seeds usually have high vigor and high germination rates, but seeds that germinate well do not necessarily have high vigor.

According to Azmi et al. (2022), the seed germination process can be stimulated by treatment with specific substances before the germination process. The provided stimulation can increase the rates of imbibition, respiration, and metabolism during the germination process. In line with this view, Sativa et al. (2022) reported that treatment with NaCl had a real effect, especially at high concentrations. If the concentration of salt applied could stimulate the germination speed, length of sprout roots, and coleoptile length of rice sprouts (Mustika et al., 2022).

### *IVT Germination Rate*

The second observation showed that the highest index value was found for the White Sigam genotype at 24,00, while the Long-life yellow rice genotype was able to grow only 20,00 seeds. On the third day, the highest index was found for the long-lived yellow rice genotype, which had 22.00 seeds, while the White Sigam genotype had 17.00 seeds. Then, on the fourth and fifth days, there was no difference in germination speed. These data show that local Kuantan Singingi rice seeds only need 4 days to germinate (Table 2). According to Suryandari and Ratnasari (2019), if the seeds germinate well and do not take long, then they have clear purity. According to Nasihin et al. (2015), identification of seed purity was carried out for selected F3 generations, and the results illustrated that by observing the DNA band patterns in F3 generations and comparing them to the parents, they contributed the expected characteristics.

***Radicle and Plumule Growth (RSGT)***

The average growth of the radicle and sprout plumule of local Kuantan Singingi rice seeds were provided in Table 3. The ANOVA revealed significant differences in radicular and plumule growth. The Long-lived yellow rice genotype has a radicle growth of 44.75 cm, which is significantly different from the growth of the White sigma genotype, which has a radicle length of 45.80 cm. The plumule lengths of the two genotypes also differed significantly. In the Yellow rice genotype, the plumule length is 28.55 cm, whereas that in the white Sigam genotype is 30.63 cm long. It is suspected that both genotypes have seeds capable of germinating normally. Sativa et. al. (2022) explained that the process of seed germination is normal when the growth of the radicle is longer than that of the plumule.

Normal germination proceeds through a series of germination attributes, such as potential roots and stems, at the right time (ISTA, 2024). Long root growth greatly influences the carbohydrate content and food reserves for the initial energy for root growth, and it is thus influenced by the environment, division, cell elongation, and tissue formation. Suryandari et al. (2019) reported that the higher the water content of seeds, the less resistant they are to storage for a long time.

Table 2. Germination Speed (Days)

| Genotype | Day 2 | Day 3 | Day 4 | Day 5 |
|---|---|---|---|---|
| White sigamous | 24a | 17b | 2a | 3a |
| Yellow Rice | 20b | 22b | 2a | 3a |
| D.C.= 0,47 | | | | |

Note: Numbers followed by the same letter in the same column are not significantly different according to LSD at α=5%

***Sprout Dry Weight (SGRT)***

Data on Table 3 show that the highest dry weight of sprouts the Long-lived yellow rice genotype is 0.06 g, while the White sigma genotype is 0.03 g. Decreased dry weight caused by small amounts of water stored in the seed. Water loss occurs quickly, so the germination metabolic process is disrupted during the germination process. Therefore, shortages of water during seed-sowing processes are not tolerated for germination.

In line with the research of Sativa et al. (2022), the highest loose dry weight of soybean sprouts was 2.85%. A decrease in water absorption during the germination phase due to salt stress will reduce the activity of various hydrolytic enzymes involved in the germination process, thereby reducing the speed and percentage of germination.

Table 3. Radicle and plumule growth (RSGT) (cm), SGRT (gram)

| Genotype | Radicle (cm) | Plumule (cm) | SGRT (g) |
|---|---|---|---|
| White Sigamous | 45.80a | 30.63a | 0.03 |
| Yellow rice | 44.75b | 28.55b | 0.06 |
| D.C.=0,04 | | | |

Note: Numbers followed by the same letter in the same column are not significantly different according to LSD at α=5%

## CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that testing the viability and vigor of local Kuantan Singingi rice seeds shows quite good figures for FCT percentage, germination percentage, germination speed, radicle, and plumule growth. In sprouts, test the seed vigor and dry weight of the sprouts. This research will continue at the gamma irradiation stage, where we will look for seeds that can withstand the various stresses.

## ACKNOWLEDGMENT

The author would like to thank the Seed Technology Laboratory, Agrotechnology Study Program, Department of Agricultural Cultivation, Faculty of Agriculture, Andalas University, for providing the author with the opportunity to conduct research during testing.

## REFERENCES

Agustina, T., and M. Syamsiah. 2018. Aplikasi lama perendaman benih dengan MOL (Mikroorganisme lokal) dari akar putri malu dalam memacu pertumbuhan bibit padi pandanwangi. Agroscience 8(1):1. https://doi.org/10.35194/agsci.v8i1.353

Asril, M., Z. Abidin, I. Arham, R. Megasari, R. Firgiyanto, A. Arifin, D. U. Zainidin, and T. AR. 2023. Teknologi dan produksi benih (Issue Februari).

Azmi, Y., A. Syaputra, and Febrianti. 2022. Uji viabilitas dan vigor benih padi (*Oryza sativa* L.) varietas karya pelalawan terhadap lama perendaman mikroorganisme lokal (MOL) pelepah kelapa sawit. Agropross: National Conference Proceedings of Agriculture 4:15–22. https://doi.org/10.25047/agropross.2022.266

Ichsan, C. N. 2006. Uji viabilitas dan vigor benih beberapa varietas padi (Oryza sativa L.) yang diproduksi pada temperatur yang berbeda selama kemasakan. J. Floratek 2 (1):37–42.

ISTA. 2024. International rules for seed testing. In Reglas Internacionales Vorschriften für die International Rules for Internationale Règles Internationales para Análisis de Semillas pour les Essais de Prüfung von Saatgut Seed Testing 2024: Vol. 12. ISTA. Zurich, Switzerland, p. 345.

Marlina, G., D. Andriani, M. Jayalaksamana, and A. Pramana. 2023. Potensi keragaman sumber daya genetik padi lokal di Kabupaten Kuantan Singingi, Provinsi Riau. Pangan 32(2):103–110.

Mustika, E. F., N. Nafisah, and R. A. Laksono. 2022. Toleransi galur-galur elit tanaman padi (*Oryza Sativa* L.) terhadap cekaman salin pada fase perkecambahan dan fase bibit. Jurnal AGROHITA 7(1):105–115. http://jurnal.um-tapsel.ac.id/index.php/agrohita/article/view/6828

Nasihin, S. R., W. H. Rizky, and N. Carsono. 2015. Pengujian kemurnian genetik benih padi galur F3 (Pandanwangi x PTB33) terseleksi menggunakan marka molekuler simple sequence repeats (SSR). Agrikultura 26(2):61–67. https://doi.org/10.24198/agrikultura.v26i2.8462

Ningsih, N. N. D. R., I. G. N. Raka, I. K. Siadi, and G. N. A. S. Wirya. 2018. Pengujian mutu benih beberapa jenis tanaman hortikultura yang beredar di Bali. E-Jurnal Agroekoteknologi Tropika 7(1):64–72.

Sari, M., E. Widajati, and P. R. Asih. 2013. Seed coating sebagai pengganti fungsi polong pada penyimpanan benih kacang tanah. Jurnal Agron Indonesia 41(3):215–220.

Sativa, N., Hamidah, J. Mutakin, A. Y. Rismayanti, and Noviyanti. 2022. Uji cekaman salinitas terhadap viabilitas dan vigor benih beberapa kultivar kedelai (*Glycine max* (L). Merril). JAGROS Journal of Agrotechnonogy and Science 7(1):39–50.

Suryandari, L., and E. Ratnasari. 2019. Studi analisis pengujian standar pada komoditi padi (*Oryza sativa* L) di UPT. PSBTPH Dinas Pertanian dan Ketahanan Pangan Jawa Timur. Prodising Seminar Nasional Biologi 1(Ip2b III):978–602.

Tefa, A. 2017. Uji viabilitas dan vigor benih padi (*Oryza sativa* L.) selama penyimpanan pada tingkat kadar air yang berbeda. Savana Cendana 2(03):48–50. https://doi.org/10.32938/sc.v2i03.210

Timotiwu, P. B., N. Nurmauli, and F. H. Khairunnisa. 2022. Studi mengenai viabilitas dan vigor benih kedelai baru dan lama. Jurnal Agrotek Tropika 10(4):541. https://doi.org/10.23960/jat.v10i4.6450

Wahyuni, A., M. M. Simarmata, P. L. I. Junairiah, T. Koryati, A. Zakia, S. N. Andini, D. Sulistyowati, Purwaningsih, Purwanti, S. Kurniasari, and J. Herawati. 2021. Teknologi dan produksi benih. In https://medium.com/@arifwicaksanaa/pengertian-use-case-a7e576e1b6bf