

Article

## Effect of Rapid Desiccation with Ethanol Immersion on Viability and Vigor of Some Rice Seeds (*Oryza sativa* L.)

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**Abstract:** The availability of quality seeds is important in crop cultivation, so quality seeds must be available when farmers need them. Quality seeds must be able to be stored for a long time. Rapid aging through soaking with 95% ethanol within 5 minutes, can predict the shelf life of seeds. Rice seeds that were treated with rapid soaking were Inpari 45 (V1), Sunggal (V2), Memberamo (V3) and Ciherang (V4) varieties. From the results of the analysis of variance, the observation parameters of Germination Power (DB), Maximum Growth Potential (PTM) and Keserempakan Tumbuh (KST) were significantly different (1%). Of the four varieties, after the seeds were soaked in 95% ethanol for 5 minutes DB, PTM and KST decreased very drastically. The order of varieties based on their seed viability and vigor levels, from high to low, are Inpari 45 (V1), Memberamo (V3) Sunggal (V2) and Ciherang (V4). Inpari 45 (V1) has the highest germination rate (DB) of 39%, while Ciherang (V4) has the lowest germination rate (DB) of 15.67%. These results suggest that the Inpari 45 (V1) variety can be stored longer than the other three varieties. Viability and vigor of seeds are not only controlled by environmental factors but also influenced by genetic factors.

**Keywords:** Rapid desiccation, rice varieties, seed viability and vigor

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### 1. Introduction

Rice is a very important crop for the Indonesian population, as it is the main source of food. To increase the productivity and quality of rice yields, it is necessary to provide quality seeds from superior varieties of rice plants. To fulfill the need for seeds, the seeds must be able to be stored for a long time. Seeds are miniature, small seeds are also beautiful, seeds of today's results, promises for tomorrow (Sadjad S. , 1993). Quality seed is pure seed of a variety that is the same size, 80% germination rate and above, free from weed seeds, diseases, pests and dirt, when germinated it will grow into strong seedlings (PALALO, 2020). Seed shelf life is the ability of seeds to maintain their viability during storage. Estimation of seed shelf-life can be estimated simulatively by rapid roasting (Fridayanti, 2014). Seeds that are stored will experience deterioration. Seeds with high

shelf-life vigor can maintain their viability well during storage. (Amalia Rosida, 2015).

Rapid desiccation is a method that can be used to obtain several levels of seed viability (Belo, 2012). (Sadjad S. , 1994) suggests a quick-roasting method using the chemical compound ethanol. Ethanol is one of the compounds produced by seeds during deterioration (AmanahA., 2016). Ethanol will increase during the imbibition process. The increase of ethanol in high vigor seeds is slower than the increase in low vigor seeds. (Woodstock, 1980). Ethanol charring takes less time (only a few minutes), and this method can also sterilize the seeds. From research (Sadjad S. , 1994) ethanol can damage the cell walls of corn seeds. The damage causes electrolytes to escape from the seed, indicated by the value of Electrical Conductivity (DHL). According to (Fridayanti, 2014) roasting can also be used as a vigor test method. Seed vigor is reflected by two information about viability, respectively the power to grow and the storability of seeds. So that the seeds are expected to be able to grow into normal plants in a suboptimal environment (Sutopo, 1988). The purpose of this study is to determine which varieties are able to maintain their viability and vigor, after aging with alcohol soaking, of the four varieties tested, so that the seeds of these varieties can be stored for a long time.

## 2. Materials and Methods

The materials used in the study were rice seeds of Inpari 45 (V1), Sunggal (V2), Memberamo (V3) and Ciherang (V4) varieties, which are staple seeds (BP). The seeds were obtained from a farmer seed producer in Wonoketro village, Jetis sub-district, Ponorogo district, harvested on August 2, 2023, with an initial germination rate of 92%. The seeds were treated by soaking the seeds with 95% alcohol for 5 minutes. Then the seeds were drained, after which the seeds were germinated using the UKDdp method (Rolled Paper Test established in plastic). Each roll germinated 100 seeds, and was repeated 3 (three) times. The selection of the method with 95% alcohol soaking for 5 minutes was based on the research of Belo and Suwarno, 2012. From their research, rice seeds soaked in 96% ethanol for 4.4 minutes had a germination rate (DB) of 50%. The research was conducted at the Agrotechnology Laboratory, PDKU Ponorogo, Universitas Merdeka Malang, in October 2023.

Seed viability is reflected in the seed germination rate (DB) and maximum growth potential (PTM) tests. Meanwhile, seed vigor is reflected in the Germination Speed test (KST). The germination test is observed on the 5th and 7th day after sowing (Sadjad S. , 1993), medium Maximum Growth Potential observed day 7 after transplanting (Fridayanti, 2014), Uniformity of Growth observed day 6 after transplanting (Palalo, 2020).

$$DB = \frac{\Sigma \text{ normal sprouts}}{\Sigma \text{ seeds planted}} \times 100\%$$

$$PTM = \frac{\Sigma \text{ sprouts that grow}}{\Sigma \text{ seeds planted}} \times 100\%$$

$$KST = \frac{\Sigma \text{ strong normal sprouts}}{\Sigma \text{ seeds planted}} \times 100\%$$

Statistical analysis as an effort to determine the effect of treatment was carried out through variance analysis of the F test with a real level of 1%. And to find out the differences in the treatment, a comparative test was carried out with the Least Significant Difference (BNT) test at the 5% level.

### 3. Results and Discussion

Based on the analysis of variance, the observation parameters of Germination Power (DB), Maximum Growth Potential (PTM) and Simultaneous Growth (KST), after rapid roasting with 95% ethanol immersion for 5 minutes on 4 varieties of rice seeds showed very significant differences (1%).

**Table 1.** Average germination rate (%), maximum growth potential (%) and growth uniformity (%) after being soaked with 95% ethanol for 5 minutes.

| Varieties                   | Viability (%) | Maximum Growth Potential (%) | Maximum Growth Potential (%) |
|-----------------------------|---------------|------------------------------|------------------------------|
| Inpari 45 (V <sub>1</sub> ) | 39 d          | 69,33 d                      | 33 d                         |
| Sunggal (V <sub>2</sub> )   | 26,33 b       | 46 b                         | 23,67 b                      |
| Memberamo (V <sub>3</sub> ) | 33,67 c       | 65,67 cd                     | 31,33 cd                     |
| Ciherang (V <sub>4</sub> )  | 15,67 a       | 32,67 a                      | 13 a                         |

Notes: Numbers accompanied by the same letter indicate no significant difference at the 5% level of the BNT test.

In the test of germination, maximum growth potential and uniformity of growth, all varieties experienced a decrease after the rapid expulsion. The Inpari 45 variety (V<sub>1</sub>) has the highest DB of 39% based on the 5% BNT test, while the Ciherang variety (V<sub>4</sub>) has the lowest DB of 15.67%. This shows that the Inpari 45 variety has the highest viability, because seed germination is a measure of viability. According to Justice and Bass (1990), the higher the seed viability, the longer the shelf life.

From the 5% BNT test, the four varieties of rapid roasting with ethanol soaking showed significantly different responses on seed germination. This shows that seed

viability is influenced by genetic factors or varieties and is also influenced by environmental factors. From the research (Sudjindro, 1994). Potential viability detected with the DB benchmark is influenced by the single factor of variety. Likewise from research (Rahayuningsih, 1998) on kenaf plants, strain as a single factor strongly influences seed viability. From research of (Muhammad Adiwena, 2021), four rice seed cultivars had different viability in the presence of seed-borne fungi. DB and PTM were still quite high in the Sungai Uma cultivar, namely 86% and 96%, although the fungus was carried by the seeds.

Rapid desiccation with 95% ethanol soaking for 5 minutes had an effect on Maximum Growth Potential (PTM), PTM decreased, but the decrease was not as great as the decrease in DB and KST. The PTM is still relatively higher after expulsion, because PTM is calculated based on the total number of seeds that germinate, both normal and abnormal sprouts. From the results of the BNT test, the Inpari 45 (V1) variety showed the highest PTM value of 69.33%, but based on statistics, the results were not significantly different from the Memberamo (V3) variety, which was 65.67%.

PTM is a parameter to measure the total viability of seeds. Keserempakan Tumbuh (KST) is a parameter to estimate the vigor of storability, because the KST value is only based on seeds that germinate normally strong. From the results of research with the 5% BNT test, the Inpari 45 (V1) variety showed the highest KST value of 33%, but based on statistics gave results that were not significantly different from the Memberamo (V3) variety, which was 31.33%. From the research (Sudjindro, 1994), Kenaf seeds affected by shocks have different KST values from the two varieties tested. With shaking, carbohydrates in the seeds decrease, while amino acids increase. Together with the increase in metabolic rate during shaking, it will result in a decrease in food reserves, causing abnormal seed growth to increase (Fridaynti, 2014).

The non-uniformity of seed growth can be caused by genetic and environmental traits. Uniformity of growth is related to the ability of seeds to utilize food reserves to grow into strong sprouts simultaneously. Seeds with low vigor value are less able to utilize food reserves than seeds with high vigor. A good KST ranges from 40 - 70% (Pinka Langlangdewi Nurrachmamila, 2017)

According to (Justice, 1990), each seed has a different rate of deterioration, influenced by genetic factors, seed dormancy, seed coat thickness, and chemical composition in the seed. Seeds that have thick and hard skin are more resistant to sub-ideal conditions. Soaking cabbage seeds with 20% ethanol for 30 minutes can be used to estimate the shelf life of cabbage seeds after six months (Amalia Rosida, 2015). When the seeds are soaked in ethanol solution, the ethanol will enter the lipid component of the membrane, which results in the destruction of cell parts and the breakdown of lipid bonds. When ethanol enters the seed, it will break down the protein configuration (AmanahA., 2016). From

research (Rahayuningsih, 1998) kenaf seeds treated with high temperature and high water content, the strains with the lowest viability had the highest fatty acid content, presumably the seeds experienced membrane damage.

## 5. Conclusions

Soaking seeds with 95% ethanol for 5 minutes can reduce germination, maximum growth potential, and germination uniformity. Seeds of Inpari 45 (V1) had the highest germination rate (39%), and were assumed to have a longer shelf life than the other three seed varieties, and had higher viability and vigor. While the Ciherang variety (V4) has the lowest germination rate (15.67%). Viability and vigor of seeds are not only controlled by the environment, but also by genetic factors.

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