

## Grain Quality of Rice (*Oryza sativa* L.) 'Menthik Wangi' of Organic Farming Yields

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### ABSTRACT

Organic rice is believed to have better nutrition than rice conventional. Not all organic rice grain is consumed. Most of the organic cultivation yields will be used as seed. Viability test is one of the quality test of rice seed. Viability is seed vitality that can be shown as a physiological and biochemical phenomenon. Seed that have high vigor will achieve high productivity levels as well. The aims of this research was to analyze the quality of rice cultivar Menthik Wangi of organic farming yields. The quality of rice seeds was tested by measuring the viability of seed and crude fat content. The test results demonstrate the viability of the grain has a 100% germination, 100% growth potential maximum, 99.33%, simultaneity grew, 97.33% vigor index,  $T_{50}$  2.33, and seed moisture content 10.67%. The fat content was conducted by soxhlet method and analyzed by T-test. The results showed that organic rice has a higher fat content (0.53%) than non-organic rice (0.24%). It can be concluded that rice seed cultivar Menthik Wangi of organic farming has a higher viability and fat content than the non-organic rice grain.

## 1. Introduction

Organic farming is currently considered as an answer to the community's concern over the use of chemicals used in agricultural cultivation. That is because organic farming uses natural waste from animals or plants so it does not endanger the body. Although considered to be less practical, organically grown rice in general has better quality than non-organic rice (Priadi *et al.* 2007). However, based on research by Syamsudin and Aktaviani (2009), the application of organic fertilizer alone is not enough to significantly increase rice yields. The application of integrated crop management is also needed. Integrated crop management can include seed selection, soil management, seeding, fertilizing, irrigation, weed control, pests and diseases (Bobihoe 2007). Organic rice seeds or seeds must come from plants grown by organic farming systems for at least one generation or two seasons for annual crops (Nurhidayati *et al.* 2008).

Seed quality includes genetic, physiological and physical quality. Genetic quality of seed could determined by its degree of genetic purity, while physiological quality could determined by the rate of decline and

seed vigor. Physical quality is determined by seed's cleanliness (Ichsan 2006). All stored seeds must have high growing strength so that they can germinate under various conditions. Seed vigor is associated in two information, viability and storability. Seeds that have high vigor will achieve high levels of productivity as well. High vigor is characterized by seed resistance to storage, pest attack, fast and evenly growing as well as being a normal, high-yielding mature plant in sub-optimal conditions (Koes and Arief 2011).

Quality rice seeds require certain standardization. One of the rice seed quality tests is the rice seed viability test. Seed viability is the life force or ability of a seed shown as a result of physiological and biochemical phenomena. Seed viability testing is generally carried out using paper or sand substrates (Suwarno and Hapsari 2008). Rice seed viability test can be performed with the Sadjad method, namely by calculating seed water content based on the seed fresh weight, germination ability that illustrates seed potential viability, maximum growth potential which illustrates the total seed viability, simultaneous growth which is vigor seeds, vigor index (VI) which illustrates vigor for growing speed, and  $T_{50}$  is the time needed to reach 50% germination (Sutariati *et al.* 2014). Tests of crude fat content in rice are needed to differentiate varieties, soil fertility, colloidal structure,

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processing methods, fertilizer application, post-harvest storage time and other environmental conditions (Oko and Ugwu 2010; Oko *et al.* 2012; Yulia and Casper 2015).

Based on testing on several types of local and imported rice varieties cultivated in Ebonyi Nigeria, rice fat content was not significantly different and included in low levels, did not reach 1% (Oko *et al.* 2012). But the rice proximate test that was cultivated in Abakaliki, Nigeria the results were significantly different. The difference depends on the ability of rice adaptation in various environmental conditions at the time (Oko and Ugwu 2010). Tarigan and Kusbiantoro (2011) said Menthik Wangi rice has a fat content of 0.23-1.41%. The fat content of rice does not have a significant difference with the varieties of Pandan Wangi and Sintanur. The level of seed viability and rice fat content become a reference for the quality of rice seeds and the price level on the market. This study aims to determine the viability of seeds and crude fat content in rice seeds Menthik Wangi varieties that are organically cultivated in the research of Siswanti and Virgiyana (2014).

**2. Materials and Methods**

The research was conducted in August-November 2015 at the Green house of the Faculty of Biology, Laboratory of Chemistry and Biochemistry, Center for Food and Nutrition Studies (PSPG), Gadjah Mada University. The rice seeds used are the result of integrated organic farming in the village of Wukirsari, Cangkringan, Sleman.

Seed moisture uses the Sadjad method (Sutariati *et al.* 2014). Seed moisture content is calculated by the formula:

$$KA = m/M \times 100\%$$

- KA : Water Content (seed)
- m : The amount of water that is evaporated (m = seed weight before drying - seed weight after drying at 105°C)
- M : Seed weight before drying

Germination (GR) illustrates the potential viability of seeds. Germination is calculated by comparing the normal germinated seeds with the number of seeds planted, multiplied by 100% (Sutariati *et al.* 2014).

$$GR = \frac{n1 + n2 + \dots + ni}{N} \times 100\%$$

or

$$GP = \frac{\sum \text{normal sprouts}}{\sum \text{seed planted}} \times 100\%$$

- GR : Germination rate
- GP : Germination percentage (germination ability)
- ni : Number of seeds germinated on day- i
- N : Number of seeds tested

Maximum growth potential (MGP) illustrates the total viability of seed observed by counting all seeds that germinated on the last day of observation compared to the total number of seeds planted and multiplied by 100%.

$$MGP = \frac{\sum \text{germinating seed}}{\sum \text{seed planted}} \times 100\%$$

Germination uniformity is a seed vigor. GU is calculated by comparing the normal sprouts (KN) on the 5 days after planting and 7 days after planting or calculated based on the percentage of normal sprouts (KN) on the day between the first count (5<sup>th</sup> day after planting) and the second (7<sup>th</sup> day after planting) which is on 6<sup>th</sup> day after planting (Sutariati *et al.* 2014).

The Vigor Index (IV) illustrates the growth velocity which calculated by comparing the number of normal sprouts on the 5<sup>th</sup> day after planting with the number of planted seeds multiplied by 100% or with the following formula:

$$VI = \frac{\sum KN}{\text{first day of calculation}} + \dots + \frac{\sum KN}{\text{last day of calculation}}$$

or

$$IV = NX / DX$$

- VI : Index vigor
- ∑KN : Number of seeds germinating normally
- NX : Number of seeds germinated on day-X
- DX : Number of days from the start germinating to the X<sup>th</sup> day

T<sub>50</sub> is the time needed to reach 50% germination, observed by counting the number of seeds that germinate every day (Sutariati *et al.* 2014).

$$T_{50} = \frac{ti + (n50\% - nj) (tj - ti)}{nj - n}$$

- ti : delivery time, when or before the seeds germinate 50%
- Tj : time between, after the seeds germinate 50%
- n50% : number of seeds germinated 50% of total germinated seeds
- nj : number of seeds germinated at tj
- ni : amount of seeds germinates at ti time

Determination of crude fat levels using the Soxhlet Method (Horwitz 2000) Flour as much as 1.5 grams wrapped in coarse filter paper, put in the upper reservoir flask in a series of soxhlet devices. Petroleum ether solvent is put as much as 50 ml into a previously weighed round flask. Extraction was carried out for 3 hours, then the solvent was evaporated in a drying oven. The fat extract is evaporated until fat deposits remain at the bottom of the pumpkin. Pumpkin is weighed again and obtained the difference between initial weight and final weight. The difference is the mass of fat, then the percentage is calculated.

### 3. Results

Measurement of rice seed viability in this study was carried out with the Sadjad method with several parameters, namely germination which illustrates seed potential viability, maximum growth potential (MGP) which illustrates total seed viability, germination uniformity (GU) is seed vigor, Vigor Index (VI) illustrates vigor grow speed, and  $T_{50}$  is the time needed to reach 50% germination and the calculation of seed moisture content is based on the wet weight of the seed.

The average water content of the Menthik Wangi rice seeds produced by integrated organic farming in Wukirsari Village was 10.67% (Figure 1).

### 4. Discussion

In general, rice farmers do not have storage space for rice seeds in accordance with the standards to maintain viability because of limited costs. Testing rice seed germination through a viability test can help farmers to know the characteristics of rice seeds that are ready to be germinated and know the range of the number of rice seeds to be germinated in a certain area of land (Sutariati *et al.* 2014).

Seed moisture content (% w.b.) is conducted to determine the readiness of rice seeds to be germinated, if the rice seeds have high water content, it can be estimated that the seeds are composed of carbohydrates, proteins, lipids, and few nucleic acids. This can result in germination failure because high water content can cause seed rotteness. Low seed water content can accelerate the germination process, especially carbohydrates in endosperm which will be overhauled into reducing sugars to be transferred to seed embryos as an energy source for germination.

The water content is good for orthodox seeds such as rice seeds. The moisture content of rice seeds depends on the post-harvest drying time and storage method. The Menthik Wangi rice seeds have been stored by researchers for 12 months after drying in the sun for 3 days. Low moisture content of Menthik Wangi rice seed causes high levels of protein, carbohydrates, and lipids and indicates that the rice is ready for germination. The moisture content value of Menthik Wangi rice seeds is lower than the standard water content value, which is a maximum of 13%, which means that Menthik Wangi's rice seeds are ready to be germinated quite high (Figure 1).

Seed moisture content can be used as a reference for seed storage so that viability is maintained. Good storage space conditions for orthodox seeds, including rice; is in dry and cold conditions. The seeds of the orthodox group are characterized by their nature which can be dried without damage to the embryo and its endosperm, the viability of the orthodox seeds does not experience a significant decrease with a decrease in water content to below 20%, so that orthodox type seeds can be stored in the condition of seeds with low water content (Syamsudin and Aktaviyani 2009).

The simultaneity of Menthik Wangi rice seed germination from integrated organic farming showed that on the 7<sup>th</sup> day there was a simultaneous germination of 50 rice seeds (Figure 2). Germination

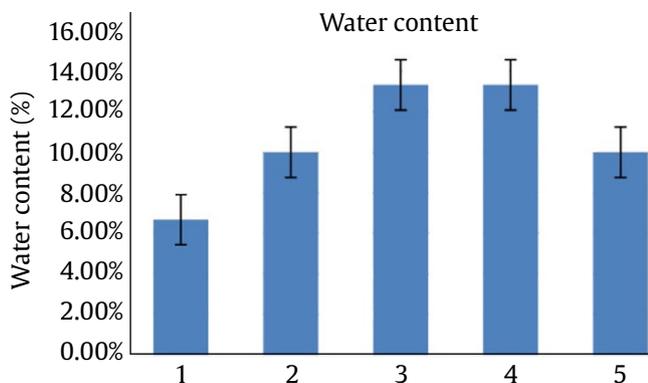


Figure 1. Water content of rice (*Oryza sativa* L) 'Menthik Wangi'

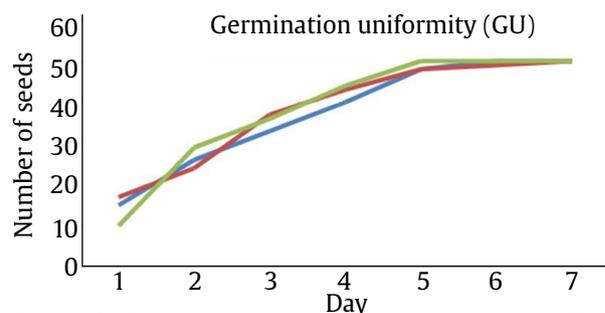


Figure 2. Simultaneous germination of organic Menthik Wangi rice seeds

uniformity (GU) is rice seed vigor. The Menthik Wangi's grain has a high Germination uniformity (GU = 99.33%). It showed rapid and uniform growth and development of sprouts. Vigor Index (IV = 97.33%) illustrates growth speed. The Vigor Index shows Menthik Wangi rice seeds have a high rate of growth into new individuals.  $T_{50}$  is the time needed to reach 50% germination.  $T_{50} = 2.33$  (days), it means that Menthik Wangi rice seeds need 2.33 days to germinate up to 50% or half of the number of rice seeds that are germinated.

There are differences among plot in simultaneity to reach  $T_{50}$  which can be caused by differences in the level of viability in each seed used, even though the germination (DB) is 100%. Each seed has factors that reduce the level of viability, for example the speed of the endosperm reshuffle process, the process of transfer to the embryo, endosperm thickness, aleurone sensitivity, the gibberelline hormone in the seeds and the process of water imbibition to initiate the germination process. Low water content (% w.b.), germination rate (GR), vigor index (VI) and high germination (GP) with  $T_{50} = 2.3$  days shows that Menthik Wangi organic rice seeds have high viability.

Crude fat test is one part of the proximate test. The sample is given a non-polar solvent, then the solvent is evaporated until the remaining fat, the fat is called crude fat (Midwest Laboratories 2015). Usually crude fat can be extracted with ether, chloroform and butanol (The Rice Association 2015). The crude fat content of Menthik Wangi rice as a result of integrated organic farming compared to non-organic Menthik Wangi rice. The measurement results show organic rice has a higher fat content (0.53%) compared to non-organic rice (0.24%). This shows that the content of microbial agents in biofertilizers given in integrated organic farming can provide better nutrients. Adequate nutrients in the growing media increase glucose. Increased glucose increases the conversion of glucose into acetyl co-A which is then converted to fat through fat synthesis. Coarse fats in plants are unsaturated fats, which are fats that have a double bond on the carbon chain. Unsaturated fats can reduce blood cholesterol levels, so it is good for health. The most fat in rice is in the spherosomes in the aleuron layer. However, the layer usually disappears during the grinding process. Nevertheless, around 1.5-1.7% of total rice fat still remains in milled rice (Oko *et al.* 2012).

## 5. Conclusion

Based on the research of the viability and crude fat content of Menthik Wangi rice seeds from the integrated organic farming, the Menthik Wangi organic rice seeds have high viability and higher crude fat content compared to non-organic rice seeds.

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