Effect of temperature and humidity to the yield and quality of germinated rice (Oriza sativa L) produced

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Abstract. Rice is the nutritious staple food which important for human daily consumption. The nutrients content in rice can be lost or reduced during the grain process. A method that can be implemented to prevent or reduced the risk of loss of nutrients content in rice is by germinating the grains. The germination of the grains will increase the nutrient content of rice and grain itself. The purpose of this research was to analyze the effect of water temperature and humidity on the quality of rice produced and to determine the best temperature and humidity treatment for the production of quality rice. The grain was soaked in water for 48 hours then germinated with variations in temperature and humidity until the grain germinates along 1 cm sprout. Duration of germination and the quality of rice produced were observed and compared to the yields, quality requirements, and the level of consumer acceptance of rice produced. The results show that germination time will fasten with increasing temperature and humidity. The best treatment during the process of the germinating grain towards the quality of rice was incubation under room temperature and humidity conditions.

1. Introduction

Most Indonesians make rice as the main food, so making rice must be controlled [1,2]. High production must be followed by high quality too, but the stage of grain into rice often causes loss of nutrients in the rice produced. High rice production must be supported by proper post-harvest handling. Each stage of post-harvest handling has an opportunity to lose the quality of rice produced. The post-harvest processing stage has an enormous influence on the yield and quality of rice to be produced [3].

Based on the results of Badani's research [4] and Rahman et al. [5], the immersion of grain in water can increase the nutritional value of rice produced. Immersion in water has been known to soften the outer layer of the grain, hence allow the water to enter the grain and activate enzymes to start the germination process. During the soaking, nutrients contained in the husk will be absorbed into the rice. By germinating the rice, some nutrition and functional components in rice will be improved including vitamins, minerals, fiber, and other components contents. In addition, during the process, there is a decrease in the content of anti-nutrient compounds, such as trypsin inhibitors, tannins, pentosan, and phytic acid [6]. Many nutritional compositions in germinated seeds are prepared for shoot growth [7]. Compared to the ground rice, germinated rice contains some nutrients such as γ-aminobutyric acid, dietary fiber, vitamin E, B1, B2, niacin, lysine, and magnesium [8]. Based on the previous description, a study was conducted to analyze the effect of water temperature and humidity on the quality of rice

produced and to determine the best temperature and humidity treatment for the production of quality rice.

2. Materials and methods

The study was conducted at the Laboratory of Central Plantation Industry and laboratory of Chemical Analysis and Food Quality Control, Makassar. Rice grain used was a local freshly harvested variety of Baranti District, Sidrap Regency, South Sulawesi Province. The grains were immersed in 1:2 (w/v) ratio of water for 48 hours before germinated in varied temperatures and humidity treatment. Two temperatures were used namely 20 and 30 °C and three humidity levels of 70, 80, and 90% were used. As a control, one seed lot was germinated under room temperature and humidity (uncontrolled environment). The germination process was carried out until 1 cm of sprout appeared on the rice grain. The germinated rice was then dried to 14$ water content and milled.

The observation was made on the length of germination, and weight loss (yield) of the grain. The measurement of rice weight loss (yield) was calculated based on the ratio of the rice produced, to the initial weight of used rice. In addition, quality requirements also determined by grounding 100 g of and manually separating for head rice, broken rice, and groats. Each rice that has been separated then weighed.

3. Results and discussion

3.1. Germination time

Table 1 shows the results on germination time in each treatment until reaching 1 cm sprout length. The fastest germination time occurred at 28 hours shown by the uncontrolled temperature and humidity. As temperature and humidity increased, the germination time shortened.

Table 1. Germination time for each sample.

Treatment T (°C), RH (%)	t (hours)
20, 70	44
20, 80	38
20, 90	38
30, 70	36
30, 80	32
30, 90	30
Uncontrolled	28

3.2. Weight loss (yield)

Figure 1 shows the weight loss or yield of the grain in different germination temperature and humidity treatments. Based on the calculation of the milling yield, the longer the curing time, the lower the yield of milling. The highest yield of milled was in the uncontrolled temperature that was 86 % and followed by a sample temperature of 30 °C and humidity of 90%. Based on the results of the study it was found that the yield of each milled decreases compared to the treatment without germination. Decreased milled yields can be due to germination processes. The germination process can damage the structure of rice so that the rice becomes cracked and amylase will degrade fats and carbohydrates during the germination process. This is consistent with the statement of Lopez and Escobedo [9] that germination can increase protein content. Increased protein content during the germination process is caused due to the formation of essential amino acids that are constituents of proteins needed for the growth process of sprouts.

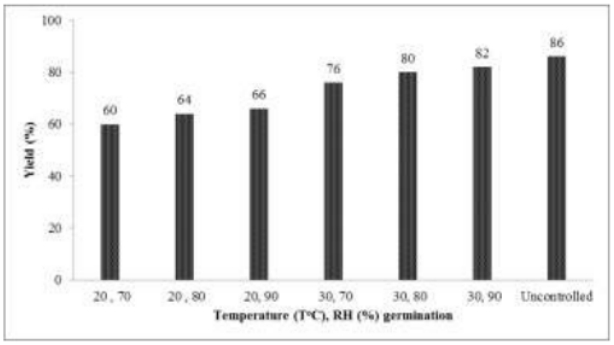

Figure 1. Relationship between yield percentage with temperature and humidity germination.

3.3. Quality requirements

The calculation of the percentage of rice quality components is shown in figure 2. Figure 2 shows that the longer the immersion and ripening time, the percentage of head rice decreases. The highest percentage of head rice obtained was the highest milled yield, namely in uncontrolled temperature which was 52 %. The treatment with the lowest head rice percentage was at the temperature germination treatment of 20 ^{o}C and humidity 70%. This is because the longer the germination time, it will damage the cells of rice so that the rice will break and be damaged when milled. In addition, the soaking time of grain used is the longer the soaking time, the more water absorbed into the rice cells will affect the quality of rice after the grinding process [10].

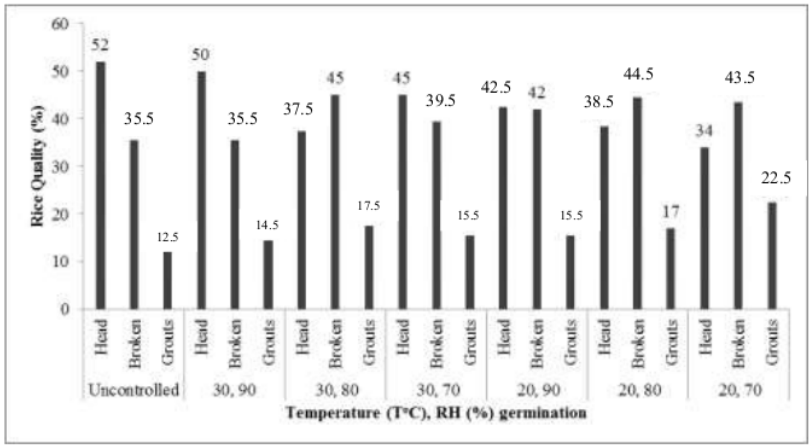

Figure 2. Relationship between Rice Quality with temperature and humidity germination.

4. Conclusions

The grain from variety has been soaked and germinated in some treatments. The duration of soaking and germination affects the length of the grain sprouts, the longer time of soaking and germination of the grain, the longer sprouts will be produced. The best treatment during the process of the

germinating grain towards the quality of rice was soaking at 12 hours and germination time 28 hours with incubation under room temperature and humidity condition.

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