

Pragilling Cooling Technique on Quality Characteristics of Milled Rice based on Cooling Temperature and Duration

Adam Bramantara Putra^{1*}, Erik Cahyono²

^{1,2} Agricultural technology, Sulawesi Utara Technology University

*Email: adh4am-brata@gmail.com

ABSTRACT

*This study aims to determine the effect of temperature, duration of cooling, and physical quality of rice that is influenced by pragiling refrigeration technique. The resultsshowed a decrease of moisture content in the process of drying of impari varieties (22.4% -13.4%) and cisadane varieties (25% -14.3%). Dry shrinkage occurs due to the amount of water that evaporates during the drying process on the 16 kg varieties of impari and cisadane varieties of 21 kg. In addition to the varieties of grain milled rice varieties also affected by the characteristics of grain quality, the varieties of impari obtained average (52.40 ± 3.23%) while in cisadane varieties obtained average (54.54 ± 1.2%). Visual appearance, color degree measurement (Lab *) of milled rice with pragiling and non cooling cooling technique has no significant effect on the given treatment. In the analysis of quality characteristics of rice with pragiling cooling technique, the quality of rice produced is better than non-coolant treatment this is seen from the percentage of head grains, broken grains and groats that produced reached 87.68%. This is in accordance with the analysis data of variance where temperature has significant effect (0.00 <0.05) on the four temperatures used. The cooling time had a significant effect on the physical quality of rice produced with significance value (0.00 <0.05) at three time levels used.*

Keywords: Grain, drying, pre-rolling cooling, rice characteristics.

INTRODUCTION

The most potential agricultural commodity in Indonesia is rice (*Oryza sativa L*). Rice is a food plant that has been continuously trying to increase its productivity to support national food needs, rice also has various varieties that have been cultivated in Indonesia. The Institute for Agricultural Research and Development has released more than 200 varieties of rice since the 1930s. The released varieties have various characteristics, including those with early maturity, high productivity, resistance to certain pests and diseases. More than 90% of rice fields in Indonesia have been planted with VUB. Some of the VUBs are familiar to residents (Raina et al, 2019). Food processing methods are quite diverse, ranging from simple methods to those that require sophisticated, complex equipment and specially trained personnel. Cold drying creates a higher quality product than other compositional liquid loss methods.

Rice is a food ingredient produced from the rice plant. Rice is also a staple food for most of Indonesia's population. Rice has a certain value for people who consume it and cannot be easily replaced with other food ingredients. Rice is a strategic commodity and is the staple food of the Indonesian people. Consuming rice every year continues to increase along with the rate of population accumulation. There have been many attempts to curb the rate of consumption of rice with a variety of local foods, but in fact, every year it always faces an increase.

The quality of rice with the cooling treatment significantly increased the total yield of rice and head rice compared to the control treatment. Head rice and total rice yielded by cooling treatment can be increased because this process can reduce moisture and increase spoilage associated with lower milled rice temperatures (Tayefe et al, 2020). Rice in hot conditions after being dried and then put into a grinding machine is usually sticky and the resulting rice cracks a lot. Ordinary drying with sunlight

occurs heating with a fairly large temperature, especially when the grain is dried during the day. This can cause a very fast drying rate, and cause water content in the material. This situation causes a decrease in the quality of rice which is indicated by a decrease in the percentage of head rice (Jeong et al, 2019). The purpose of this study was to determine the effect of temperature, cooling time, and physical quality of rice which were influenced by the milling cooling technique.

METHOD

This research uses the rice milling method with pre-milled cooling and non-pre-milled cooling techniques, besides that, drying treatment is also given by utilizing direct sunlight. The experimental design used was CRD (Completely Randomized Design) in the form of a factorial experiment with statistical analysis, having two factors, namely the cooling temperature factor and the cooling time factor. The cooling temperature factor consists of 4 temperature variations, namely: 160 C, 190 C, 210 C, 240 C. As for the treatment factor, the cooling time is divided into 3 time levels, namely: 10 Minutes, 15 Minutes, and 20 Minutes.

Each treatment was repeated 3 times so that there were 80 samples in each rice variety, using 2 pre-milling cooling treatments, namely temperature and cooling time. The rice milling process is carried out every day, in the morning and evening. Parameters in this study, measurement of water content, milled yield, physical quality testing of rice include: rice head, broken rice, groats and color testing. Rice drying was carried out for 6 hours/day and carried out for 2 days. Each treatment was made in three repetitions, so there were 80 samples in each rice variety. Observation parameters in this study were rice drying in the form of changes in water content and drying shrinkage. Milled yield analysis. Observation of the physical quality of rice in the form of the percentage of grain heads, broken grains and groats. Visual appearance in the form of color. The research results will be processed using two factorial CRD (Completely Randomized Design) namely cooling temperature and cooling time. Data analysis was carried out using the Statistical Package for Social Science (SPSS) repeated measurement model.

RESULT AND DISCUSSION

In the process of drying the moisture content of the impari variety, the initial moisture content indicated that the grain would follow a period of decreasing water content but the decrease was not too much. When drying is done by covering the grain with tarpaulin, the water content continues but not too much. Furthermore, the water content decreases and then remains relatively constant. This shows a significant effect. The moisture content of the Cisadane variety, the initial moisture content before drying was 25%, the first 2 hours of drying showed the water content decreased sharply. Then it shows the water content is still ongoing but relatively constant. Furthermore, the moisture content of the grain again decreases and at the end of drying follows a fixed period. This has a significant effect on reducing the moisture content of the grain in the drying process. ($0.00 < 0.02$).

The amount of grain used in the drying process, each variety is 125 kg, with different water content before drying. Kabb impari variety 22.4% while cisadane variety 25%. After drying, the grain weight decreased, impari varieties became 109 kg and cisadane varieties 104 kg. Based on these results, it can be seen that the amount of water that evaporates during the drying process in the 16 kg impari variety and 21 kg cisadane variety. The time required for drying on the varieties of impari and cisadane is the same. When the grain is resting (tempering time) there is a diffusion of water vapor from the inside to the outer surface of the grain to reduce the moisture gradient and increase the drying rate.

The initial weight of the grain before milling was 10 Kg and after the milling process the rice produced in the impari variety was $52.40 \pm 3.23\%$ on average. The yield value of milled rice in this impari variety tends to be smaller. The impari temperature variety has no significant effect on the percentage of milled yield but for cooling time it has a significant effect. Meanwhile, the interaction between temperature * cooling time has no significant effect on the value of milled yield. The effect of cooling temperature and cooling time on cisadane varieties is $54.54 \pm 1.2\%$ on average. The yield of milled rice in the cisadane variety tends to be higher than the yield of milled rice in the impari variety. However; by performing a t-test (t-test, SPSS), the average yield of this milled rice on the cisadane variety, temperature and cooling time have a significant impact on the percentage of milled yield value.

For grain heads in the treatment of temperature, cooling time and variety have a significant effect on the percentage value resulting from the pre-milled cooling technique treatment by combining the values obtained from the impari and cisadane varieties. This is in accordance with the analysis of variance data where temperature has a significant effect ($0.00 < 0.05$) on the four temperatures used. Cooling time

has a significant effect on the physical quality of the rice produced with a significant value ($0.00 < 0.05$) at the three time levels used. The interaction between temperature and variety also resulted in a significant value. The temperature*variety interaction also had a significant effect. But for the interaction between cooling time*variety, cooling time*temperature, cooling time*temperature*variety did not have a significant effect on the results for head grains.

In broken grains, the average percentage of the physical quality of milled rice for the cooling time temperature treatment and varieties, broken grains had a significant impact with significance ($0.00 < 0.05$). Meanwhile for the interaction of temperature*variety, cooling time*variety, cooling time*temperature, cooling time*temperature*variety had no significant effect.

Based on analysis of variance for groats. Temperature had an insignificant impact on the percentage value of the groats. Cooling time and variety have a significant effect on the percentage value of the groats. Meanwhile, only the interaction between cooling time and variety affects the physical quality of the milled rice produced.

The results of the analysis of variance for the data on the color test with observations covering the level of brightness (L^*), the degree of red color (a^*) and the degree of yellow color (b^*) for the cisadane and impari varieties, the cooling temperature and time had no significant or no significant effect on the quality. milled rice, the interaction between temperature * cooling time also has no significant effect.

Discussion

This study showed that the pre-milled cooling technique on the physical quality components of milled rice in impari and cisadane rice varieties produced could be improved because this process can reduce humidity and increase damage associated with lower milled rice temperatures. In the varieties of impari and cisadane, the quality produced is still there but not too significant. The pre-milled cooling method is able to maintain the physical quality of rice based on the Indonesian National Standard for rice quality and consumer acceptance is better than non-cooling.

the initial period of grain drying, in this phase the drying process takes place quickly, this is indicated by a sharp decrease in the water content. In the drying process, there is always free evaporation of water on the surface of the grain, in which case the evaporation rate is considered the same as the drying speed. This phase ends when the rate of evaporation of water from the inside to the surface of the grain is smaller than the rate of evaporation of water on the surface of the grain. Temperatures that are too high during drying can also cause the grain to break. We recommend that when it reaches noon when the sun will be hot, the grain is covered with a tarp.

The water content produced by the observed dry grain is between 13-14%, therefore the grain at this optimum water content is termed dry milled grain (GKG). At a higher water content, the grain is difficult to peel, on the other hand, at a lower water content, the grain will break easily. The milling process for this damaged skin will work well if the milled grain has a water content ranging from 13-14%. The water content is usually expressed as a percentage by weight of water to the wet material or in g of water for every 100 grams of material which is referred to as the wet basis water content (bb). The weight of dry matter or solids is the weight of the material after undergoing heating for a certain time so that the weight is constant or constant (Saha & Roy, 2020). The milling loss calculation was tried as an effort to increase the milled yield so that the rice yields obtained were more optimal. The milling loss calculation was tried as an effort to increase the milled yield again so that the rice yields obtained were more leverage.

Observations made obtained the results that the yield of cracked rice on the impari variety was obtained on average ($52.40 \pm 3.23\%$) while the cisadane variety was obtained on average ($54.54 \pm 1.2\%$). The yield of milled rice is influenced by the quality of the grain, the type of rice, and the performance of the machinery used in the milling process. The yield of milled rice is highly dependent on the raw material of grain, type/variety, level of maturity, and pre-handling method and the type and configuration of the process in the grinding machine used (Sofi et al, 2020). If grain is stored for a long period of time it will be easy to mold and result in low rice yields (Andika et al, 2021). Milling time affects the amount of head of rice, when the milling time increases, the percentage of head of rice decreases and the percentage of the amount of bran increases (Sari et al, 2020). Grain grain mass is used to determine the effective diameter that can be used in the theory of seed volume estimation (David & Kartinaty, 2019).

The quality of milled rice is said to be of good quality if the results of the milling machine produce high head rice with slightly broken rice. The milled quality is also determined from the amount of white rice or the yield. The quality of the milled rice is related to the selling value of the rice. The constraint of

the rice production process is the amount of broken rice when it is processed in the milling machine. This can cause the quality of rice to decrease (Hadipernata et al, 2020). In general, the effectiveness of different cooling methods in reducing the temperature of rice followed an order from high to low, each 10°C increase in milled rice temperature was associated with a decrease in percentage points in the temperature range produced by the various cooling methods. The results of the quality of milled rice also verified that the milling temperature is an important factor affecting the quality of the rice assessed using the milling procedure.

CONCLUSIONS

Pre-milled cooling technique can increase the percentage of grain heads compared to non-cooling techniques. The temperature and time of cooling affect the milled rice. The water content of grain undergoes 3 phases of decline, fast, constant and decreasing. The water content of 13 -14% is the water content where the grain is quite stable, meaning that it is not easy to reabsorb water, so that the increase in water content occurs quite slowly. At a moisture content of 14%, grain is quite safe to store if environmental influences are not damaging. The economic value of coarse rice is based on the quality of its milling. The cooling method significantly increases the total rice yield and total head of rice. Cooling with cold air causes TRY and HRY to increase than normal treatment. When only the internal heat exchanger is used, cold air cooling increases the percentage of total rice yield, cold air cooling produces a larger increase.

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