Determination of the best treatment of the harvesting, physicochemical properties, organoleptic test using the effectiveness index method on the Aceh local rice genotype M7

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Abstract. The need for rice continues to increase every year in line with population growth so that eventually it becomes a problem for national food. The society’s view of fulfilling carbohydrate needs is one of the factors in increasing rice demand. This study aims to determine the best treatment of the harvesting, physicochemical properties, organoleptic test using the effectiveness index method on M7 genotype Aceh local rice. The results showed that the determination of potential quality of M7 genotype Aceh local rice was in the potential yield parameter and the weight of 1000 grains, the best physicochemical properties of M7 genotype rice were found in G2 which had a value of 0.107. While the parameters of kamba density, water content, and amylose content were found in G6 with the results of 0.178; 0.089 and 0.044. In the parameters of milled rice soaking, whiteness and starch content, the highest product values were found in the G3 with the results of 0.067; 0.133 and 0.200. In the parameters of the rice dimensions and amylpectin levels, the highest values was in G4 and G5 with results of 0.156 and 0.022 and the best organoleptic test results on the M7 genotype Aceh local rice was found in G3 which had a value of 1.000. In the attributes of aroma, color, texture, shape and overall acceptance, the panelists chose Aceh local rice in G3 with the results of 0.133; 0.067; 0.333; 0.267 and 0.200.

1. Introduction

Rice is one of the most produced and consumed grains in the world, characterized as the primary source of food for over half of the world’s population. Rice is also an important source of energy for human consumption because of its high concentration of starch and source of proteins, vitamins and minerals [1][2].

The quality of rice is largely determined by its physicochemical properties; in which it is dominated by starch of around 80-85%. The physical and chemical properties of rice greatly determine the cooked level quality and the taste quality of the rice produced [3]. More specifically, the quality is determined by amylose content, protein content and fat content. In addition to food ingredients, the main components generally consist of water content, ash, carbohydrates, proteins and fats [4]. This analysis becomes necessary to do because it provides data on the main content of the food ingredient. Another factor is because of the proximate analysis in food is related to the nutrient level of the foods. The nutritional levels need to be found out because they are connected to the quality of the foods.
To determine the best treatment from the final results of a study, it can be used Effectiveness Index Method or by using the De Garmo method, a method by grouping parameters and doing weighting or scoring, in which the weight given is in accordance with the importance/priority of each parameter in affecting the results of the research or affect the level of consumer acceptance which is initiated by experts or panellists [5].

The purpose of this study was to determine the best treatment of potential yields, physicochemical properties, organoleptic test using effectiveness index method on M7 genotype Aceh local rice. This information is the initial data for the development of local Aceh rice M7 genotype in Aceh Province.

2. Material and Methods

2.1. Materials and Research Tools

The materials used in this study were varieties of sanbei M7 genotype rice with strains, namely: USK-238-016-UF1-12 (G1), USK-238-016-UF5-65 (G2), USK-238-016-CKU-41 (G3), USK-238-016-39E-12 (G4), USK-238-016-57E-05 (G5) and USK-239-016-10D-03 (G6). The rice for this study was obtained from the Seed Industrial and Technology Laboratory, Department of Agrotechnology, Faculty of Agriculture, Universitas Syiah Kuala. The tools used in this study were analytic scale, spectrometer, pycnometer, ovens, petridis, spatula, trenocci grading machine and stationery.

2.2. Work Procedures

Determination of the best treatment of all measured parameters is determined by the value of the effectiveness of De Garmo. The best treatment value is obtained from observations that have been made on the parameters of potential yield (weight of grain per panicle, rice grain weight, empty grain weight, weight of 1000 grain, potential yields) physicochemical properties (milled rice rendemen, degree of sosoh, whiteness, dimension of rice [6], kamba density [7], water content [8], amylose [9], amylpectine [8], and starch [8]) and organoleptic tests (hedonic tests [10]). Here is the formula for finding the best value:

\[
Weight \ Value \ (NB) = \frac{Treatment \ Score}{Total \ Weight} \tag{1}
\]

\[
Effectiveness \ Value \ (NE) = \frac{Np-Ntj}{Ntb-Ntj} \tag{2}
\]

Information:
Np = Treatment Value
Ntj = The Worst Value
Ntb = The Best Value

\[
Product \ Value \ (NP) = NE \times NB \tag{3}
\]

Information:
NE = Effectiveness Value
NB = Weight Value

3. Results and Discussion

Table 1 shows the product value of the harvesting of M7 genotype rice with the best result of gamma ray irradiation was in G5 which had a value of 0.695 and the worst value was in G6 which had a value of 0.097. In the parameters of grain weight per panicle, high grain weight and potential yield, the highest product value was found in G4 with the result of 0.133; 0.200 and 0.067. In the parameter of empty grain weight, the highest value was found in G2 with the result of 0.333 and in the parameter weight of 1000 grains. The highest product value was found in G1 with a result of 0.267.
Amylose content in rice plays an important role and determines the quality of the rice produced as well as determine other physical characteristics [15]. The main things related to the determination of the harvesting of the M7 genotype rice quality were density, water content, and amylose content, which had a value of 0.107. In the parameters of kamba density, water content, and amylopectin levels, the highest value was in G4 and G5 with results of 0.156 and 0.022.

| Parameter                    | BN   | G1   | G2   | G3   | G4   | G5   | G6   |
|------------------------------|------|------|------|------|------|------|------|
| Weight of grain per          | 0.133| 0.197| 0.026| 0.000| 0.000| 0.560| 0.074|
| pincel                       |      |      |      |      |      |      |      |
| Rice grain weight            | 0.200| 0.289| 0.058| 0.159| 0.032| 0.558| 0.112|
| Empty grain weight           | 0.333| 0.533| 0.177| 1.000| 0.333| 0.500| 0.167|
| Weight of 1000 grain         | 0.267| 1.000| 0.267| 0.215| 0.057| 0.430| 0.115|
| Potential yields             | 0.067| 0.288| 0.019| 0.195| 0.013| 0.559| 0.037|
| Total (cumulative)           | 1.000| 0.548| 0.435| 0.505| 0.665| 0.695| 0.097|

BN: Weight Value; NE: Effectiveness Value and NP: Product Value

Table 2. Effectiveness Value of the Physicochemical Properties

| Parameter                  | BN   | G1   | G2   | G3   | G4   | G5   | G6   |
|----------------------------|------|------|------|------|------|------|------|
| Milled rice                | 0.067| 0.000| 0.000| 0.464| 0.031| 1.000| 0.067|
| rendermen                  |      |      |      |      |      |      |      |
| Degree of sosoh            | 0.111| 0.000| 0.000| 0.000| 0.000| 0.000| 0.000|
| Whiteens                   | 0.133| 0.925| 0.123| 0.000| 0.000| 1.000| 0.133|
| Dimension of rice          | 0.156| 0.941| 0.147| 0.000| 0.000| 0.293| 0.046|
| Kamba density              | 0.178| 0.000| 0.000| 0.196| 0.035| 0.174| 0.031|
| Water content              | 0.089| 0.800| 0.071| 0.400| 0.036| 0.000| 0.000|
| Amylose                    | 0.044| 0.102| 0.004| 0.116| 0.005| 0.000| 0.000|
| Amylopectin                | 0.022| 0.866| 0.019| 0.000| 0.000| 0.993| 0.022|
| starch                     | 0.200| 0.832| 0.166| 0.000| 0.000| 1.000| 0.200|
| Total (cumulative)         | 1.000| 0.531| 0.107| 0.499| 0.433| 0.484| 0.601|

BN: Weight Value; NE: Effectiveness Value and NP: Product Value

The main thing related to the determination of physicochemical properties of the M7 genotype rice quality was amylopectin. Amylopectin is the main fraction of rice starch, but the high amylose content determines the quality of the rice produced as well as determine other physical characteristics [15]. Amylose content in rice plays an important role in determining the overall results of cooking [16][17].

The main things related to the determination of the harvesting of the M7 genotype rice quality were the potential result parameter and the weight of 1000 grains. According to Akhtar’s research, rice yield is a positive effect between genetics and the number of grain per panicle [11]. The ripeness process and the weight of 1000 grains have a negative effect on plant height both on phenotypic and genetic levels [12]. This is in line with Mawardi who stated that the yield potential per hectare obtained is closely related to the weight of the grain containing the clumps and each genotype has different abilities in carrying out its physiological functions. The increase in grain yield from several rice genotypes correlates with an increase in weight of 1000 grains [13][14].
Amylose content affects the level of rice softness. The lower the amylose content of rice, the higher the rice softness, and vice versa [18].

Table 3. Effectiveness Value of the Organoleptic Test

| Parameter       | BN  | G1  | G2  | G3  | G4  | G5  | G6  |
|-----------------|-----|-----|-----|-----|-----|-----|-----|
|                 | NE  |   NP|  NE |   NP|  NE |   NP|  NE |
| Aroma           | 0.133 | 0.909 | 0.121 | 0.636 | 0.085 | 1.000 | 0.133 |
| Color           | 0.067 | 0.000 | 0.000 | 0.053 | 0.004 | 1.000 | 0.067 |
| Texture         | 0.333 | 0.000 | 0.000 | 0.227 | 0.076 | 1.000 | 0.333 |
| Shape           | 0.267 | 0.000 | 0.000 | 0.340 | 0.091 | 1.000 | 0.267 |
| Overall acceptance | 0.200 | 0.000 | 0.000 | 0.187 | 0.037 | 1.000 | 0.200 |
| Total (cumulative) | 1.000 | 0.121 | 0.292 | 1.000 | 0.160 | 0.545 | 0.340 |

BN: Weight Value; NE: Effectiveness Value and NP: Product Value

The best product value of the organoleptic test for the M7 genotype rice quality was in G3 which had a value of 1.000 and the worst value was in G1 which had a value of 0.121. In parameters of aroma, color, texture, shape, and overall acceptance, the highest value was found in G3 with results of 0.133; 0.067; 0.333; 0.267 and 0.200.

The main thing related to the organoleptic test of M7 genotype rice quality was the color. Color is the first impression captured by panelists before recognizing other stimuli. Color is very important for every food as attractive colors will influence consumer acceptance [19].

4. Conclusion

Determination of the harvesting of the M7 genotype rice was the potential result and the weight of 1000 grains. The product value of physicochemical properties of the M7 genotype rice quality was in G2 which had a value of 0.107. In the parameters of kamba density, water content, and amylose content, the highest product value was found in G6 with results of 0.178; 0.089 and 0.044. In the parameters of the milled rice soaking, whiteness and starch content, of the highest product values was found in the G3 with the results of 0.067; 0.133 and 0.200. In the parameters of rice dimensions and amyllopectin levels, the highest value was found in G4 and G5 with results of 0.156 and 0.022. The best value of the organoleptic test product for the M7 genotype rice quality was in G3 which had a value of 1.000 and the worst value was in G1 which had a value of 0.121. In the parameters of aroma, color, texture, shape, and overall acceptance, the highest values were found in the G3 with the results of 0.133; 0.067; 0.333; 0.267 and 0.200.

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