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Characteristic of Panicle in M4 Red Rice Mutant

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Abstract. The need for rice is always increasing every year in line with population growth so that rice commodities have a very important role. Red rice which has been known for a long time, needs to be given priority in research to overcome the problem of food and nutrition shortages. The important of yield component to be improved, which has a crucial organ with economic values, is rice panicle. The study aimed to obtain information on relationship within the panicle characters on rice production. The experiment was conducted during 6 month using 10 red rice mutants lines M4 and 2 non-mutant lines as a control. Data from yield components used were The number of grains per panicle, panicle density, percentage of filled grain per panicle, grain length, grain width, and thick grain. Based on the results of the analysis of cross prints of these characters, it is known that there are four characters that have a total positive and significant direct effect on the weight of grain per panicle the number of grains per panicle, panicle density, panicle length and percentage of filled grain per panicle, so these characters are important and effective to be used as a selection component in increasing grain production in red rice plants. Tests of several M4 generation red rice mutants based on grain characterization showed very significant differences in grain length and grain width characters. The longest grain is GK2 strain (10.33 mm) and the widest grain is G9 strain (3.29 mm).

Keyword : Red rice Mutant, Panicle, grain

1. Introduction

Rice (Oryza sativa L.) is the main foodstuff of most of Indonesia's population. Rice is the main food commodity of the people of Indonesia, almost all residents in this country consume rice every day. The need for rice to meet food needs always increases every year in line with population growth. In terms of increasing and strengthening food security in Indonesia, rice commodity has a very important and strategic role (Bulog, 2018). [1]

Intensification of national superior rice has been done but it has not been able to meet food needs. On the other hand available local rice that has not been used and cultivated well and intensively. Local rice varieties planted by farmers are varieties that have been planted for decades and are selected by nature. Local rice planting is favored by farmers because some have good adaptability to the sub-optimal environment including peatland ecology, delicious rice taste, fragrant aroma, proven resistance to pests and good quality rice. New varieties are partly undesirable by farmers because they require intensive maintenance and optimal environment optimal (Munandar et al.,[2] 1996; Hidayat, 2002). [3]

Local rice that is widely known by the community in general is brown rice. In addition to containing carbohydrate, fat, protein, fiber and minerals, brown rice also contains anthocyanin and is widely consumed as a healthy food (Abdullah Buang 2017)[4]. Red rice local rice generally has the characteristics of a long life, long panicles, little tillers and a fairly high posture.[5] According to (Okasa et al.,(2019) [6], another characteristic of local rice is that it has strong and deep roots but is not responsive to the application of fertilizer, deep age, high stems so that it easily fell and low production, however the quality of rice is not bad compared to national rice.

Rice production is determined by one of its main organs, namely rice panicles. Various components of the yield continue to be improved, one of which is an important organ of economic value, namely rice panicle. The lack of information on genetic studies and morphology of rice panicles encourages in-depth study of morphological characters of rice panicles to produce varieties with panicle ideotypes that can increase yield potential. Rice panicles consist of complex branches and grains found along branches.[7] The contribution of these two components will determine the yield of rice in addition to the number of productive tillers. The yield on rice plants is determined by the characters associated with the yield components, especially panicle characters,[8] so this research needs to be done to determine the direct effect of panicle characters on production yields.

2. Materials and Method

This research was carried out in the Paddy Field in Tana Toraja District, Gandang Batu Sillanan District, Buntu Limbong Village and continued at the Hasanuddin University's Faculty of Agriculture seed laboratory. The research took place in December to July 2019. The experiment was arranged based on a Randomized Block Design (RCBD) with two replications. The treatments were 10 M4 generation mutant lines and 2 non-mutant lines as controls.

Land management is carried out using a tractor until the land is clean and ready for planting. The seedlings are planted in a 1m x 1m seedling land. after the seeds are 3 weeks old, the seeds are transferred to the prepared land.

Planting is done manually. The spacing used is 30cm x 30cm with one seed per planting hole. The soil condition at the time of planting is muddy. Weeding is done 2 times where the first weeding is done after the plants are 7 days after planting and the second weeding is done after the plants are 15 days after planting. Fertilizing is done 2 times, namely the first fertilizing at 2 weeks after planting and the second fertilizing at the age of 8 weeks after planting. Spraying pests according to the types of pests that attack. Harvesting is done if the rice grain has yellowed according to harvest criteria. Harvesting is done manually.

Observations were made on each of the 12 samples from each treatment line and control line. Characteristics of yield components observed for panicle characteristics were number of grains per panicle, panicle density, panicle length, percentage of filled grain per panicle, weight of 100 seeds and grain yield per panicle. Panicle density data is obtained from the division between the number of grains per panicle and panicle length. Data were tabulated using MS Excel 2010. Path coefficient analysis was

performed using SPSS version 16. Characteristics of yield components observed for grain characteristics are grain length, grain width, and grain color. The observational data obtained were analyzed in variance and if there was a real effect on food treatment continued with the LSD test.

3. Results and discussion

3.1 Panicle characteristics

Path analysis is used to determine the direct and indirect effects of characters that contribute to grain yield. The characters tested using cross analysis are the characters that have a real correlation coefficient value of the grain weight per panicle.[9] The results of the path analysis of red rice panicle characters are shown in Table 1, from these results shows that all characters are the number of grains per panicle, panicle density, panicle length, percentage of filled grain per panicle and weight of 100 seeds have a positive correlation coefficient on production per panicle that is 0.095, 0.0592, 0.244, 0.249, 0.163.

Table. 1 Direct, indirect and total effects of the characters panicle components to the grain weight per panicle

Characters of panicle components	Direct effects	Indirect effects					Total effects
		X1	X2	X3	X4	X5	
X1	0.095	-	-0.182	-0.112	-0.484	0.501	0.0131**
X2	0.592	0.572	-	0.928**	0.741**	-0.224	0.3591**
X3	0.244	0.729	0	-	0.805**	-0.083	0.3744**
X4	0.249	0.111	0.006	0.002	-	-0.119	0.3105**
X5	0.163	0.097	0.483	0.797	0.714	-	-0.0030ns

X1 = number of grain per panicle, X2 = Density of panicle, X3 = panicle length, X4 =Percentage of grain content per panicle, X5 = Weight of 100 seeds, ** = significant at the 0.01 level, ns = non significant

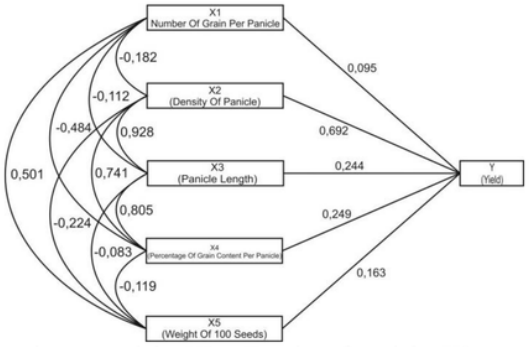
Characters in these conditions have a direct influence that tends to be uniform among characters. Characters with the highest direct effect on grain weight per panicle are owned by panicle density (0.592) so that the direct effect is a reflection of the magnitude of the correlation coefficient. Jugin (2002) [10]states that the nature of each genetic and the environment in which the variety grows will affect the grain density of each panicle. Voidness can also be caused by non-genetic factors, such as pests and diseases.

The character with the smallest direct effect is found in the number of grains per panicle (0.095). According to Singh and Chaudary (2007),[11] if the correlation coefficient between characters has a real value and is almost the same as the value of direct influence, then the correlation value shows the actual relationship between the two characters. If the correlation coefficient value is real but the direct effect is negative or very small, then the indirect effect causes the correlation coefficient value to be real.

In this study there are four characters that have a total positive and significant direct effect on grain weight per panicle, namely the number of grains per panicle, panicle density, panicle length and percentage of filled grain per panicle with a total value of direct influence respectively 0.0131, 0.3591, 0.3744 and 0.3105. The character that has the highest total direct influence is owned by panicle length of 0.3744, so it can be used as a selection criterion for selecting superior mutant line red rice with high grain yield per panicle and only one character has a negative and insignificant total direct effect value to the production of grain per panicle that is the weight of 100 seeds (-0.0030). This is consistent with the opinion of Wibowo Puji (2010) [12] which states that panicle length is a parameter that determines

the high and low productivity of a strain / variety and panicle length components are the main supporting factors for yield potential because the longer the panicle the greater the chance of the number of grain in one rice plant .

Figure 1. A path diagram of some rice panicle characters on grain production per panicle.



X1 = number of grain per panicle, X2 = Density of panicle, X3 = panicle length, X4 =Percentage of grain content per panicle, X5 = Weight of 100 seeds,

The diagram shows that the number of grains per panicle, panicle density, panicle length, percentage of filled grains per panicle, and the weight of 100 seeds has a positive correlation coefficient on grain production per panicle ie 0.095, 0.592, 0.244, 0.249, 0.163

3.2 Characteristics of grain

The grain characters observed in this study were grain length and grain width.

Table 2. Average length and width of grain of several local red rice mutant lines

Lines	Grain Lenght	Grain Width
GK1	7.77 cd	2.64 g
GK2	10.33 a	2.32 h
G1	7.87 bcd	2.90 e
G2	8.19 bcd	2.94 d
G3	8.27 bc	2.83 f
G4	8.16 bcd	2.90 e
G5	8.36 b	2.99 bc
G6	8.07 bcd	2.95 cd
G7	8.34 b	3.01 b
G8	7.68 d	2.86 ef
G9	7.90 bcd	3.29 a
G10	7.97 bcd	2.78 g

Values in each average column followed by different letters for each treatment showed significant differences according to LSD 5%

From Table 8. the average grain length of some mutant rice lines showed significant differences. The longest grain length was obtained in the GK2 strain (10.33 mm), while the shortest grain length was obtained in the G8 strain (7.68 mm). From table 8. it can also be seen that the grain width in some mutant

rice lines shows very significant differences. The widest grain width was obtained in the G9 strain (3.29 mm), while the narrowest grain width was obtained in the GK2 strain (2.32 mm).

The length and width of the grain represent a very real difference from each line tested. The difference is caused by genetic differences that cause each cultivar to have special characteristics and characteristics that are different from each other. This is consistent with the statement of Herlina Fitri (2009) [13] which states that the genetic makeup is one of the factors causing diversity in plant appearance. The genetic program will be expressed on a variety of plant traits which include the shape and function of plants that produce different plant growth diversity.

4. Conclusion

1. Based on the results of this path analysis there are four characters that have a total positive and significant direct effect on the weight of grain per panicle, namely the number of grains per panicle, panicle density, panicle length and percentage of filled grain per panicle with the total value of each direct effect 0.0131, 0.3591, 0.3744, and 0.3105, so these characters are important and effective to be used as a selection component in increasing grain production in red rice plants.
2. Tests of several M4 generation red rice mutants based on grain characterization showed very significant differences in grain length and grain width characters. Where the one who has the longest grain is the GK2 strain (10.33 mm) and the one who has the widest grain is the G9 strain (3.29 mm). this can support grain production in red rice plants.

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