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Characterization of Several Rice (*Oryza sativa* L.) Varieties as Germplasm

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Abstract. Characterization of Rice plant (*Oryza sativa* L.) is required to obtain its potential or to eliminate unwanted characters for variety improvement. This research was conducted from September 2018 to April 2019. Non-factorial randomized block design (RBD) was used, with five varieties, namely 'Landak' (V1), 'Inpari 24' (V2), 'Sintanur' (V3), 'Sidenuk' (V4) and 'Ciherang' (V5). The characters observed were plant height, number of productive tillers, panicle length, flag leaf length, flowering age, harvesting age, number of grain, number of pithy grains, and yield potential. The data were analyzed using ANOVA and Tukey's HSD test at 5%. The result showed that Ciherang belonged to the first group (≤ 20 tillers). Sidenuk, Sintanur, Inpari 24 belonged to the second group (21-30 tillers), and 'Landak' fell under the third group (> 36 tillers). For harvesting age, 'Ciherang' and 'Sintanur' were in the first group (≤120 days), 'Sidenuk' and 'Inpari 24' were in the second group (121-140 days), and 'Landak' come under the third group (> 140 days). For 1000 grain weight, three varieties resulted lower than their plant description: 'Landak' (20.26 g), 'Ciherang' (25.30 g), and 'Sintanur' (26.48 g), while 'Inpari 24' and 'Sidenuk' exceeded their plant description with 26.89 g and 26.06 g, respectively.

1. Introduction

Indonesia is one of the countries that is wealthy in large diversity of germplasm, but this potential has not been developed optimally. The development of the potential for germplasm is needed to create development in various industrial fields, especially agriculture. The development of germplasm for the benefit of farmers continues. One of the realistic efforts that can be done is by reducing input costs, for example, by producing superior local rice seeds at relatively cheap cost, so that the benefits obtained by farmers are greater. The development of germplasm also aims to conserve local rice varieties as gene banks for plant breeding purposes [1].

Rice is a very important staple requirement for the society. Rice contains sufficient nutrients which is also known as an energy food which is very important for human body as the main sustenance [2]. However, many people currently prefer food that is not only compact with energy, but also have health and medicinal benefits, such as black rice.

Black rice is one type of rice in the world, apart from white rice, brown rice and red rice. Currently, black rice is starting to be in great demand and consumed by the public as a functional food because it contains one or more compounds that have physiological functions for health. Black rice is one of the rice that has a high anti-oxidant content compared to white rice because it has a dark purple pericarp layer [3]. Anticancer content can be used as a health functional food ingredient because it functions as an anticancer, antioxidant, hypoglycemia and provides anti-inflammatory effects. Anthocyanin pigments are also effective which can reduce cholesterol levels. Hence, black rice has a good health

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value for functional food. However, it has a slightly unlikable taste compared to white rice. Further variety improvement for black rice is a prospective option, in order to preserve its health benefit, but improve other qualities.

Thus, black rice as one of the germplasm that needs to be preserved, which can also be used as a genetic source in plant breeding, needs to be characterized to determine its genetic potential. With the identification of the agronomic and morphologic characters of local superior variety of black rice, it is hoped that information obtained can later be used in development programs of local potentials.

2. Materials and Methods

The research was conducted from September 2018 to April 2019 at the Jember State Polytechnic screen house, Jember Regency, East Java. This study used a non-factorial randomized block design with 1 factor Variety (V), namely:

V1 = Black ('Landak')
V2 = 'Inpari 24'
V3 = 'Sintanur'
V4 = 'Sidenuk'
V5 = 'Ciherang'

Each treatment was repeated 5 times, in which 25 experimental units were obtained. The results of the observations were analyzed using ANOVA and further tested using Least Significant Difference (LSD) at 5% error level.

Observation parameters include qualitative and quantitative parameters. Qualitative parameters include plant shape, stem color, leaf surface, leg color, leaf tongue color, leaf ear color, leaf color, grain color, grain shape. Quantitative observations include vegetative plant height (cm), number of tillers, flowering age (days after planting), harvest age (days after planting), generative plant height (cm), panicle length (cm), flag leaf length, number of productive tillers, number of grains per panicle, number of pithy grains per panicle, Production per hectare, potential yield.

3. Results and discussion

3.1. Qualitative Parameters

Qualitative observations are descriptive observations using analyzes that are differentiated by class or type, both visually and using scores. The results of qualitative observations of five local superior rice cultivars are presented in Table 1.

Table 1. Summary Of Qualitative Observation Data

Characters	Varieties				
	V_1	V_2	V_3	V_4	V_5
Plant Form	Upright	Upright	Upright	Upright	Upright
Stem Color	Drak Green	Green	Green	Green	Green
Leaf Surface	Very Rough	Rough	Rather Rough	Rough	Rough
Foot Color	Dark Green	Green	Green	Green	Green
Color Of Leaf Togue	Colorless and hairy	Colorless	Colorless	Colorless	Colorless
Leaf color	Green	Green	Green	Green	Green
Grain color	Straw yellow	Straw yellow	Net yellow	Straw yellow	Straw yellow
Grain form	Medium	Gent	Gent	Gent	Gent

Note: Landak (V_1), Inpari 24 (V_2), Sintanur (V_3), Sidenuk (V_4), Ciherang (V_5)

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Based on the data in Table 1, it can be seen that the shape of 'Landak' (V1), 'Inpari 24' (V2), 'Sintanur' (V3), 'Sidenuk' (V4) and 'Ciherang' (V5) is upright which is depicted from the angle of the stems formed less than 30°. Plant shape is the appearance of a clump of plants based on the angle formed between the tiller stems and the imaginary line in the middle of the clump and perpendicular to the ground surface area. An upright plant shape can trigger the growth of many and productive tillers so that it can increase production yield.

The color of the stems, the surface of the leaves, the color of the legs, the color of the tongue of the leaves and the color of the leaves show different observations for each rice plant variety as shown in Table 1. Differences in the color of the legs, tongue color, stem color and leaf surface are caused by genetic factors brought by their parents. The appearance of a plant is determined by genetic, environmental and interactions between the two. The qualitative characters that emerge are influenced by many genetic factors that are carried or passed down from the parents [4]. Green leaves provide a better opportunity for photosynthesis and the leaf epidermis, including stomata, is an anatomical feature that can be used to distinguish rice cultivars [5]. The appearance of the epidermis, which consists of long cells and short cells, as well as the stomata type are characteristics that can be used to distinguish each type of plant from the Gramineae tribe. The chances of photosynthesis are better in green rice plants, this is the leaf that has a lot of chlorophyll so that it can produce assimilates which will later be stored in the form of rice [6].

Grain color and grain shape in each variety also have different characteristics. These differences are due to different rice varieties. This is influenced by genetic factors that can produce different shapes and colors of grain. Genetic factors can be in the form of parental traits or genes carried by parents that are passed on through the parent so that the form of grain can be produced according to the description of the rice variety. Grain is actually not a seed but a rice fruit covered in lemma and palea. This fruit occurs after the completion of pollination and fertilization. Lemma and palea are what form the husk or grain skin [7]. The shape of the grain in each rice plant variety shows that 'Landak' (V1) is round and small in shape and the color of the grain is straw yellow so it has less weight than the four varieties, while 'Inpari 24' (V2), 'Sintanur' (V3) 'Sidenuk' (V4) and 'Ciherang' (V5) showed slender grain shape and are straw yellow and clean yellow.

The shape of grain can affect the production of grain produced in each rice variety. The larger the grain size, the higher the weight of 1000 grains in which will affect rice production in each variety. The form of grain which is slender and has a yellow-straw color of grain is favored by farmers because of its shape and will affect the weight of 1000 seeds. The new type of rice (PTB) IRRI apart from low yields, long life, still has a round grain shape and medium lime grains so it is not liked by farmers [6].

3.2. Quantitative Parameters

Quantitative characters which are important characters such as production, protein content and yield quality are controlled by many genes, each of which has a small effect on these characters [4]. The summary of data from quantitative observations on several rice varieties can be seen in Table 2 below:

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Table 2. Summary Of Results Test F (Anova) Quantitatitve Observation

No.	*Observation Parameters*	*Notation*
		Factor V (Varieties)
A.	*Vegetative phase*	
1.	*Plant height at 21st DAP*	NS
2.	*Number Of Tillers at 70st DAP*	**
B.	*Generative phase*	
3.	*Plant height*	**
4.	*Panicle length*	**
5.	*Flag leaf length*	**
6.	*Number of productive tillers*	**
7.	*Flowering age*	**
8.	*Harvest age*	**
9.	*Number of grains per panicle*	**
10.	*Number of pithy grains per panicle*	**
11.	*Yield (production per hectares)*	**
12.	*Yield potential*	**

Note :
NS = non significant
* = significant at 5% of error level*
** = significant at 1% of error level*

The qualitative parameters of each variety showed different results, this was influenced by genetic factors that were passed on by the parents. Quantitative parameters indicate the number of tillers that appear due to the spacing used during cultivation. The rice varieties used in this study had a higher number of tillers compared to the number of tillers in the variety description. This is because the method of planting is on a bucket and each bucket consists of one plant, while planting on land can produce smaller number of tillers. The small number of tillers was caused by the competition for nutrients that were given so that the absorption of nutrients was not optimal. Nutrient provision, spacing, and temperature can affect plant height [8]. Dense planting, high nitrogen application, and high temperature can affect the length of the stem internodes, besides the genetic characteristics carried can affect the plant height of each rice plant variety.

Table 3 Quantitative character of each variety tested on several agronomic parameters

Variety	Observation parameters					
	Generative Plant Height (cm)	Number of Productive Tillers	Panicle Length (cm)	Flag Leaf Length (cm)	Flowering Age (DAP)	Harvest age (DAP)
Sidenuk (V4)	99,60 ab	20,73 a	22,19 b	22,12 b	85,13 a	122,67 cd
Ciherang (V5)	96,80 a	19,40 a	22,32 b	21,86 a	84,07 a	122,53 c
Sintanur (V3)	100,60 b	22,27 a	22,04 b	22,93 b	85,13 a	118,47 b
Inpari 24 (V2)	110,53 c	23,33 a	21,79 b	21,99 b	86,60 ab	114,47 a
Landak (V1)	152,33 d	35,73 b	19,62 a	32,91 b	112,00 b	221,47 d

Note: Numbers followed by the same letter in the same column show insignificant differences according to the LSD test at 5% error level

From table 3, it appears that 'Landak' (V1) has the highest generative plant height and the number of productive tillers compared to other varieties, with 152.33 cm of plant height and 35.73 productive

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tillers. The number of productive tillers determines the level of reproductive ability of a variety. The classification of the number of tillers was classified as very high (> 25 tillers/plant), high (20 - 25 tillers/plant), moderate (10 - 19 tillers/plant), low (5 - 9 tillers/plant), and very low (<5 tillers/plants) [9].

'Landak' has the shortest panicle, which is 19.62 cm, but has the longest flag leaf which is 32.91 cm. The length of the panicles can trigger a lot of grain growth, so that rice production can increase with the presence of grains that appear in each rice plant panicle. The ability to produce rice panicle types and the productivity level of each panicle will determine the total productivity of the plant [10].

'Ciherang' (V5) had the fastest flowering age at 84.07 days after planting (DAP), while the longest flowering age was 'Landak' (V1) with 112 DAP. The fastest harvesting age was 'Inpari 24' (V2) with 114.47 DAP, while the longest harvesting age was 'Landak' (V1) with 221.47 DAP. The flowering age of rice plants affects the harvest age of each rice plant variety. The faster the rice plants flower, the faster the harvest age of each rice plant variety will be.

Flowering age is influenced by the generative characteristics of these rice varieties. In addition to generative characteristics, factors that can affect the flowering age of rice plants are temperature, solar radiation, humidity and season when the plants enter the generative phase.

Table 4. Quantitative character of each variety tested on several production parameters

Variety	Observation parameters				
	Number of Grain Per Panicle	Number of Pithy Grain Per Panicle	Production Per Hectare (ton/ha)	Potential Yield (ton/ha)	Weights of 1000 grains
Sidenuk (V4)	177,73 b	177,73 c	13,01 ab	15,43 ab	26,06 bc
Ciherang (V5)	157,44 ab	140,27 b	11,01 a	12,34 a	25,30 b
Sintanur (V3)	143,64 a	127,04 ab	11,99 a	13,54 a	26,48 c
Inpari 24 (V2)	136,78 a	120,27 ab	11,98 a	13,64 a	26,89 cd
Landak (V1)	148,16 a	106,53 a	14,93 b	17,14 b	20,26 a

Note: Numbers followed by the same letter in the same column show insignificant differences according to the LSD test at 5% of error level

Table 4 shows that 'Sidenuk' (V4) produced more grain per panicle and more pithy grain per panicle than other varieties, with 177.73 grains per panicle and 177.73 pithy grains per panicle. The varieties that had the most production per hectare and yield potential were 'Landak' (V1) 14.93 ton/ha and 17.14 ton/ha, respectively.

The number of grains per panicle consists of empty and pithy unhulled rice, this is influenced by genetic and phenotypic factors. One factor that is influenced by genetic factors is the number of tillers that appear in rice plants, while the phenotypic factors are influenced by sunlight, temperature, climate and proper maintenance.

Meanwhile, the variety that had the highest weight of 1000 seeds was the 'Inpari 24' (V2) with 26.89 gram, while the variety with the lowest 1000 grain weight was the 'Landak' (V1) 20.26 gram. 'Landak' has a low seed weight of 1000 seeds because the size of 'Landak' seed is small compared to the size of the seeds of other varieties. The 1000 grain weight is one of the methods used to test the quality of a seed. The shape and size of the seeds are determined by genetic factors that can affect the weight of 1000 seeds of a seed. The length and weight of seeds depends on the amount or not of dry matter contained in the seeds [7]. The dry matter in the seeds is obtained from photosynthesis which can then be used for seed filling.

3. Conclusions

In conclusion, the agronomical and morphological characters of 'Landak' as a local black rice has been obtained, in both vegetative characters and production characters, with of all the tested white rice variety above being in accordance with the variety description.

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