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Agronomic Characteristics and Kinship Of 10 High Yielding Inbred Rice Varieties (Oryza Sativa L.) In West Java

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Abstract
Background. The success of rice production is influenced by many factors, one of which is the selection of varieties. Varieties, as a supporting factor in increasing agricultural productivity, will be able to show values according to potential yields with optimal farming management.
Aims. This study aims to examine the differences in agronomic characteristics and kinship of 10 high-yielding inbred rice varieties (Oryza sativa L.) in West Java. The experiment was conducted at the Variety Display Land, Pamekaran Village, Soreang District, Bandung Regency. The experiment was conducted from April to August 2024. The experimental location was situated at an altitude of 700 m above sea level.
Methods. The agronomic characteristic experiment method used a qualitative descriptive approach. In the experimental approach, a Randomized Block Design (RBD) was employed with 10 inbred rice phenotype treatments, repeated three times. The materials used in this experiment were 10 high-yielding inbred rice varieties.
Result. Based on the study's results, similarities were observed in morphological characters among several inbred rice varieties, including those in Group I, Inpari 32 HDB, and Situ Bagendit, with a similarity level of 100%. In Group II, the Mekongga, Inpari 42, Inpari 33, and Inpari 30 varieties, and in Group III, the Ciherang and Padjadjaran Cakrabuana Agritan varieties, achieved a coefficient value of 78%.
Conclusion. The similarity is 0.10 or 100% with a similarity coefficient level of 100% seen from the morphological character data based on the Rice UVOP Table.

Keywords: Agronomic Characters, Relationships, Kinship, Rice, Yield.

INTRODUCTION

West Java is one of the largest rice-producing provinces in Indonesia. In 2023, West Java produced 9.14 million tons of GKG rice, ranking it one level below East Java, which

produced 9.71 million tons of GKG (Central Bureau of Statistics, 2024). If converted into rice, West Java is expected to produce around 5.25 million tons of rice in 2023. West Java Province can be categorized as having the most significant rice needs compared to other provinces. Based on Central Bureau of Statistics (2023), the population of West Java is 50.025 million people, with a rice consumption rate of 82.78 kg/capita/person/year, so the rice needs of the people of West Java are 4.14 million tons, so that West Java still has a rice surplus of 1.1 million tons of rice. However, this condition must be maintained considering the increasing population and the decreasing potential harvest area. Therefore, providing rice production to meet the community's rice needs sustainably is necessary to prevent food shortages.

The success of rice production is influenced by many factors, one of which is the selection of varieties. Varieties, as a supporting factor in increasing agricultural productivity, will be able to show values according to potential yields with optimal farming management (Aristya & Taryono, 2019). Varieties with desirable and profitable characteristics can support high yields. Identifying characteristics in plants is highly beneficial for distinguishing one plant from another (Akbar et al., 2022; Ulfa et al., 2023; A'yun et al., 2022).

Agronomic characters are traits that influence or determine the potential yield of a plant. High diversity in the generative phase indicates that characters are more influenced by genetic factors, allowing them to have a significant effect on the components of yield and overall plant yield. The new superior rice varieties studied have different performances in growth, number of tillers, yield components, and yield (Hamdani & Haryati, 2021). Agronomic characters play a role in the distribution of a plant's yield, including the number of productive tillers, the number of empty tillers, the number of grains per panicle, and the weight of dry milled grain (Ezward et al., 2020).

Characterization is an observation of good traits that are influenced or not influenced by the environment (Yulina et al., 2020). These traits encompass both qualitative and quantitative characteristics of plants. Each variety of a commodity can exhibit similarities or differences in traits or characteristics. The existence of these similarities or differences can be used to determine the degree of kinship between rice varieties. The more similarities in traits, the closer the kinship relationship. Conversely, the more differences in traits, the further the kinship relationship. Grouping the same traits is the basis for classification (Nursida et al., 2024).

The information generated from characterization activities is valuable, including

plant performance, which can provide an indication of yield and identify characters that need to be improved in a variety or accession, allowing for the development of new varieties that can address future challenges (Yullianida & Hermanasari, 2023). In addition, morphological and agro-morphological characterization of plants will provide information on the uniqueness of a genotype. Thus, the quality of agricultural products, in the form of new, superior varieties, can be obtained according to the expectations of the community, especially farmers. West Java currently cultivates rice with a variety of different varieties. High-yielding varieties that are popular in West Java include Inpari 32 HDB, Ciherang, Mekongga, Situ Bagendit, Inpari 42 Agritan GSR, Inpari 30, Inpari 33, Cakrabuana Agritan, Padjadjaran Agritan, and Inpari 50 Marem. These ten varieties have high yield potential and are quite popular among the public, based on seed data certified by the West Java Food Crops and Horticulture Seed Supervision and Certification Center (BPSBTPH).

MATERIALS AND METHODS

The experiment was conducted at the Variety Display Land, Pamekaran Village, Soreang District, Bandung Regency. The experimental period was April-September 2024.

The materials used in this study were 10 high-yielding inbred rice varieties, namely Inpari 32 HDB, Ciherang, Mekongga, Situ Bagendit, Inpari 42 Agritan GSR, Inpari 30, Inpari 33, Cakrabuana Agritan, Padjadjaran Agritan, and Inpari 50 Marem. Urea fertilizer, SP 36, KCl, lime/dolomite, manure, herbicide, fungicide, insecticide, bucket, and sack.

The tools used in this study were a camera, meter, scales, stationery, labels, hoes, machetes, knives, scissors, tongs, brand boards, raffia rope, and a calculator, as well as a UVOP table.

The experimental method of agronomic characteristics uses qualitative descriptive methods. In the experimental approach, a Randomized Block Design (RBD) was used with 10 phenotype treatments of Inbred rice and repeated 3 times.

RESULTS AND DISCUSSION

One of the primary factors contributing to the success of efforts to increase rice production is the use of superior varieties that yield high yields and are resistant to pests and major diseases. For this reason, rice germplasm is essential as a source of genetic traits for developing superior varieties.

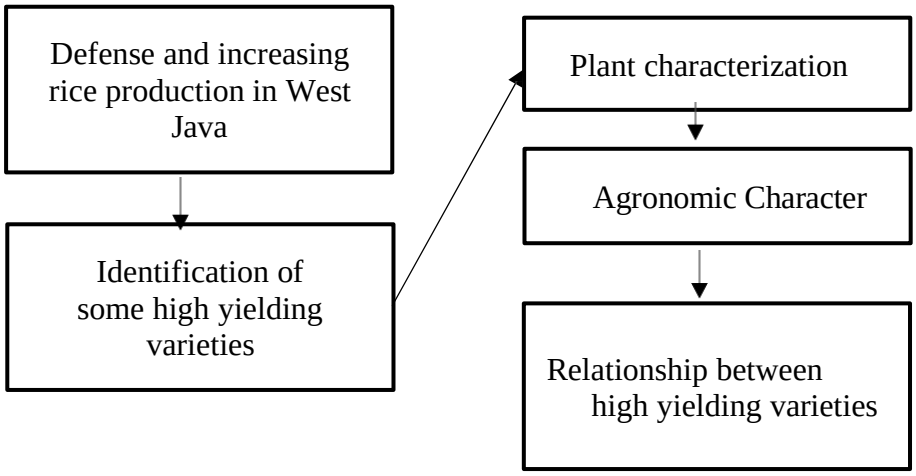

Figure 1. Agronomic Characteristics and Kinship of 10 High-Yielding Inbred Rice Varieties in West Java

The morphological characteristics of 10 inbred rice varieties have similarities and differences in leaf color, leaf surface hairs, leaf sheath color, leaf tongue shape, and flag leaf width (Table 1).

Table 1. Identification of Morphological Characters In 10 Superior Inbred Rice Varieties.

Variety name	Leaf Color	Leaf surface hairs	Leaf Sheath Color	Leaf Tongue Shape
Inpari 32 HDB	green	fine	green	Split
Ciherang	dark green	rough	green	Split
Mekongga	dark green	fine	dark green	Acute
Situ Bagendit	green	rough	green	Split
Inpari 42 Agritan Gsr	green	rough	green	Split
Inpari 30	green	rough	green	Split
Inpari 33	light green	fine	light green	Split
Cakrabuana Agritan	green	rough	green	Split
Padjadjaran Agritan	light green	fine	green	Split
Inpari 50 Marem	green	rough	green	Split

Leaf color characteristics are divided into three groups, namely light green, green and dark green. The light green leaf color character is found in the Inpari 33 and Padjadjaran Agritan varieties. Inpari 32 HDB, Situ Bagendit, Inpari 42, Agritan GSR, Inpari 30, Cakrabuana Agritan and Inpari 50 Marem have the same leaf color, namely green. In contrast, the Ciherang and Mekongga varieties have dark green leaf colors.

The characteristics of the leaf surface hairs of 10 hybrid rice varieties are divided into two groups. Fine hairs are found in the Inpari 32 HDB, Mekongga, Inpari 33, and Padjadjaran Agritan varieties. Rough leaf surface hairs are found in the Ciherang, Situ Bagendit, Inpari 42 Agritan Gsr, Inpari 30, Cakrabuana Agritan, and Inpari 50 Marem varieties.

The characteristics of leaf sheath color are divided into three groups, namely light green, green, and dark green. The characteristics of light green leaf sheath color are obtained in the Inpari 33 variety. The characteristics of green leaf sheath color are obtained in the Inpari 32 HDB, Ciherang, Situ Bagendit, Inpari 42 Agritan Gsr, Inpari 30, Cakrabuana Agritan, Padjadjaran Agritan varieties, and the Inpari 50 Marem variety. The characteristics of green leaf sheath color are obtained in the Mekongga variety.

The characteristics of the leaf tongue are generally split, except for the Mekongga variety, which is acute. The characteristics of the superior hybrid rice plant, including height at the ages of 30 HST, 60 HST, and 75 HST, are presented in Table 2.

Table 2. Characteristics of Rice Plant Height at the Age of 30 HST, 60 HST and 75 HST

Variety Name	Average Plant Height		
	30 DAP	60 DAP	75 DAP
Inpari 32 HDB	67.67^{d}	92.47^{f}	96.13^{c}
Ciherang	66.00^{d}	94.53^{g}	110.80^{f}
Mekongga	60.67^{c}	81.87^{d}	100.13^{d}
Situ Bagendit	64.30^{d}	87.27^{e}	100.13^{d}
Inpari 42 Agritan Gsr	70.83^{e}	73.80^{a}	91.60^{a}
Inpari 30	58.63^{c}	86.73^{e}	98.87^{d}
Inpari 33	49.40^{a}	75.53^{b}	90.80^{a}
Cakrabuana Agritan	49.00^{a}	80.67^{d}	99.07^{d}
Padjadjaran Agritan	53.47^{b}	78.60^{c}	93.60^{b}
Inpari 50 Marem	60.57^{c}	92.80^{f}	102.93^{e}

Description: The average number marked with the same letter in each column shows no significant difference according to the Skott-Knott Test at a 5% level of significance.

Based on Table 2, at the age of 30 HST, the Inpari 42 Agritan Gsr variety exhibited the highest plant height compared to other varieties; however, at the ages of 60 HST and 75 HST, the Ciherang variety showed the highest plant height among the other varieties.

The characteristics of Panicle Length, Number of Vegetative Tillers, and Number of Productive Tillers can be seen in Table 3.

Table 3. Characteristics of Panicle Length, Number of Vegetative Tillers and Number of Productive Tillers

Treatment	Panicle Length (cm)	Number of Vegetative Offshoots	Number of Productive Offspring
Inpari 32 HDB	24.40[a]	20.93[b]	22.73[b]
Ciherang	28.40[b]	25.60[c]	24.00[b]
Mekongga	28.13[b]	21.47[b]	23.60[b]
Situ Bagendit	28.80[b]	24.87[c]	16.07[a]
Inpari 42 Agritan Gsr	27.73[b]	20.27[b]	19.00[a]
Inpari 30	26.87[b]	24.47[c]	24.87[b]
Inpari 33	27.07[b]	13.80[a]	21.67[b]
Cakrabuana Agritan	27.60[b]	14.07[a]	25.07[b]
Padjadjaran Agritan	27.13[b]	14.33[a]	16.87[a]
Inpari 50 Marem	27.33[b]	29.60[d]	31.47[c]

Description: The average number marked with the same letter in each column shows no significant difference according to the Skott-Knott Test at a 5% level of significance.

Based on Table 3, the analysis of the lowest panicle length observations yielded results that were more favorable in the Inpari 32 HDB variety compared to other treatments. The highest number of vegetative and productive tillers was obtained in the Inpari 50 Marem variety compared to other varieties.

To determine the kinship relationships among the 10 rice varieties, cluster analysis was performed. Cluster analysis is a method that aims to separate individual units into several groups with specific properties, allowing a group of multiple variable data to be described simply in terms of these groups. The results of the cluster analysis are presented in the form

of a dendrogram, with correlation coefficient distances expressed as a percentage of similarity. The data was processed using Microsoft Excel and NTSYS programs. The dendrogram was created using the SHAN (Sequential Agglomerative Hierarchical Nested Cluster Analysis) function with the UPGMA (Unweighted Pair Group Method with Arithmetic Mean) method. Furthermore, to see the differences in appearance between the tested characters, the quantitative data were analyzed using analysis of variance, followed by the Scott-Knott Test at the $\alpha = 5\%$ level.

These similarities and differences are often used to determine genetic kinship between rice varieties. The more similar the characteristics of a plant, the closer the genetic relationship. Conversely, the greater the differences in plant personality, the greater the distance in kinship. Grouping based on similar characteristics is the basis for variety classification (Irawan & Purbayanti, 2018). Identification of several rice varieties is essential and can serve as an initial step in producing rice varieties with high yields.

Phenetic analysis produces a dendrogram that divides 10 inbred rice varieties into two branches (Figure 2).

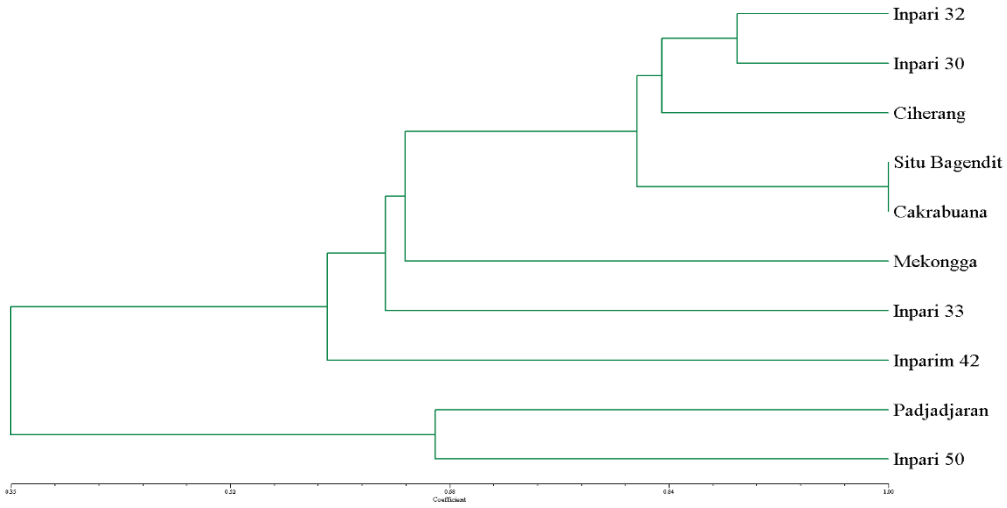

Figure 2. Dendrogram of Kinship Relationship of 10 Inbred Rice Varieties Based on Morphological Characteristics

Kinship relationship of 10 inbred rice varieties based on morphological characteristics (Figure 2). Based on the dendrogram of 10 inbred rice varieties tested, they have almost the same similarity with a similarity value level of 0.59, namely in Growth Habits, Ligula/Flag

Leaves, Leaf Tongue Shape and Leaf Tongue Shape and Grain Color, all inbred rice varieties, namely Inpari 32 HDB, Ciherang, Mekongga, Situ Bagendit, Inpari 42, Inpari 30, Inpari 33, Cakrabuana Agritan, Padjadjaran Agritam, and Inpari 50 Marem.

Similarity analysis of ten inbred rice varieties resulted in the highest phenotype similarity (KF) analysis, namely Situ Bagendit and Cakrabuana, Inpari 32, Inpari 30, Ciherang, Mekongga and Inpari 30 reaching a similarity coefficient value of 0.90 or 90% of various similarities in morphological characters such as leaf shape, plant height and leaf tongue shape, while the lowest was shown by the Ciherang and Cakrabuana Agritan rice varieties, namely with a similarity coefficient value of 0.78 or 78%.

This is what was stated by Maulana et al. (2014), that in the same cluster, it is characterized by almost the same genotype name. This indicates that these genotypes originate from the same population, resulting in a higher level of kinship. However, on the other hand, there are genotypes with very different names but very high levels of kinship, because it is possible that the genetic material comes from the same parent but is spread to different places so that it is given a different name by the collector. Information and knowledge about genetic diversity and kinship relationships between individuals are crucial for plant breeders, as breeding programs rely on high genetic diversity to create recombinations that assemble new varieties (Hanifa et al., 2021). Each of the inbred rice varieties tested in Bandung Regency has different adaptability to growth and yield.

CONCLUSION

1. There are differences in the morphological characteristics of growth and yield components of inbred rice plants.
2. There are similarities in morphological characters among several inbred rice varieties, including Inpari 32 HDB and Situ Bagendit, with a similarity level of 100%. In Group II, the Mekongga, Inpari 42, Inpari 33, and Inpari 30 varieties, and in Group III, the Ciherang and Padjadjaran Cakrabuana Agritan varieties, achieved a coefficient value of 78%. Similarity of 0.10 or 10% with a similarity coefficient level of 10% based on morphological characters, as seen in the Rice UPOV Table.

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