Uniformity Test of the F_8 Upland Rice Lines Crosses between Local Bangka Rice with Superior Varieties with Lodging Resistance in Balunijuk Rice Fields

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Abstract. Developing process rice lines become varieties must meet the criteria that were high uniformity. High uniformity indicates that the plant is stable and able to adapt to various planting locations. This research aimed determines uniformity F8 lines and recommended the F8 lines as superior variety with lodging resistance. This research was carried out from September 2021 to January 2022 in Balunijuk rice fields, Bangka District. This research was conducted using experimental method with randomized block. Treatment consisted of 5 F8 lines and 5 comparison varieties. The F8 lines used 191-06-09-23-03, 21B-57-21-21-23, 23F-04-10-18-18, 23A-56-20-07-20 and 23A-56-22 -20-05. The comparison varieties used, Danau Gaung, Inpago 8, Inpago 12, Rindang 1, and PBM UBB 1. Data analysis using the F test (Analysis of Variance) followed by the Least Significant Increase (LSI) test, the variability test, and the uniformity test. The results showed that the F8 lines had narrow genotype and phenotype variability in all characters observed. This indicates that the uniformity of the tested lines is high. The percentage of uniformity was obtained in the range between 88.88 and 100%. The F8 lines that can be recommended a candidate superior varieties were lines 23a-56-20-7-20 for white rice and lines 23a-56-22-20-5 for red rice with a lodging index of 0% and percentage uniformity of 100%.

Keywords: Upland Rice, Uniformity Test, Variability.

1 Introduction

Rice (*Oryza sativa* L.) is one plants that is a source of food for almost half of the world's population. Indonesia is one the countries where rice is the main source of food for the population. National rice production from year to year is still not able to keep up with the number of population growth in Indonesia [1]. The demand for rice is increasing along with the increasing population, in 2019 the demand for rice will increase by around 2.5 to 5 million tons per month [2]. Another serious problem with traditional rice production is very high water input, with very high dependence on ground water for rice cultivation [3].

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The obstacle faced in plant cultivation in Bangka Belitung is the soil condition which is dominated by ultisol soil [4] Ultisols have a pH ranging from 3.7 to 6.4. Ultisol soils with mass pH have high Fe and Al saturation [5]. High Fe content will inhibit the growth of rice plants, resulting in crop failure and a decrease in rice production [6]. Soil in Bangka Regency has an average pH of <5. The rice field in Balunijuk has a low fertility rate because it consists mostly of ultisol soil [7]. Currently, the use of Balunijuk rice fields is not optimal due to several constraints such as funds and infrastructure. Therefore, farmers use paddy fields for upland rice cultivation.

The Province of Bangka Belitung Islands has 26 local rice accessions that have been identified [8]. Local rice plants have the advantage of being resistant to both biotic and abiotic stresses [9]. The problems faced when cultivating local rice are easy to fall because it has a height of > 100 cm, has a long lifespan, low yields, and is not drought tolerant [10]. High rice plants with weak stems will easily fall [11]. Lying down is one of the obstacles when cultivating rice because it causes reduced yields [12]. According to Zhu et al [13], lodging down can reduce rice production by up to 50%.

Efforts that can be made to overcome the problem of local rice, as well as the utilization of the Balunijuk rice field are using technology to create superior varieties. One way to get superior varieties is through crosses [14]. Crossing of rice plants to obtain fall-resistant varieties has been carried out since 2017. Mustikarini et al [15], the selection of national varieties of rice that is resistant to fall is obtained by the Banyuasin variety. Mustikarini [8], the F2 generation research resulted in 40 selected lines. Mustikarini et al [9], the study of the F4 generation obtained 3 lines with good fall resistance. Mustikarini et al [16], obtained a line that has the potential to have the ability to withstand falling from the selection results of the F2 generation.

The line that will be released as a new superior variety must meet one of the requirements, namely that the population in the line must be uniform. Genetic diversity analysis is useful for providing basis for various purposes such as conservation breeding strategy, utilization and determination and improvement of rice based on local varieties [17]. Sa'diyah et al [18], mention that the test of line uniformity is very necessary for securing a variety so that it has characteristics that do not deviate when the variety is registered. Line uniformity can be determined from the value of variability. Hanifah and Ruswandi [19], stated that plants with low variability values had a higher probability of plant uniformity and vice versa.

The rice plant uniformity test was carried out to obtain genetically uniform rice plants. The results this study is expected to be used a reference in the development of upland rice lines as varieties resulting from crosses between local accessions and national varieties.

1.1 Materials and Methods

The tools used are scissors, wood, rope, envelope, hoe, tractor, lawn machine, analytical scale, machete, ground fork, watering plants, ruler, sprayer, RHS Color Chart, meter, handphone camera, and stationery. The materials used are 5 F8 lines consisting of 19I-06-09-23-03, 21B-57-21-21-23, 23F-04-10-18-18, 23A-56-20-07-20 and 23A-56-22-20-05 and 5 comparison varieties, namely Inpago 8, Inpago 12, Rindang 1, Danau

Gaung and PBM UBB1. Other ingredients consist of insecticides, pesticides, fungicides, manure, chemical fertilizers, rope, and paranet.

This research was conducted using experimental method with randomized block design (RBD). The treatments consisted of 5 F8 upland rice lines and 5 comparison varieties. Each experimental unit consists of 3 blocks with a total of 30 experimental units. Each plot measuring 4 x 5 m consists of 320 planting holes, with a total of 3 seeds in each planting hole. The samples observed in each plot were 10 clumps so the total sample was 300 clumps. This uniformity test research was carried out through several activities. These activities consist of land management, planting, embroidery, maintenance, harvesting, and post-harvest.

Observation of qualitative character consists of lodging index, leaf surface texture, leaf color, stem color, rice husk color, and rice shape. Observation of quantitative characters consists plant height, number of tillers, flag leaf length, flowering age, panicle length, harvest age, number of pithy seeds, production of plots, and weight of 1000 seeds.

Qualitative data analyzed descriptively and presented in tables or figures. Quantitative data analysis includes variability test to determine uniformity. In addition, quantitative data analyzed using the F test (Fisher's test) at the 95% confidence level continued the LSI (Least Significant Increase) test.

The value of variability can be calculated using the mean squared analysis of variance, genetic, environmental, and phenotypic variance with the following formula:

$$\sigma^2 g = (MSg-MSe)/r$$
$$\sigma^2 e = MSe/r \qquad (1)$$
$$\sigma^2 f = \sigma^2 g + \sigma^2 e$$

Description:
$\sigma^2 g$ = Genetypic variance
$\sigma^2 e$ = Variety of environments
$\sigma^2 f$ = Phenotypic variance
MSg = Middle square of genotype
MSe = Middle square of error
r = Replications

Standard deviation of genetic and phenotypic with the following formula [20]:

$$\sigma\, \sigma^2 g = \sqrt{\frac{2}{r^2}\left\{\frac{MSg^2}{DFg+2} + \frac{MSe^2}{DFe+2}\right\}}$$
$$\sigma\, \sigma^2 f = \sqrt{\frac{2}{r^2}\left\{\frac{MSg^2}{DFg+2}\right\}} \qquad (2)$$
$$2\,(\sigma\, \sigma^2 g) = 2 \text{ x } \sigma\, \sigma^2 g$$
$$2\,(\sigma\, \sigma^2 f) = 2 \text{ x } \sigma\, \sigma^2 f$$

Description:
$\sigma\ \sigma^2g$= Standard error of genotypic variance
$\sigma\ \sigma^2f$ = Standard error of phenotypic variance
DFg = Degree of genetic freedom
DFe = Degree of error freedom
MSg = Middle square of genotype
MSe = Middle square of the error

The grouping of the criteria for the value of genetic variability and phenotypic variability is as follows [20]: Genotypic variability is wide when $\sigma^2g \geq 2\ (\sigma\ \sigma^2g)$, and it is said to be narrow when $\sigma^2g < 2\ (\sigma\ \sigma^2g)$. Phenotypic variability is wide when $\sigma^2p \geq 2\ (\sigma\ \sigma^2p)$, and it is said to be narrow when $\sigma^2p < 2\ (\sigma\ \sigma^2p)$.

Character uniformity test in each selected genotype was analyzed with the following formula:

Standard deviation (sd) ≤ (1.27 x sd comparison variety) = Uniform
Standard deviation (sd) > (1.27 x sd comparison variety) = Non-Uniform

Least Significant Increase

The LSI test was carried out to compare the genotype diversity of the lines with the comparison genotypes. The LSI test formula is as follows:

$$LSI = t_{(0,05;db)} \sqrt{\frac{MSE}{r}} \tag{3}$$

Description :
t(0,05;db) = t value α = 0.05
MSE = Mean Square Error
r = Replications

Check value + LSI genotype value of test line indicates that test line is better than comparison. Check value + LSI < genotype value of test line indicates that the test line not better than comparison. Determination of the best line is not only seen in the resistance to fall but also in the production character.

2 Results

The uniformity test study was conducted in the Balunijuk rice field. The land is land with ultisol soil. Research on the F 8 line was carried out using 5 selected lines in the F 7 selection with the national variety as a comparison. The F8 line and the tested varieties had a resistant index of 0% in the category of very lodging resistant.

The surface texture of the leaves on rice plants has similarities between lines 19i-06-09-23-03, 21b-57-21-21-23, 23f-04-10-18-18, 23a-56-22-20-5 with varieties of Rindang 1 and Danau Gaung which have a medium texture. Line 23a-56-20-7-20 with Inpago 8, Inpago 12, and PBM UBB 1 varieties had a slippery texture.

Table 1. Qualitative character of lines F_8 of upland rice plants.

Parameter G	LI	SC	LC	LT	RC	RS
19i-06-09-23-03	Very lodging resistant	Yellowish-green	Yellowish-green	M	White	R/VL
21b-57-21-21-23	Very lodging resistant	Yellowish-green	Yellowish-green	M	White	R/M
23a-56-20-7-20	Very lodging resistant	Yellowish-green	Yellowish-green	S	White	R/S
23a-56-22-20-5	Very lodging resistant	Yellowish-green	Yellowish-green	M	Red	R/M
23f-04-10-18-18	Very lodging resistant	Yellowish-green	Yellowish-green	M	White	R/S
Danau Gaung	No lodging resistant	Yellowish-green	Yellowish-green	M	White	R/VL
Inpago 8	Very lodging resistant	Yellowish-green	Yellowish-green	S	White	R/M
Inpago 12	Very lodging resistant	Yellowish-green	Yellowish-green	S	White	R/S
PBM UBB 1	No lodging resistant	Yellowish-green	Yellowish-green	S	Red	R/VL
Rindang 1	Very lodging resistant	Yellowish-green	Yellowish-green	M	White	R/M

Notes:

- G (genotype), LI (Lodging index), SC (stem color), LC (leaf color), LT (leaf texture), RC (rice color) and RS (rice shape).
- M (medium) and S (smooth).
- R/VL (round, long), R/M (round, medium), and R/S (round, short).

The results of observations of qualitative characters can be seen in table 1. The character of stem color and leaf color on upland rice plants studied have the same color. The lines and varieties studied had leaf and stem colors that were yellowish-green (Figure 1).

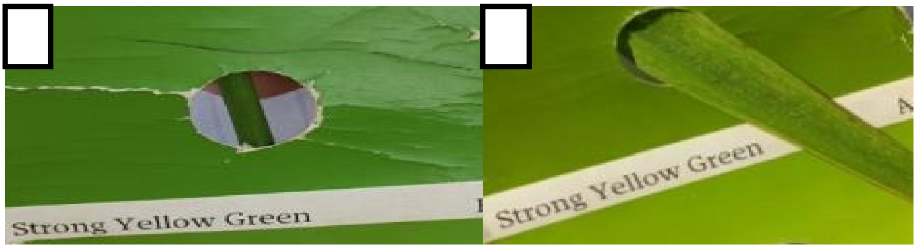

Figure 1. Figure 1. Characteristics of stem color and leaf color of the F 8 line of upland rice and 5 comparison varieties. The color of the stems and leaves is yellowish green. (a) stem color, (b) leaf color.

The color of the rice husk in the tested lines and varieties varied. Strain 19i-06-09-23-03, 21b-57-21-21-23, 23a-56-20-7-20, 23f-04-10-18-18, Danau Gaung variety. Inpago 8, Inpago 12, and Rindang 1 have a white skin color. The 23a-56-22-20-5 line and the PBM UBB 1 variety had a red epidermis (Figure 2).

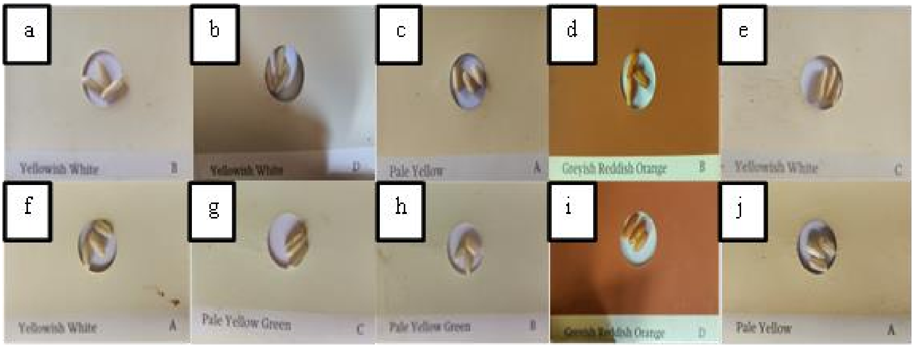

Figure 2. Characteristics of rice husk color Upland rice lines and 5 comparison varieties. (a) 19i-06-09-23-03, (b) 21b-57-21-21-23, (c) 23a-56-20-7-20, (d) 23a-56-22-20- 5, (e) 23f-04-10-18-18, (f) Danau Gaung, (g) Inpago 8, (h) Inpago 12, (i) PBM UBB 1 and (j) Rindang 1.

The shape of rice from the results of the study consisted of 3 categories, namely, (1) round, very long, (2) round, medium, and (3) round, short. The round category, very long (1 mm wide, 8 mm long) consisted of the 19i-06-09-23-03 line, the varieties Danau Gaung and PBM UBB 1. The round, medium category (1 mm wide, 6 mm long) consisted of line 21b-57-21-21-23, 23a-56-20-22-5, Inpago 8 and Rindang 1 varieties. Round, short category (1 mm wide, 5 mm long) consisted of 23a-50-20- 7-20, 23f-04-10-18-18 and Inpago 12 varieties (Figure 3).

The variability test on the F8 line showed that all the characters tested had narrow criteria. Genetic and phenotypic variability with narrow criteria showed that all the characters tested on the F8 line had a high level of uniformity (Table 2).

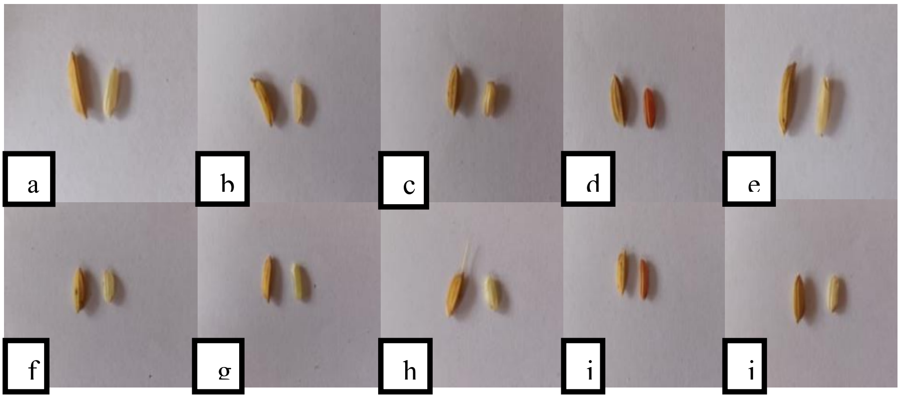

Figure 3. The shape of the pithy grain of rice in each line and variety. (a) 19i-06-09-23-03, (b) 21b57-21-21-23, (c) 23a-56-20-7-20, (d) 23a-56-22-20- 5, (e) 23f-04-10-18-18, (f) Danau gaung, (g) Inpago 8, (h) Inpago 12, (i) PBM UBB 1 and (j) Rindang 1.

Table 2. The value of the variability of the F 8 line of upland rice.

Character Quantitative	Genetics			Phenotype		
	$\sigma^2 g$	$2(\sigma^2 g)$	Criteria	$\sigma^2 f$	$2(\sigma^2 f)$	Criteria
Plant Height (cm)	-8.29	18.23	Narrow	8.71	10.06	Narrow
Number of productive tillers (stems)	0.78	2.40	Narrow	1.89	2.18	Narrow
Flag Leaf Length (cm)	26.25	37.26	Narrow	31.96	39.91	Narrow
Flowering Age (DAP)	8.83	12.13	Narrow	10.43	12.04	Narrow
Panicle Length(cm)	8.33	13.62	Narrow	11.53	13.32	Narrow
Harvest Age (DAP)	8.83	12.13	Narrow	10.43	12.04	Narrow
Number of pithy seeds (grain)	-3467.5	3803.71	Narrow	690.65	797.50	Narrow
Plot Production (gr)	95318,64	138004.69	Narrow	118194.68	136479.46	Narrow
Weight 1000 Seeds (gr)	1.64	2.97	Narrow	2.49	2.87	Narrow

Note : "Genetic Variability" $\sigma 2g \geq 2(\sigma 2g)$= broad, $\sigma 2g < 2(\sigma 2g)$= narrow and " Phenotypic Variability " $\sigma 2f \geq 2(\sigma 2f)$= broad , $\sigma 2f < 2(\sigma 2f)$= narrow [21]. A negative value (-) is considered zero (0) [22].

The results of the uniformity test in table 3 show that almost all of the characters tested on lines 19i-06-09-23-03 and 21b-57-21-21-23 were uniform except for the plot production characters. The lines 23f-04-10-18-18, 23a-56-20-7-20, and 23a-56-22-20-5 showed that all the characters tested were uniform. The characters consisted of plant height, number productive tillers, flag leaf length, flowering age, panicle length, harvest age, number of pithy seeds, production per plot, and weight 1000 seeds. The range percentage of uniformity in the tested F 8 lines was 88.88-100%.

Tabel 3. F_8 line uniformity.

Genotype	PT		NPT		LFL		FA		PL		HA		NPS		PP		WOS		PU
	Ds		Ds		Ds		Ds		Ds		Ds		Ds		Ds		Ds		(%)
19i-06-09-23-03	4,62	U	1,54	U	3,63	U	4,36	U	2,45	U	4,36	U	105,80	U	438,10	NU	0,46	U	88,88
21b-57-21-21-23	3,07	U	1,10	U	2,83	U	0,58	U	5,49	U	0,58	U	129,80	U	396,10	NU	1,08	U	88,88
23a-56-20-7-20	3,80	U	1,30	U	5,79	U	0,58	U	2,04	U	0,58	U	35,50	U	133,40	U	1,15	U	100
23a-56-22-20-5	3,29	U	1,53	U	1,88	U	2,65	U	2,28	U	2,65	U	95,22	U	178,30	U	2,70	U	100
23f-04-10-18-18	3,71	U	1,62	U	3,95	U	2,65	U	3,53	U	2,65	U	104,80	U	144,80	U	1,30	U	100
Comparison	16,75		2,56		12,49		6,85		8,95		10,48		343,80		394,97		2,99		

Note : (1) PT (plant height), NPT (number of productive tillers, LFL (length of flag leaf), FA (flowering age), PL (panicle length), HA (harvest age), NPS (number of pithy seeds), PP (plot production), WOS (weight 1000 seeds), and PU (percentage uniformity). Ds (Differentiation Standard). (2) Value sd < sd comparison = Uniform (U), sd value > sd comparison = Not Uniform (NU).

The results showed that the lines were only better than the comparison varieties in terms of plant height, flowering, and harvesting ages. The shortest plant height was line 23a-56-22-20-5, which was 75.49 cm and highest plant height was line 23f-04-10-18-18, which was 98.56 cm. The average plant height of the 5 tested lines was 88.89 cm. The fastest flowering age was line 23a-56-20-7-20, which was 55.66 DAP and the longest flowering age was line 21b-57-21-21-23, which was 61 DAP. The average flowering age of all tested lines was 58.59 DAP. The fastest harvesting age was lines 23a-56-22-20-5 and 23f-04-10-18-18, which was 95 DAP and the longest harvesting age was lines 21b-57-21-21-23, which was 100.66 DAP. The average harvest age of all tested lines was 89.98 DAP.

The LSI test was carried out to compare the F 8 line with the comparison variety. The LSI results showed that all tested lines were almost better than the comparison varieties in terms of plant height, flowering, and harvesting ages. The characters of the number productive tillers, flag leaf length, panicle length, number of pithy seeds, production of plots, and weight of 1000 seeds in the LSI test showed that all F 8 lines were not better than the comparison varieties (Table 4).

Tabel 4. LSI test results rice genotypes on comparison varieties

Genotype	PT	NPT	LFL	FA	PL	HA	NPS	PP	WOS
19i-06-09-23-03	95,49ad	3,56	32,67	61,00cd	19,94	96,00d	421,63	958,75	26,30
21b-57-21-21-23	96,60ad	3,26	32,41	65,66d	24,03	100,66d	369,46	1029,85	27,70
23a-56-20-7-20	95,55ad	4,96	25,31	55,66abcdef	20,76	90,66cd	261,36	825,59	27,16
23a-56-22-20-5	75,49 abcdef	3,40	27,02	60,00cd	19,40	95,00d	348,80	761,95	23,00
23f-04-10-18-18	98,56ad	3,26	32,41	60,00cd	25,35	95,00d	389,56	730,35	28,00
Danau Gaung+LSI (a)	115,30	6,06	50,74	58,12	41,43	88,15	833,26	1598,77	31,26
Inpago 12+LSI (b)	91,42	5,60	41,98	55,67	31,71	85,82	1029,16	1317,22	28,09
Inpago 8+LSI (c)	93,22	5,46	41,48	62,45	32,74	92,48	697,36	1216,04	29,93
PBM UBB 1+LSI (d)	112,28	5,73	56,82	72,45	33,13	103,82	996,43	1769,01	32,06
Rindang 1+LSI (e)	91,51	6,23	47,68	55,79	36,47	78,15	720,03	1560,51	31,96
$\bar{X}$g+LSI (f)	88,89	6,00	44,34	58,59	32,43	87,98	768,30	1452,74	30,51
Value LSI	15,30	2,50	10,98	4,21	7,88	9,18	324,20	551,88	3,93

Note:

- PT (plant height), NPT (number of productive tillers, LFL (length of flag leaf), FA (flowering age), NPS (number of pithy seeds), PP (plot production), WOS (weight of 1000 seeds) and PU (percentage of uniformity).
- The letters listed behind the numbers indicate that: (a) better than Gaung Danau, (b) better than Inpago 12, (c) better than Inpago 8, (d) better than PBM UBB 1, and (e) better than leafy.
- xg= Average genotype of lineage.
- The test line was better than the comparison on the character of the number of productive tillers, flag leaf length, panicle length, number of pithy seeds, production per plot, and weight of 1000 seeds if the test line check value + LSI, while on the character of plant height, flowering age, and harvest age if the test line check value – L.

3 Discussion

Uniformity testing is one of the requirements that must be met before releasing varieties. The lines released as varieties must have a high degree of uniformity. Uniformity is an important trait in plant populations [23]. The uniformity test is define proprietary products of plant breeding and allow inscription or protection of novel varieties through PVP or utility patents [24]. Plants are said to have uniformity if they have properties that never change even though environmental changes occur. The uniformity value was obtained by testing the qualitative and quantitative characters of the lines tested with comparison varieties.

The F8 upland rice strain tested was the result of a cross between local accession and national variety. Mustikarini et al [8], the selection method used is the pedigree method in each selection. The selected lines in F1 were 26 lines, F2 was 56 lines, F3 obtained 56 lines and F4 selection got the best 56 lines [9]. The results of the F5 selection produced the 10 best lines, the F6 selection got the best 5 lines, namely 19I-06-09-23-03, 21B-57-21-21-23, 23F-04-10-18-18, 23A- 56-20-07-20 and 23A-56-22-20-05. The five lines were continued as the F 7 to F 8 generations. Line 19i-06-09-23-03 was the result of crossing the PBM UBB 1 X Inpago 8 variety. Line 21b-57-21-31-23 was the result of crossing the Inpago 8 X accession variety. Lines 23a-56-20-7-20 and 23a-56-22-20-5 were the result of crosses from the Banyuasin X beam accession. Line 23f-04-10-18-18 is the result of the cross-accession of Inpago X Beam 8. The cross was carried out to obtain rice plants that are resistant to falling, have high production, and have a high level of uniformity.

The results of the LSI (Least Significant Increase) follow-up test in the F 8 generation showed that the tested strain had the potential to be a genotype. The genotype that has a higher character value than the comparison variety in the LSI test indicates the line has a good appearance and is included in the superior genotype criteria [25]. The F8 line showed a significant effect on the growth of rice plants, namely on the character of plant height, flowering age, and harvest age.

The results of F8 line test showed that the lowest plant height was in line 23a-56-20-7-20 with the third-largest production plot of the five tested lines, which was 825.59 grams. Wu et al [26], states that plants with low height have better to lodging resistance. Huang et al [27], revealed that short-sized rice plants will allocate photosynthetic results towards filling seeds so that they can increase production. Plant height can be used as a benchmark for plant growth but plant height is not necessarily a guarantee of getting higher production yields [28]. Generally, the genetic factors of a cultivar greatly affect plant height, namely differences in genetic composition [29].

The results of the LSI test showed that the tested lines had lower plant heights than the comparison varieties. . Lines with lower plant heights than the parents showed successful selection to obtain the characteristics of lodging resistance [8]. Rice plants that have a short plant height will be more resistant to falling because the stems are stronger and are protected from the wind. Agree with Niu et al [30], improving crop lodging resistance by adjusting plant height. The lodging index value based on observations that have been made shows that all F 8 lines and comparison varieties have excellent resistance to falling.

The stem color and leaf color of the F 8 line showed that the line had the same color, namely yellowish green. The yellowish-green stem color of the line has similarities to the stem color of the previous generation line, namely the F7 generation, namely lines 19i-06-09-23-03, 21b-57-21-21-23, and 23a-56-22-20-05. The leaf color tested in the F8 generation also had similarities with the previous generation, namely lines 19i-06-09-23-03, 23a-56-20-7-20, and 23a-56-22-20-5 with a yellowish-green color. Aryana

[31], plants that show relatively the same results at different times and in specific places include stable plants.

The surface texture of the leaves in the F 8 line was similar to several lines in the previous generation but also had differences in some lines. Leaf surface textures that have similarities with the previous generation are lines 19i-06-09-23-03 and 23a-56-22-20-5 with medium leaf surface textures and 23a-56-20-7-20 lines with leaf surface textures slippery. Leaf surface texture includes qualitative characters. According to Osudare et al [32], qualitative characters are slightly influenced by genetic and environmental factors. Lines that have a good stability mechanism indicate that these lines are stable and able to adapt to different environments [33].

The character of the number of productive tillers in the entire F8 line, the average number of productive tillers in the line ranged from 1.1 to 1.6 stems/plant. The number of productive [34], dan panicle characteristics increases the yield of rice crops [35]. Agree with Paul [36], that the success of the production is strongly influenced by the number of productive tillers. According to Kartahadimaja et al [29], the large number of productive tillers that appear can affect the number of panicles and increase the grain yield of rice plants.

The long character of the flag leaf plays a role in the production of assimilate in the seed filling process which acts as a source [37]. Length the flag leaf can be used as a potential phenotypic marker in determining superior traits as producer of high production. Lines that have a longer flag leaf length have the potential to increase production yields and become one of the superior lines. In the F8 study, the line that had the longest flag leaf was line 19i-06-09-23-03 with an average flag leaf length of 32.67 cm with a total production of 958.75 grams per plot and was the second-largest plot of 5 lines production tested.

The character of the number of pithy seeds planted in the line had a lower number of pithy seeds compared to the comparison variety. The variation for yield production of genotype caused by genetic factors brought by their parent [38]. The average grain weight of the rice lines in this study ranged from 261.36 to 421.63 grams/plot. The amount of grain is a yield component that supports the potential yield of rice plants so that the line with a higher amount of grain content has the opportunity to give higher yields [39].The line with the highest pithy seed character was line 19i-06-09-23-03.

Production per plot of 5 lines was not better than the comparison variety. The low production can also be influenced by the genetics of the parental characters who have small seed sizes so that the weight of the seeds produced is also low [40].

Character weight of 1000 seeds, showed no significant effect on the comparison varieties. According to Zhao et al [39], weight of 1000 seeds in rice plants is determined by grain yield. Weight of 1000 seeds is one of the factors supporting the grain yield. When the grain formed has a high density, it will also have a high harvest weight (tons/ha).

Upland rice plant line F8 generation has a narrow value of genetic and phenotypic variability. The narrow variability in genotypic and phenotypic variability showed that all the characters tested in the F8 generation had high uniformity. Fathoni and Sugiharto [41], plant uniformity testing is determined by the size of the variation in the population. According to Herrera et al [42], enough levels of diversity based on DNA methylation, often heritable, may affect adaptation and divergence without involvement of genetic variation. Uniformity in a population shows homogeneity or relatively similar results between the plants tested. Sasmita [43], stated that traits that appear in lines that are homozygous and have narrow variability will provide a great opportunity to get uniform lines with the desired traits.

4 Conclusion

The results of the analysis of genetic diversity of all observed characters in the five genotypes of upland rice had narrow genetic and phenotypic diversity (Table 2). According to Martono [44], characters with a narrow variety are quantitative in nature which are controlled by many genes (polygen). Quantitative genetic traits that are controlled by many genes are the end result of a growth process related to morphological and physiological traits. Narrow variability values indicate that each individual is in a uniform population, so the chances of getting a good new generation are higher [45].

The characters in the F8 line of rice plants had high uniformity in each of the tested characters. The uniformity that appears shows that the line is starting to show stability in the F8 generation and is ready for final testing before being released as a variety, namely the multilocation test. Agree with Wahda et al [21], that plant characters that already have uniformity can be continued for multi-location testing. Khadijah [46], states, the homogeneity of the observations made shows that the population is uniform. The interaction of genotypes with the environment can be used to find out how genotypes can grow well in a certain location and have a high level of adaptation so that the yields given are classified as stable. In addition, the interaction of genotypes with the environment can also play an important role in breeding programs because it can be used as a decision when releasing varieties that are tolerant to certain conditions [47].

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