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Observing The Performance of Gogo Rice Breeding Lines

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ABSTRACT

Observation is one of the stages in the selection to obtain the expected rice lines to be tested at the yield and multi-location testing stage as candidates for breeding rice varieties. The research was carried out at the Tamanbogo Lampung Experimental Garden in the 2021 planting season (MT) using an augmented design with five replications of comparison varieties: Inpago 8. Inpago 12, Inpago 13. Situbagendit, and Situpatenggang. As many as 247 promising breeding rice lines were used as materials in this experiment with their respective advantages. Each line was planted with a 0.9 m x 5 m plot size with a spacing of 30 cm x 15 cm. Fertilizer used is 300 kg/ha NPK + 100 kg/ha Urea. Weeding is done twice, precisely at the time before the next fertilization I and II. The observations include 50% flowering age, harvest age, plant height, tiller quantity, dry-milled grain yield, and resistance to biotic and abiotic stresses. The analysis of variance showed that the genotype significantly affected plant height and productive tiller quantities. High heritability and genetic advances in plant height characters indicate that this character is a selection criterion so that selection can be made to increase these characters. The comparison varieties significantly affected the character of plant height and productive tiller quantities. From this activity, 37 breeding lines were obtained with higher yields than the comparison varieties.

Keywords*:* *observation, performance, breeding rice*

1. INTRODUCTION

Dry land has great potential to support the improvement in national rice production through an increase in the planting area. In 2017 the rice harvest area in Indonesia reached 15.1 million hectares, 16.1 million hectares of which were donated from dry land. However, the national dryland rice productivity in 2017 was 3.3 tonnes/ha, far below the average lowland rice productivity of 5.3 tonnes/ha (BPS, 2020). The low rice productivity in dry land is due to the land's many physical and biological constraints. Physical constraints commonly found in dry land include drought, soil acidity, aluminum (Al) poisoning, and low soil fertility (Fagi et al. 2004; Toha et al. 2009; Toha 2012; Rochayati & Dariah 2012). Meanwhile, the main biological obstacle to rice cultivation in dry land is blast disease which can cause a significant decrease in yield and even cause *Puso/*fruitless (Santoso et al. 2007; Sudir et al. 2014). The pressure due to these constraints varies depending on the type of dry land, climate, and topography.

The breeding rice program aims to assemble breeding rice varieties with high yield potential and are tolerant to biotic and abiotic stresses, such as blast disease resistance (Inpago 6), tolerance to Al poisoning (Inpago 12), shade tolerant (Shade 1 and Shade 2), highland adaptive (Luhir 1 and Luhur 2) and good quality rice (Inpago 7 and Inpago 13) (Sastro et al. 2021). Various efforts, including assembling new varieties, continue to broaden farmers' choices in determining the most appropriate variety in their area. This study's purpose was to determine the genetic diversity and performance of breeding rice lines as a basis for determining selection criteria to obtain new superior varieties of breeding rice.

2. MATERIALS AND METHODS

An observational experiment of blast-resistant breeding rice lines was carried out on dry land in the Tamanbogo area, Lampung, during planting season (MT) 1 2021, on dry land using an augmented design with five replications for each control variety. Observation is one of the stages of a plant-breeding program to obtain and release new superior varieties, shown in Figure 1.

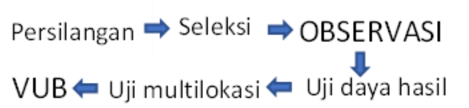

Figure 1. Observation as one stage of the plant-breeding program

The materials used in this experiment were 247 breeding rice lines and control varieties. Each line was planted with a 0.9 m x 5 m plot size with a 30 cm x 15 cm spacing. The fertilization used was 300 kg/ha NPK + 100 kg/ha urea, given three times, precisely at 7 days after planting: 200 kg/ha NPK dosage, 35 days after planting: 100 kg/ha urea dosage, and 65 days after planting: 100kg /ha NPK dosage.

The data observed included: 50% flowering age, harvesting age, plant height, tillers quantity, dry milled grain yield, general appearance, and resistance to existing biotic and abiotic stresses following the standard from IRRI (2014). Data were analyzed using Microsoft Excel and the statistical program SAS 9.1.

3. RESULT AND DISCUSSION

The analysis of variance from the

observational experiments at Tamanbogo KP showed that blocks significantly affected all the tested line characters. Genotype only affected plant height and productive tiller quantities. The checks and the breeding lines in the checks significantly affected the character of plant height and the productive tiller quantities (Table 1). The appearance of plants in the field can be seen in Figure 2.

The appearance of the plants from the observed characters is shown in Table 2. Plant height varied from 53 cm to 169.3 cm. The highest strain was B15397D-KR-38-PC-1, and the shortest was B15941F-MR-2. Plant height is one of the plant characteristics affected due to high Al stress in the field. Compared to the average of Check varieties with medium plant height, such as Inpago 8, Inpago 12, and Inpago 13, some of the observed breeding lines mostly have similar heights. Thus, it is suspected that these lines are Al tolerant based on the results of Mulyaningsih et al. (2016).

The highest productive tiller quantity was line B15941F-MR-4, with 36.7 tillers. Meanwhile, the line with the least number of tillers was BcmF-84-6, with an average of 1.7 tillers. The tillers' quantity is one of the criteria for tolerance to Al. Most likely, the breeding lines with a few tillers were Al intolerant, considering the observational planting area conditions were land with low pH and Al saturation (Utama 2010).

The flowering age ranges from 72 days after sowing (DAP) to 97 DAP, and the harvesting age ranges from 100 DAP to 116 DAP. The flowering ages of the tested lines were not significantly different from the Check variety, although several breeding lines were deeper than the Check or above 108 DAP for harvesting ages.

The results shown are the yield of dry-milled grain per plot of 5 m2.

Table 1. The mid squares of the breeding lines characters in the MT1 2021 observation test

Source of Diversity	db	Plant height	Productive tiller quantities	Flowering age	Harvesting age	Yield
Block	4	9314*	7.38*	147.5*	263.3*	2.36*
Genotype	251	397.9*	9.89*	10.5	10.14	0.73
Line vs. check	1	3075*	0.02	7.84	4.99	0.72
Check	5	496.8*	5.21*	20.8	20.6	1.96*
Line(check)	246	383.5*	10.04*	10.4	9.91	0.71
Galat	15	76.3	1.78	16.4	15.4	0.56

*significantly different at the 5% level

Figure 2. The appearance of plants in the field at MT 1 2021

The highest yield was 1.82 kg on line B15150E-MR-50. This breeding line's yield is higher than the average check variety, reaching 0.7 kg. Besides this type B15150E-MR-50, there are 37 more lines with higher yields than the check variety: B14958-MR-11-25-4-1, B15203B-MR-1-Blk-45, B15844E-TB-8. B15845E-TB-49. B15511F-TB-14, B15570F-TB-36, B15798F-TB-13, B15798F-TB-24, B15798F-TB-28. B15799F-TB-18. B15800F-TB-2, B15800F-TB-10, B15800F-TB-19. B15800F-TB-23. B15801F-TB-2, B15801F-TB-4, B15801F-TB-8. B15801F-TB-28. B15937F-TB-13, B15937F-TB-30, B15391D-KR-16-1-PC-1, B15391D-KR-16-2-PC-2, B15397D-KR-27-PC-1, B15397D-KR-27-PC-2, B15397D-KR-27-PC-4, B15397D-KR-27-PC-5, B15397D-KR-36-PC-1, B15397D-KR-36-PC-2, B15397D-KR-36-PC-3, B15397D-KR-36-PC-4, B15397D-KR-38-PC-1, B15397D-KR-38-PC-2, B15397D-KR-38-PC-3, B15397D-KR-38-PC-4, B15397D-KR-38-PC-5. B15402E-KR-18-PC-4, and B15511D-KR-46-PC-2.

Table 2. Performance of breeding rice lines in an observational experiment at KP Tamanbogo MT1 2021

No.	Lines	Plant height	Productive tiller quantities	Flowering age	Harvesting age	Yield
1	BcmF-70-13	69.3	5.0	88	110	0.1
2	BcmF-70-14	66.7	6.7	85	106	0.1
3	BcmF-84-6	68.0	1.7	82	105	0.0
4	BcmF-84-7	85.0	14.7	85	106	0.5
5	BcmF-84-9	89.7	12.3	82	105	0.2
6	BcmF-84-12	76.7	14.0	82	105	0.3
7	BcmF-84-27	71.3	7.7	82	105	0.1
8	BcmF-84-28	95.0	11.7	82	105	0.1
9	BcmF-84-29	73.7	5.7	82	105	0.2
10	BcmF-84-31	78.7	8.0	82	105	0.2
11	B14958-MR-11-25-4-1	121.7	9.0	85	106	1.3
12	B14948-MR-3-15-3-5	77.0	10.0	85	105	0.6
13	B14957-MR-2-3-2	108.0	9.3	82	105	1.0
14	BP30475c-SKI-2-1-1-1-2	77.7	6.3	87	108	0.5
15	BP30475c-SKI-2-1-1-1-3	83.0	9.7	87	108	0.5
16	B15514F-TB-28	107.0	7.0	87	108	0.4
17	TP 30568	99.3	15.3	83	105	0.6
18	2017IRBN-013	67.0	7.0	87	108	0.2
19	2017IRBN-014	64.0	8.0	87	108	0.1
20	2017IRBN-028	72.7	7.7	87	108	0.1
21	IR 99427-4-1-3-2-3	59.7	12	85	106	0.1
22	IR 99368-10-1-3-2-3	68.7	4.3	87	108	0.1
23	IRRI 157	74.3	4.7	80	102	0.1
24	B15150E-MR-50	105.0	8.3	80	102	1.8
25	B15203B-MR-1-Blk-45	98.0	6.0	80	102	1.1

No.	Lines	Plant height	Productive tiller quantities	Flowering age	Harvesting age	Yield
26	B15678E-MR-2-2-1	72.7	11.0	81	102	0.2
27	B15915F-MR-15	90.0	11.0	81	102	0.3
28	B15922F-MR-20	95.0	8.3	80	102	0.6
29	B15923F-MR-9	81.7	7.3	81	102	0.3
30	B15923F-MR-10	90.0	9.7	81	102	0.4
31	B15923F-MR-11	97.3	8.7	72	103	0.6
32	B15923F-MR-12	74.0	8.7	72	103	0.1
33	B15923F-MR-14	118.0	10.0	76	100	0.2
34	B15923F-MR-16	86.0	8.3	82	103	0.3
35	B15923F-MR-18	102.3	10.7	81	103	0.4
36	B15923F-MR-26	92.3	9.7	78	100	0.2
37	B15923F-MR-30	93.0	9.0	81	100	0.2
38	B15924F-MR-5	76.0	2.7	82	102	0.1
39	B15924F-MR-7	81.0	12.7	82	102	0.3
40	B15930F-MR-6	85.3	8.7	77	100	0.4
41	B15930F-MR-19	60.3	6.0	81	102	0.1
42	B15930F-MR-22	80.0	7.3	81	102	0.1
43	B15930F-MR-23	76.3	5.0	81	102	0.0
44	B15930F-MR-29	74.3	6.0	81	102	0.1
45	B15932F-MR-13	98.3	5.7	81	102	0.1
46	B15941F-MR-2	53.0	7.7	82	103	0.1
47	B15941F-MR-3	62.3	13.3	82	103	0.1
48	B15941F-MR-4	60.3	36.7	82	103	0.1
49	B15943F-MR-4	53.0	9.0	82	103	0.1
50	B15943F-MR-30	54.3	8.0	82	103	0.0
51	B15944F-MR-16	65.0	6.3	85	106	0.1
52	B15946F-MR-15	73.0	5.3	87	108	0.0
53	B15958F-MR-22	61.3	7.3	87	108	0.0
54	B15958F-MR-24	67.7	9.3	85	106	0.0
55	B15966F-MR-1	74.0	3.3	87	108	0.0
56	B15844E-TB-8	80.0	8.7	85	105	1.1
57	B15845E-TB-49	100.0	8.3	83	105	1.0
58	B15511F-TB-14	99.0	9.3	85	106	1.1
59	B15511F-TB-31	109.7	9.0	85	105	0.4
60	B15570F-TB-31	110.7	7.0	85	105	0.5
61	B15570F-TB-36	126.7	10.7	78	100	1.4
62	B15760F-TB-12	116.7	12.3	80	102	0.9
63	B15760F-TB-27	106.7	8.7	82	103	0.5
64	B15761F-TB-2	111.0	9.3	78	100	1.1
65	B15761F-TB-13	121.7	8.7	78	100	0.7
66	B15772F-TB-24	123.0	13	78	100	0.8
67	B15773F-TB-19	108.7	9.7	82	103	0.4
68	B15779F-TB-15	105.7	7.7	80	100	0.4
69	B15780F-TB-7	107.0	13.0	82	103	0.4
70	B15780F-TB-11	92.7	6.7	83	102	0.3
71	B15783F-TB-1	88.0	10.0	83	103	0.4
72	B15783F-TB-2	82.0	8.3	83	103	0.1

No.	Lines	Plant height	Productive tiller quantities	Flowering age	Harvesting age	Yield
73	B15783F-TB-4	93.3	12.0	83	103	0.2
74	B15783F-TB-7	92.3	8.7	80	100	0.2
75	B15783F-TB-8	79.3	6.0	82	102	0.1
76	B15783F-TB-9	84.0	10.3	82	103	0.1
77	B15785F-TB-27	83.3	4.0	83	103	0.3
78	B15794F-TB-9	101.7	6.3	83	103	0.2
79	B15794F-TB-10	109.7	7.0	83	103	0.3
80	B15795F-TB-29	107.3	10.3	83	103	0.1
81	B15797F-TB-21	100.0	7.0	83	103	0.3
82	B15797F-TB-28	109.7	8.7	82	103	0.7
83	B15797F-TB-29	108.3	8.0	83	103	0.9
84	B15798F-TB-9	104.7	9.3	83	103	0.9
85	B15798F-TB-11	103.7	8.0	83	103	0.8
86	B15798F-TB-13	105.7	9.3	82	104	1.0
87	B15798F-TB-24	114.7	12.0	81	103	1.3
88	B15798F-TB-28	124.3	10.7	82	104	1.2
89	B15799F-TB-18	113.7	9.0	82	104	1.1
90	B15800F-TB-2	116.0	16.3	80	100	1.1
91	B15800F-TB-10	114.7	10.0	78	100	1.1
92	B15800F-TB-19	119.7	8.0	80	102	1.2
93	B15800F-TB-23	115.7	8.3	78	100	1.0
94	B15801F-TB-1	105.0	5.0	83	105	0.9
95	B15801F-TB-2	116.3	8.3	77	100	1.2
96	B15801F-TB-4	112.0	12.7	80	100	1.5
97	B15801F-TB-8	113.7	12.0	80	100	1.3
98	B15801F-TB-9	103.7	10.7	78	100	0.8
99	B15801F-TB-11	104.7	9.7	83	103	0.8
100	B15801F-TB-17	100.0	6.7	85	105	0.5
101	B15801F-TB-21	89.7	9.3	85	106	0.2
102	B15801F-TB-22	104.0	10.7	83	105	0.9
103	B15801F-TB-23	118.3	9.3	81	102	1.0
104	B15801F-TB-26	115.0	9.3	83	105	0.7
105	B15801F-TB-28	122.3	9.7	80	102	1.1
106	B15805F-TB-2	109.3	12.7	83	102	0.6
107	B15805F-TB-3	99.3	11.0	83	105	0.4
108	B15839F-TB-9	82.3	14.0	97	115	0.4
109	B15839F-TB-19	91.7	8.0	85	106	0.2
110	B15839F-TB-26	76.3	10.3	85	106	0.3
111	B15839F-TB-28	93.3	11.0	91	115	0.2
112	B15839F-TB-30	81.7	14.3	92	106	0.2
113	B15909F-TB-7	88.7	8.3	82	103	0.1
114	B15937F-TB-9	125.7	9.3	80	100	0.7
115	B15937F-TB-13	130.3	10.0	80	100	1.5
116	B15937F-TB-30	126.3	8.3	81	102	1.1
117	B15942F-TB-11	119.3	9.3	81	102	0.9
118	B15942F-TB-18	107.7	10.7	83	105	0.8
119	B15942F-TB-27	100.0	10.7	83	105	0.7

No.	Lines	Plant height	Productive tiller quantities	Flowering age	Harvesting age	Yield
120	B15953F-TB-25	93.7	6.0	78	100	0.9
121	B15882F-TB-19	98.0	11.3	80	101	0.6
122	B15887F-TB-25	88.3	8.3	82	105	0.2
123	B15887F-TB-26	86.0	7.7	85	106	0.2
124	B15898F-TB-13	85.0	10.3	83	105	0.2
125	B15898F-TB-24	76.3	16.3	81	105	0.1
126	B15492E-KR-14	98.7	10.7	81	102	0.3
127	B15492E-KR-19	85.7	10.0	90	115	0.1
128	B15492E-KR-35	78.3	6.3	90	115	0.2
129	B15809E-KR-6	73.0	7.0	91	115	0.1
130	B15823E-KR-12	85.0	6.0	91	115	0.1
131	B15823E-KR-29	102.3	8.0	84	106	0.2
132	B15826E-KR-31	96.3	6.3	82	105	0.1
133	B14969C-MR-2-WN-8-blk	136.7	7.0	83	105	0.4
134	B14969C-MR-2-WN-10-blk	129	9.3	83	105	0.6
135	B14969C-MR-3-WN-2-1	120.7	7.0	83	104	0.6
136	B14969C-MR-3-WN-2-2	120.3	7.0	83	105	0.6
137	B14969C-MR-3-WN-4-1	137.7	7.0	83	105	0.5
138	B14969C-MR-5-WN-4-1	145.0	7.0	83	105	0.5
139	B14969C-MR-5-WN-7-blk	130.0	4.3	83	105	0.4
140	B14969C-MR-5-WN-8-blk	148.7	7.0	83	106	0.1
141	B14969C-MR-23-WN-2-2	127.7	6.7	83	105	0.8
142	B14969C-MR-28-WN-1-blk	124.0	5.7	85	107	0.5
143	B15319E-KR-41-2	97.7	7.3	85	107	0.1
144	B15391D-KR-16-1-PC-1	124.7	10.0	80	102	1.1
145	B15391D-KR-16-1-PC-2	110.7	7.7	82	105	0.5
146	B15391D-KR-16-1-PC-3	129.3	10.3	80	102	0.7
147	B15391D-KR-16-1-PC-4	109.0	7.7	85	106	0.8
148	B15391D-KR-16-1-PC-5	105.3	8.7	81	102	0.8
149	B15391D-KR-16-1-PC-6	107.7	11.7	80	102	0.9
150	B15391D-KR-16-1-PC-7	109.0	12.3	81	102	0.8
151	B15391D-KR-16-1-PC-8	105.3	8.3	83	105	0.4
152	B15391D-KR-16-1-PC-9	115.3	8.7	80	102	0.5
153	B15391D-KR-16-1-PC-10	111.3	6.0	80	102	0.5
154	B15391D-KR-16-2-PC-1	129.7	13.0	80	102	0.8
155	B15391D-KR-16-2-PC-2	135.7	9.3	80	102	1.1
156	B15391D-KR-16-2-PC-3	149.7	11.7	80	103	1.0
157	B15391D-KR-16-3-PC-1	117.3	7.3	82	103	0.3
158	B15391D-KR-16-3-PC-2	117.0	7.7	82	105	0.3
159	B15391D-KR-16-3-PC-3	134.3	9.7	82	105	0.6
160	B15391D-KR-16-3-PC-4	127.7	8.0	82	105	0.4
161	B15391D-KR-16-3-PC-5	128.7	5.7	85	105	0.6
162	B15391D-KR-16-3-PC-6	132.7	9.0	82	103	0.8
163	B15391D-KR-16-3-PC-7	96.0	8.0	85	107	0.5
164	B15391D-KR-34-PC-1	129.3	6.7	85	107	0.6
165	B15391D-KR-34-PC-2	104.0	8.7	85	107	0.3
166	B15391D-KR-34-PC-3	124.3	7.7	85	107	0.3

No.	Lines	Plant height	Productive tiller quantities	Flowering age	Harvesting age	Yield
167	B15394D-KR-18-1-PC-1	112.0	4.3	85	107	0.1
168	B15394D-KR-18-1-PC-2	103.0	4.3	85	108	0.1
169	B15394D-KR-18-1-PC-3	119.0	8.7	84	107	0.2
170	B15394D-KR-18-1-PC-5	123.7	10.7	84	107	0.2
171	B15394D-KR-18-1-PC-7	112.7	8.0	83	107	0.1
172	B15394D-KR-18-1-PC-9	112.3	9.0	83	107	0.1
173	B15394D-KR-20-PC-1	111.7	7.7	81	103	0.5
174	B15394D-KR-20-PC-2	125.0	11.3	81	103	0.4
175	B15394D-KR-20-PC-3	102.0	10.3	81	103	0.5
176	B15394D-KR-20-PC-4	112.7	9.3	81	103	0.3
177	B15394D-KR-20-PC-5	108.7	10.0	82	105	0.1
178	B15394D-KR-20-PC-6	113.3	11.7	82	105	0.2
179	B15394D-KR-20-PC-7	103.0	8.7	81	103	0.3
180	B15394D-KR-31-PC-1	113.7	6.3	82	105	0.2
181	B15394D-KR-31-PC-2	109.7	9.7	81	102	0.2
182	B15394D-KR-31-PC-3	112.7	9.7	81	103	0.3
183	B15394D-KR-31-PC-4	109.0	6.0	81	103	0.8
184	B15394D-KR-31-PC-5	113.0	8.7	82	105	0.3
185	B15394D-KR-31-PC-6	115.0	9.0	83	105	0.5
186	B15394D-KR-31-PC-7	119.3	7.3	83	105	0.5
187	B15394D-KR-31-PC-8	122.7	6.0	83	105	0.6
188	B15394D-KR-31-PC-9	132.7	10.3	81	103	0.8
189	B15394D-KR-31-PC-10	135.0	7.0	81	103	0.8
190	B15397D-KR-27-PC-1	137.0	12.3	81	103	1.3
191	B15397D-KR-27-PC-2	128.0	8.3	81	103	1.2
192	B15397D-KR-27-PC-3	127.3	7.3	81	103	0.8
193	B15397D-KR-27-PC-4	133.0	13.0	81	103	1.3
194	B15397D-KR-27-PC-5	134.3	13.3	81	103	1.2
195	B15397D-KR-27-PC-6	129.7	11.3	83	105	0.8
196	B15397D-KR-31-3-PC-1	135.7	8.0	83	105	0.7
197	B15397D-KR-31-3-PC-2	138.0	6.7	83	105	0.4
198	B15397D-KR-31-3-PC-3	126.0	9.7	83	105	0.5
199	B15397D-KR-36-PC-1	146.7	7.3	81	103	1.6
200	B15397D-KR-36-PC-2	147.0	11.3	81	103	1.6
201	B15397D-KR-36-PC-3	149.0	6.3	81	102	1.5
202	B15397D-KR-36-PC-4	152.3	5.7	81	102	1.3
203	B15397D-KR-38-PC-1	169.3	9.0	82	105	1.4
204	B15397D-KR-38-PC-2	147.0	6.7	82	105	1.3
205	B15397D-KR-38-PC-3	164.3	10	82	105	1.3
206	B15397D-KR-38-PC-4	138.7	6.3	82	105	1.3
207	B15397D-KR-38-PC-5	155.7	13.7	81	105	1.1
208	B15397D-KR-38-PC-6	141.0	8.7	81	105	1.0
209	B15397D-KR-39-PC-1	127.7	18.0	81	105	0.6
210	B15397D-KR-39-PC-2	112.3	14.0	82	105	0.8
211	B15397D-KR-39-PC-4	124.7	13.0	80	103	0.9
212	B15397D-KR-39-PC-5	126.7	15.0	81	105	1.0
213	B15397D-KR-39-PC-6	124.0	10.7	81	100	0.8

No.	Lines	Plant height	Productive tiller quantities	Flowering age	Harvesting age	Yield
214	B15397D-KR-39-PC-7	134.7	11.0	80	100	0.7
215	B15402E-KR-18-PC-4	131.0	13.3	78	100	1.2
216	B15511D-KR-46-PC-2	128.7	10.7	80	102	1.5
217	B15892F-PC-3	84.3	12.7	87	110	0.2
218	B15892F-PC-5	94.0	13.0	86	110	0.3
219	B15892F-PC-8	81.0	6.3	87	110	0.0
220	B15892F-PC-9	87.0	5.7	87	116	0.0
221	B15892F-PC-12	68.7	7.3	90	113	0.1
222	B15892F-PC-14	76.3	10.7	90	113	0.0
223	B15892F-PC-15	82.0	11.3	90	113	0.1
224	B15892F-PC-22	79.7	11.0	90	113	0.3
225	B15892F-PC-23	96.0	9.7	90	113	0.1
226	B15892F-PC-24	80.3	9.0	90	113	0.0
227	B15892F-PC-25	87.0	9.0	90	113	0.2
228	B15892F-PC-26	105.3	12.7	90	113	0.2
229	B15892F-PC-29	106.0	9.3	90	113	0.2
230	B15892F-PC-31	89.3	6.3	90	113	0.3
231	B15892F-PC-33	72.7	7.3	90	112	0.0
232	B15892F-PC-35	91.0	11.3	90	112	0.5
233	B15892F-PC-38	97.0	9.3	90	112	0.1
234	B15892F-PC-39	89.0	6.7	90	112	0.0
235	B15892F-PC-40	88.7	18.3	90	112	0.0
236	B15900F-PC-2	66.7	7.7	90	112	0.0
237	B15900F-PC-4	90.3	7.7	90	112	0.1
238	B15900F-PC-6	82.3	10.3	90	112	0.0
239	B15900F-PC-7	82.3	5.7	90	112	0.0
240	B15920F-PC-1	86.0	9.7	90	112	0.0
241	B15920F-PC-35	58.3	3.7	90	112	0.0
242	B15933F-PC-1	94.0	11.3	85	108	0.4
243	B15939F-PC-7	93.7	6.7	87	108	0.3
244	B15939F-PC-20	102.0	11.7	85	110	0.9
245	B15939F-PC-22	87.7	9.7	87	110	0.1
246	B15939F-PC-26	79.3	11.0	87	110	0.2
247	B15939F-PC-29	114.7	7.3	87	110	0.1
Check A	Inpago 8	98.0	10.4	84.8	108.6	1.0
Check B	Inpago 12	95.0	8.5	84.4	105.8	0.6
Check C	Situ Bagendit	73.7	8.3	85.2	106.2	0.1
Check D	Situ Patenggang	102.4	10.1	80.0	102.4	0.6
Check E	Inpago 13	93.3	8.3	85.2	105.2	0.7
Check + LSI*						
Check A	Inpago 8	108.5	12.0	89.7	108.6	1.9
Check B	Inpago 12	105.5	10.1	89.3	110.5	1.5
Check C	Situ Bagendit	84.2	9.9	90.1	110.9	1.0
Check D	Situ Patenggang	112.9	11.7	84.9	107.1	1.5
Check E	Inpago 13	103.8	9.9	90.1	109.9	1.6

* LSI Note: Plant height = 10.5; productive tiller quantities = 1.6; flowering age=4.9; harvest age=4.7; result=0.9

The tested lines had an average score of resistance to leaf blast disease, neck blast, and resistance to Al poisoning in the field, respectively, 1.752; 2,546. and 3.521 (Figure 3). The distribution of disease attacks and Al poisoning implied that most of the breeding lines tested had low scores on the attack or resistance level.

Quantitative character selection can be based on genetic parameter values without neglecting the average population. Information on genetic diversity and heritability is needed to improve plant characteristics through plant breeding programs. This information provides an initial provision as a selection criterion (Lasmiana et al. 2016). The data shows a high heritability value for plant height (Table 3).

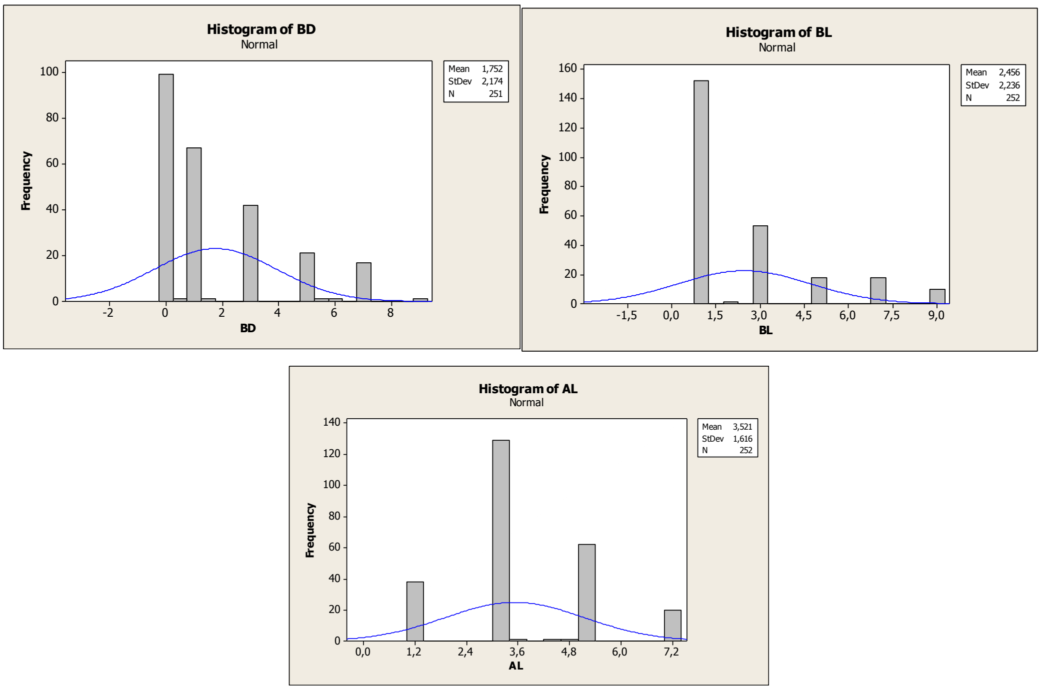

Figure 3. Distribution of resistance levels to leaf blast (BD), neck blast (BL), and Al poisoning of the tested breeding lines

This result shows that genetic factors are more influential on plant height characteristics than environmental factors. Oladosu et al. (2014) reported high heritability values for flowering age, harvesting age, and plant height.

The coefficient of genetic progress (GFC), the coefficient of phenotypic diversity (KKF), and genetic progress (KG) are effective genetic parameters for determining selection criteria. Pratap et al. (2012) research results showed that high heritability, KKG, KF, and KG scores were found in grain yield characters. However, Widyayanti et al. (2017) stated that the highest KKG values for rice lines were found in high characters, while the lowest KKG values were for flowering characters and harvesting age. A high KKG score indicates the potential for effective character improvement efforts through selection (Nur et al. 2012). The GFC value appears slightly higher than the KKG, indicating that the environment has less influence on breeding lines' performance (Sebasan et al. 2014) or that the genetic contribution to phenotypic diversity is higher than environmental factors (Andriani & Damanhuri 2018). Heritability and high genetic progress in plant height characteristics indicate that plant height is a selection criterion, and selection can be made to improve these characteristics (Lingaiah et al., 2014). According to Natawijaya (2012), selection pressure can be applied to characters with high genetic diversity and can be used as selection criteria. Yahya et al. (2012) also reported characters with high heritability scores of wheat and wide genetic diversity in the productive tiller quantities, tiller quantity, and leaf area. A character's high genetic diversity indicates an opportunity to improve wheat through this character. Therefore, character determination as a selection criterion requires heritability, high genetic progress, and wide genetic diversity.

Table 3 Character genetic parameters of all breeding lines tested

Character	VG	VP	H	KKG	KKF	KGH	KG (%)
Yield	0.02	3.22	0.01	14.12	175.58	0.02	2.34
Plant Height	65.19	68.39	0.95	7.89	8.09	16.24	15.88
Productive tiller quantity	1.47	4.67	0.31	13.28	23.68	1.40	15.35
Flowering Age	1.03	4.23	0.47	1.22	2.47	1.99	2.39
Harvesting Age	2.03	5.23	0.39	1.35	2.17	1.83	1.74

Note: VG=genotypic variance, VP=phenotypic variance, H=heritability, KKG=genetic diversity coefficient KKF=phenotypic variance coefficient, KG=genetic progress

Table 4. Correlation between results and characters of the tested breeding lines

Character	Plant Height	Productive tiller quantity	Flowering Age	Harvesting Age
Productive tiller quantity	0.049 0.443			
Flowering Age	-0.393 0.000	-0.092 0.147		
Harvesting Age	-0.338 0.000	-0.092 0.148	0.905 0.000	
Yield	0.671 0.000	0.163 0.009	-0.455 0.000	-0.452 0.000

In Table 4, it can be seen that the characteristics of plant height and the productive tiller quantities have a significant positive correlation to yield, while age has a significant negative correlation to yield. This result shows that obtaining the expected lines with high yields can be seen or selected based on the high plant height and the large productive tiller quantities.

4. CONCLUSION

The results of the analysis of variance showed that genotype only affected plant height and productive tiller quantities. The control variety significantly affected the character of plant height and the productive tiller quantities. From this activity, 37 lines were obtained with higher yields than the three comparison varieties.

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