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ADVANCE YIELD TRIAL OF 10 RESISTANT RICE LINES TUNGRO DISEASE AT TUNGRO DISEASE RESEARCH STATION LANRANG SIDRAP

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ABSTRACT

*One of the factors that influence national rice production instability is an attack of tungro disease that can lead to decreased production by up to 90% even if attacking in the vegetative period can cause crop failure. To reduce tungro disease in the field can be by using resistant varieties which are the most effective components in tungro control.Advanced yield trial is one step toprocess of producing tungro resistant varieties. This research aimed to identify the results of tungro resistant strains that have higher phenotypic character and yield potential than other tungro resistant varieties. The research was conducted at Tungro Disease Research Station , Lanrang Sidrap from December 2017 - March 2018 using a Randomized Complete Block Design (RCBD). were tentungro resistant lines and check varieties i.e Inpari 7 Lanrang and Ciherang and it was repeated 3 times. Data were analyzed using the F test and tested for significance with the Least Significant Difference (BNT). Correlation test was conducted between growth components, yield components and yields. The results showed that the lines tested had different performances on the growth component, yield component and yield.There are three lines, namely BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9, BP12206f-8-3-2*B-LR-20-4 and BP12280-3f-7-Kn-2-1*B-Lrg-1-16-14 which produced the highest productivity, which was supported by the number of filled grain per panicle and the number of panicles per clump.Flowering age 50%, number of panicles and number of filled grains were positively correlated with grain yield.*

Keywords:Rice, Tungro, Resistant Promising Line, Advanced Yield Trial

INTRODUCTION

Rice is the staple food for most Asian people and is consumed by 2.9 billion people in Asia (Brar & Khush, 2013)(Yamano et al., 2016) including Indonesian people. Increasing Population growth demands efforts to increase domestic rice production. One of the challenges in efforts to increase national rice production is the presence of pest attacks on rice plants, one of which is tungro disease which can significantly reduce production (Bunawan et al., 2014) depending on when the plant is infected, location and risk of infection, the season and variety (Widiarta, 2007). The following symptoms of tungro describe by Rivera and Ou (1965) is stunting of plants and yellowing of leaves are the most conspicous symptoms, when infected an early stage of growth, plants produce few tillers, root developments is poor, panicles formed on infected plants are small, sterile, and incompletely exserted and grains have dark blotches.

Broad tungro attack in the Dry Season from April to June 2018 according to OPT Data and DPI 2018 there are 1,418 Ha in 19 provinces in Indonesia with a ratio of planting area of 0.03% (*Direktorat Perlindungan Tanaman Pangan*, 2018). Oneway to reduce the development of tungro disease is by using resistant varieties (Muliadi, 2016) can be done through assembling varieties with various sources of resistance genes, both against viruses and vectors. Efforts formation of resistant varieties with high yield requires several stages of selection namely yield potential trial, advanced yield trial and multi-location test before release (Elixon et al., 2017)(Lestari et al., 2018). Advance yield trial is the final stage of a plant breeding program. To support the release of varieties, it is necessary to test the yield and adaptability of the lines or varieties (Arifin et al., 2011). The general characteristics of high yielding varieties are high yields, resistance to pests, tolerance to climate change and disease and preferable quality and taste (Hamdani & Haryati, 2021).

Therefore it is necessary to carry out a advance yield trial to identify the results of tungro resistant strains that have higher phenotypic character and yield potential than other tungro resistant varieties to gives farmers the option to choose a better variety.

MATERIAL AND METHODS

The research was conducted at paddy field Tungro Disease Research Station , Lanrang Sidrap from December 2017 - March 2018. The materials used were ten tungro resistant lines which has been tested for tungro resistance and check varieties i.e Inpari 7 Lanrang (tungro resistant varieties) and Ciherang (high production varieties and farmer preferences)(Table 1).

Research designed by using a Randomized Complete Block Design (RCBD) with 3 replications, so that there were 36 trial units. One unit of experiment is a plot of 3 m x 4 m with 25 cm x 25 cm spacing. Plant samples taken randomly in the experimental unit of 10 plants per line. Seedlings are planted after 21 days days after seedling. Fertilization is done twice, the first fertilization at 7 days after planting with a dose of NPK Ponska 300 kg/ha and urea 84 kg/ha and the second fertilization at 45 days after planting with a dose of Urea 166 kg / ha. Pests and diseases are controlled by following an integrated control system.

Table 1 Resistant Lineand Comparison Varieties

No.	Resistant line and comparison varieties	Tungro resistant score
1.	BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9	1 (higly resistance)
2.	BP12280-4f-Kn-3-1-1*B-Lrg-1-1-7	1 (higly resistance)
3.	BP12280-4f-Kn-3-3-1*B.Lrg.1-1-15-8	1 (higly resistance)
4.	BP12280-3f-7-Kn-2-1*B-Lrg-1-16-5	1 (higly resistance)
5.	BP11206f-8-3-2*-LR-20-4	1 (higly resistance)
6.	BP12280-3f-7-Kn-2-1*B-Lrg-1-16-14	1 (higly resistance)
7.	BP11208f-2-2-3*B-Lrg-2-1-7	1 (higly resistance)
8.	BP5796-4f-2-Kn-1-1*B-Lrg-1-1-14	1 (higly resistance)
9.	BP12280-4f-Kn-3-2-1*B-Lrg-1-20-4	1 (higly resistance)
10.	BP12280-3f-7-Kn-1-1*B-Lrg-1-8-13	1 higly resistance)
11.	Ciherang	
12.	Inpari 7 Lanrang	

Observations were made on 10 clumps of sample plants based on the Rice Plant Characterization and Evaluation System Guide (IRRI, 2013) with the following observation components are : flowering age of 50% (days), number of panicles per m2/number of productive tillers, plant height (cm), density score, weight of 1000 grains, number of filled and unfilled grain per panicle, moisture content (%) and grain yield (kg / ha).

Data analysis was by F test analysis and means were tested for significance followed by Least Significance Difference (LSD) test. To find out the correlation between the growth components, yield components and yields, a correlation test was carried out. Data processing using the SPSS 17.00 program.

RESULT AND DISCUSSION

Growth Components

Flowering age of 50% in Table 2 showed that there were 3 lines significantly different from the two comparison varieties, namely BP12280-4f-Kn-3-3-1 * B.Lrg.1-1-15-8, BP12280-3f-7-Kn-2-1 * B- Lrg-1-16-5 and BP5796-4f-2-Kn-1-1- * B-Lrg-1-1-14. These three lines are more early 3-6 days than the comparison varieties. Line BP5796-4f-2-Kn-1-1- * B-Lrg-1-1-14 has the shortest flowering age of 75 days after seedling.

Table 2 Average Growth Components of test lines and control varieties.

Lines/ varieties	Flowering age of 50%	Number of panicles	Plant height	Density score
BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9	81 a	21	116	1 good
BP12280-4f-Kn-3-1-1*B-Lrg-1-1-7	80 ab	14	121	1 good
BP12280-4f-Kn-3-3-1*B.Lrg.1-1-15-8	79 bc	18	124	1 good
BP12280-3f-7-Kn-2-1*B-Lrg-1-16-5	78 c	19	122	1 good
BP12206f-8-3-2*B-LR-20-4	80 ab	21	116	1 good
BP12280-3f-7-Kn-2-1*B-Lrg-1-16-14	81 a	20	123	1 good
BP5796-4f-2-Kn-1-1-*B-Lrg-1-1-14	75 d	19	119	1 good
BP12208f-2-2-3*B-Lrg-2-1-7	81 a	21	117	1 good
BP12280-4f-Kn-3-3-1*B.Lrg.1-1-4-4	80 ab	21	116	1 good
BP12280-3f-7-Kn-2-1*B-Lrg-1-10-13	80 a	20	123	1 good
CIHERANG	81 a	20	120	1 good
INPARI 7	81 a	21	119	1 good

According to (Kartina et al., 2017) that flowering age is negatively correlated with the number of empty unfilled grains, the shorter flowering period, the higher number of empty unfilled grains. Likewise, the results of this study of the three lines that had a short flowering period had a relatively higher number of empty unfilled grains than the comparison varieties (Table 3).

The number of panicles per hill ranges from 14-21 panicles and generally the same as the comparison varieties (Table 2). The number of tillers/panicles according to the (IRRI, 2013) guidelines is grouped into 5 criteria, ie very few (<5 tillers), few (5-9 tillers), medium (10-19 tillers), many (20-25 tillers), and very many (> 25 tillers). There are 6 lines that have the same panicle number or higher than the comparison varieties and are classified in the rice group with a large number of tillers, namely BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9, BP12206f-8-3-2*B-LR-20-4, BP12280-3f-7-Kn-2-1*B-Lrg-1-16-14, BP12208f-2-2-3*B-Lrg-2-1-7, BP12280-4f-Kn-3-3-1*B.Lrg.1-1-4-4 and BP12280-3f-7-Kn-2-1*B-Lrg-1-10-13, while line BP12280-4f-Kn-3-1-1*B-Lrg-1-1-7, BP12280-4f-Kn-3-3-1*B.Lrg.1-1-15-8, BP12280-3f-7-Kn-2-1*B-Lrg-1-16-5 and BP5796-4f-2-Kn-1-1-*B-Lrg-1-1-14 included in the rice group with a number of medium tillers.

According to (Rachmawati et al., 2014) the higher the number of productive tillers will be followed by an increase in grain yield per hill. The six lines that had the same or higher number of panicles than the comparison varieties also had a higher average grain yield and were not significantly different from the comparison varieties Inpari 7 except for the BP12280-4f-Kn-3-3-1 * B line. Lrg. 1-1-4-4 has a lower grain yield than the comparison variety Inpari 7 (Table 3), this is supported by the statement of (Wang et al., 2007) and (Kartina et al., 2017) which stated that the number of tillers in rice plants is directly proportional to the number of panicles produced and has a close relationship with grain yield.

Table 3 The Average Yield Components and Yield of The Test Lines and Control Varieties

Lines/ varieties	Weight of 1000 grains	Number of filled grain	Number of unfilled grain	Grain yield (kg/ ha)	
BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9	25,6	556	1230	2218,28	a
BP12280-4f-Kn-3-1-1*B-Lrg-1-1-7	26,65	613	1209	1574,42	cd
BP12280-4f-Kn-3-3-1*B.Lrg.1-1-15-8	26,25	441	1194	1284,34	d
BP12280-3f-7-Kn-2-1*B-Lrg-1-16-5	26,25	585	1161	1963,.82	abc
BP12206f-8-3-2*B-LR-20-4	24,1	603	797	2175,10	a
BP12280-3f-7-Kn-2-1*B-Lrg-1-16-14	24,23	391	1046	2144,99	ab
BP5796-4f-2-Kn-1-1-*B-Lrg-1-1-14	26,75	354	1119	1656,17	bcd
BP12208f-2-2-3*B-Lrg-2-1-7	24,45	519	1506	1945,80	abc
BP12280-4f-Kn-3-3-1*B.Lrg.1-1-4-4	28,3	339	774	1746,77	abcd
BP12280-3f-7-Kn-2-1*B-Lrg-1-10-13	23,8	635	1428	2067,09	abc
CIHERANG	24,65	458	605	2123,97	ab
INPARI 7	30,2	702	918	1895,59	abc

Plant height showed that were not significantly different between the test lines and the comparison lines. The lowest lines are BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9, BP12206f-8-3-2 * B-LR-20-4, and BP12280-4f-Kn-3 -3-1 * B.Lrg.1-1-4-4 with a plant height of 116 cm and the highest line among all the tested lines and control varieties was BP12280-4f-Kn-3-3-1 * B.Lrg.1- 1-15-8 with a height of 124 cm. The plant height of the 10 test and comparison lines ranged from 116 to 124 which were classified as moderate. Based on the (IRRI, 2013) guidelines, the height of rice plants in the generative phase was divided into 3 groups, namely short plants that had a height < 90 cm, medium plants between 90-125 cm, and tall > 125 cm. According to (Kartina et al., 2017), plant height has a positive effect on grain weight.This statement is not following the results of this study which showed that the highest line BP12280-4f-Kn-3-3-1 * B.Lrg. 1-1-15-8 actually had the lowest grain yield and was significantly different from the comparison varieties, whereas BP12280-3f-7-Kn-2-1 * B-Lrg-1-1-10-9 and BP12206f-8-3-2 * B-LR-20-4 lines with a plant height of 116 cm whereas it had grain yields tall one. This shows that plant height does not always affect yield.

The density score of 10 test lines is classified as good, meaning that during the study the line tested did not fall until entering the harvest time. This can happen because the test strain has a short plant height criteria to moderate according to (IRRI, 2013) guidelines so it does not easily fall.

Yield ComponentsandYield

The average weight of 1000 of 10 test lines was lower than the Inpari (Table 3). whereas compared to the ciherang variety 6 lines showed a higher weight of 1000 grains, namely BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9, BP12280-4f-Kn-3-1-1*B-Lrg-1-1-7, BP12280-4f-Kn-3-3-1*B.Lrg.1-1-15-8, BP12280-3f-7-Kn-2-1*B-Lrg-1-16-5, BP5796-4f-2-Kn-1-1-*B-Lrg-1-1-14 dan BP12280-4f-Kn-3-3-1*B.Lrg.1-1-4-4. Classification of 1000 grain weight refers to the research of (Sari & Puwoko, 2018) namely mild class (<25 g), moderate (25-30 g), and weight (> 30 g). The research of (Yakub & Isminingsih, 2013) showed that the weight of 1000 seeds had a significant positive correlation with grain yield, whereas the results of this study indicate that not all lines that weigh 100 grains high also have high grain yield. The results of (Arifin et al., 2011) showed that the weight of 1000 grains inpari 7 higher ciherang on tungro-affected land, as well as the results of this study showed that the weight of 1000 grains inpari 7 was higher than ciherang on land conditions of research there are no symptoms of the tungro disease.

In general, the test lines showed filled grain per panicle lower than inpari 7 variety and there were 6 test lines which showed higher filled grain than ciherang varieties, namely BP12280-3f-7-Kn-2-1 * B-Lrg-1- 1-10-9, BP12280-4f-Kn-3-1-1 * B-Lrg-1-1-7, BP12280-3f-7-Kn-2-1 * B-Lrg-1-16-5, BP12206f-8-3-2 * B-LR-20-4, BP12208f-2-2-3 * B-Lrg-2-1-7 and BP12280-3f-7-Kn-2-1 * B-Lrg- 1-10-13. According to (Sregar et al., 2013) the more the number of pithy grains per panicle, the higher the productivity of the plant, but in the BP12280-4f-Kn-3-1-1 * B-Lrg-1-1-7 line, the number of pithy grains per panicle was not followed. by the increase in plant productivity, this is supported by the statement of (Fatimaturrohmah et al., 2016) which states that the amount of filled grain rice produced in a panicle does not fully reflect the high yield that will be obtained.

In general, the tested lines had a higher number of unfilled grains than the Ciherang variety (Table 3). Two test lines showed a lower number of unfilled grains compared to Inpari 7, namely BP12206f-8-3-2 * B-LR-20-4 and BP12280-4f-Kn-3-3-1 * B.Lrg.1-1-4-4. unfilled grains can be caused by many factors, such as dryness, stink bug attack, lack of light intensity, and bacterial leaf blight so that photosynthate filling in rice grains is not optimal (Agustiani et al., 2019). (Fatimaturrohmah et al., 2016) stated that the fast filling and ripening of grain will create a void at the base of the panicle, this happens in test lines that having a short flowering life on average has a high percentage of empty grain because lines that have a short flowering life have a short vegetative phase which is crucial in filling seeds, this is in line with (Kartina et al., 2017) which states that the vegetative period is needed by plants to collect photosynthate products which will be distributed to all plant organs for growth and seed filling.

Table 3 shows that 7 lines had had higher grain yield than inpari 7, although not significantly different, while compared to the Ciherang variety 3 lines had higher grain yields. BP12280-3f-7-Kn-2-1 * B-Lrg-1-1-10-9 line had the highest grain yield compared to other test lines and control varieties. The grain yield was not significantly different from the BP12206f-8-3-2 * B-LR-20-4, BP12280-3f-7-Kn-2-1 * B-Lrg-1-16-14, and Ciherang Strains. three lines with higher grain yield than Ciherang indicated that grain yield is good because Ciherang as varieties that are popular in indonesia and favored by farmers with high production (Nugraha et al., 2017). The difference in grain yield in each test line was influenced by other yield components such as weight of 100 seeds, filled grain, unfilled grain, and also the the ability of the test lines to take advantage of environmental potential. According to (Fatimaturrohmah et al., 2016), The difference in yield of each genotype tested is influenced by the ability of plants to tolerate the environment during the growth period and differences in genetic potential which result in different growth performances and yields.

Correlation of growth component, yield component and yield

The correlation shows that there is a relationship between the growth component, yield component and grain yield, both positive and negative correlation (Table 4). The correlation between the two characters can be in the form of a growth component correlation or yield component correlation (Safriyani et al., 2019).

Flowering age 50% positively correlated with the number of panicles, grain content and grain yield (Table 4). This shows that the faster the flowering age of 50%, the higher the number of panicles and grain contents, and will contribute to increasing grain yields.

The number of panicles was positively correlated with grain yield.The higher the

Table 4 Correlation Growth Component, Yield Component and Yield

Variable	Number of panicles	Plant height	Weight of 1000 grains	Number of filled grain	Number of unfilled grain	Grain yield
Flowering age of 50%	0,27*	-0,15	0,13	0,34*	-0,10	0,45*
Number of panicles		-0,49	-0,07	-0,07	-0,21	0,60*
Plant height			-0,16	0,02	0,26*	-0,33
Weight of 1000 grains				0,06	-0,26	-0,45
Number of filled grain					0,23	0,26*
Number of unfilled grain						-0,16

number of panicles, the higher the grain yield. According to (ZHANG et al., 2010), the higher the number of panicles per clump, the higher the grain production.

Grain content was positively correlated with grain yield (Table 4).The higher the grain content per clump, the higher the grain yield per clump.This indicated that high grain content resulted in increased grain yield per clump and production (Afa et al., 2021).

CONCLUSIONS

The lines tested had different performances on the growth component, yield component and yield. There are three lines, namely BP12280-3f-7-Kn-2-1*B-Lrg-1-1-10-9, BP12206f-8-3-2*B-LR-20-4 and BP12280-3f-7-Kn-2-1*B-Lrg-1-16-14 which produced the highest productivity, which was supported by the number of filled grain per panicle and the number of panicles per clump. Flowering age 50%, number of panicles and number of filled grains were positively correlated with grain yield.

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