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Performance of Selected Plants in F2 and F3 Generation for Yield and Yield Component Characters of New Plant Type Rice Genotypes at Aerobic Rice Culture.

Suwarto^{1*}, Untung Susanto² and Siti Nurchasanah¹

¹Plant Breeding Laboratory, Department of Agrotechnology, Faculty of Agriculture, Jenderal Soedirman University, Purwokerto, Indonesia

²Indonesian Center for Rice Research (ICRR), Sukamandi, Subang, West Java

ABSTRACT

Using the variability present in the F2 population originating from New Plant Type (NPT) rice population, selection was practiced for high grain yield. Expected response to selection was estimated in F3 generation and compared with F2 generation. The F3 generation showed significant positive selection response for plant height, number of grain per panicle, panicles length, and flowering (days to 50% flowering), thus indicating the effectiveness of selection for these characters. This indicates the effectiveness of selection for these characters in F2 generation. The correlation and regression coefficient between F2 and F3 generation was significant for these characters. But, grain yield per clump showed non significant response in F3 generation. The correlation and regression coefficient between F2 and F3 generation was non significant for grain yield per clump, which indicates straight selection for this character during early generation (F2) may not be effective. Selection for plant height, number of grain per panicle, panicles length, and flowering (days to 50% flowering) can be made in the early segregating generation. Grain yield per clump is not effective for selection in early generation.

Keywords: New Plant Type, rice, aerobic

***Corresponding author**

INTRODUCTION

Rice is the staple food crop for more than two thirds of the world population and gives 35-60% of calories requirement. Food security of the Indonesia directly related to rice production [6]. Water reservoirs are decreasing due to intermittent drought and erratic rainfall which compelled the rice growers across Asia to switch over crops. The increasing scarcity of water threatens the irrigated rice production system in one hand and increased pressure on food production due to increasing population [3]. To overcome this situation it is essential that alternate ways of rice cultivation with less water and without compromising on yield were evolved and popularized. New Plant Type of rice appropriate at aerobic rice cultivation with suitable drought tolerant varieties addressed earlier in suboptimal situation were benefiting answer to address the water scarce situation already set in and for near future.

Breeding for plant improvement achieved through any breeding method depends on the variability available for selection and methodology of selection [2]. Considerable genetic variability can be generated by crossing two appropriately chosen parents. Once variability is generated the rate and progress achieved through selection depends on the various factors like selection intensity, availability of genetic variability, its genetic association with other related characters and breeding methodology. Grain yield is a complex character and is the result of interaction of many variables due to different gene association that might exist in different population and might result in quite different relationships. It is also largely influenced by environment [1,7]. Further genotype and environmental interaction reduces the effectiveness of early generation selection [4,8]. Large environmental differences may lead to failure of parental yield to be indicative of the yield of progeny [1]. So, direct selection for improvement of grain yield in segregating population may not be effective. The parent progeny correlation and regression between two generations shows lesser susceptible to environmental effect and is very useful for selection in segregating population for the production of NPT improved genotypes. The present investigation was aimed at studying the response of selection for yield and its component characters through mean, percentage of population mean and also through parent progeny correlation and regression coefficient between F₂ and F₃ NPT generations.

MATERIALS AND METHODS

The materials used in the present research were the seeds of F₂ plants of each of the three crosses involving one *Javanica* sub species rice (Melati) and two *indica* sub species of rice (Fatmawati and Inpari 13). The experiment was conducted during late *wet* season (March – June 2013) in the experimental garden of Agrotechnology Department, Faculty of Agriculture, Jenderal Soedirman University, Purwokerto, Indonesia. Standard aerobic rice cultural practices and need based plant protection measures were undertaken. Individual plant selections were made in each of the three F₂ populations. Based on the performance selections were made on plant height, number of panicles per plant, grain density, grain yield per plant and days to 50 % flowering. The 75 recombinant plants were selected, their data were recorded, harvested individually and carried forwarded to the F₃ generation.

The F₃ generation was raised during the early dry season (July – October 2013). The 75 families of F₃ were raised at a rate of 240 plants per family in separate sub plot. In each sub plot, families were grown in 12 rows having 20 hills per row with 30 cm × 20 cm spacing between and within rows. The observations were recorded from 27 random plants (9 plants per replication) from each F₃ family as in F₂ population. Progeny mean, range and percentage of population mean for selected individual for each population were estimated. Mean values were used to estimate the parent offspring correlation and regression between F₂ and F₃ generation. The 90 best performers F₃ were selected and forwarded to F₄ generation.

RESULTS AND DISCUSSION

The F₃ generation showed significant positive selection response for plant height, number of grain per panicle, panicles length, and flowering (days to 50% flowering), thus indicating the effectiveness of selection for these characters. This indicates the effectiveness of selection for these characters in F₃ or latter generation. The correlation and regression coefficient between F₂ and F₃ generation was significant for these characters

(Table 1 – 2).

The yield performance of F3 families raised from the selected F2 populations on the basis of phenotypic performance presented in Table 1. Grain yield per clump showed non-significant response in F2 generation. The correlation and regression coefficient between F2 and F3 generation was non-significant for grain yield per clump, which indicates straight selection for this character during early generation may not be effective. There was practically no relation between the yield of individual F2 selection and the mean yield of corresponding F3 families. This is also proved by the evidence of non-significant correlation and regression (Table 2 and Fig. 5). Similar type of finding was also reported by Barman and Borah [1] and Sharma *et. al.*, [5]. Thus selection based on phenotypic performance for yield in early generation is ineffective.

In respect of plant height, number of grain per panicle, panicles length, and flowering (days to 50% flowering) F3 generation showed high mean performance and percentage of population mean than in F2 generation. Moreover these characters showed strong correlation and regression between F2 and F3 generation (Table 2 and Fig 1 – 4).

Table 1: Mean performance of selected plants in F2 and F3 generation for different characters.

Characters	F2 Population			F3 population		
	Range	Mean	% of F2 population mean	Range	Mean	% of F3 population mean
Plant height (cm)	100 - 129	116.25	112.50	103 – 130	114.24	108.30
No of grain per panicles	259 - 403	320.42	125.62	265 – 396	315.40	118.50
Panicles length (cm)	25 - 35	29.90	130.20	26 - 39	30.27	120.56
Day to 50% flowering	81 - 98	87.89	125.46	83 - 96	88.70	108.90
Grain yield per clump (g)	50 - 68	59.29	128.30	51 - 69	60.30	119.50

Table 2: Parent offspring correlation and regression of the crosses over segregating generation for different characters.

Characters	Correlation coefficient F2 – F3	Regression coefficient F2-F3
Plant height (cm)	0.85 **	0.79 **
No of grain per panicles	0.83 **	0.77 **
Panicles length (cm)	0.86 **	0.95 **
Day to 50% flowering	0.70 **	0.74 **
Grain yield per clump (g)	0.17	0.16

.** Significant at 1% level of probability.

The intergeneration correlation and regression for yield component characters are presented in Table 2. The F2 generation showed significant positive correlation and regression with F3 generation for plant height, number of grain per panicle, panicles length, and flowering (days to 50% flowering). The highest correlation was observed in panicles length (0.86) followed by plant height (0.85), number of grain per panicles (0.83) and lowest is days to 50% flowering (0.70). This indicated the effectiveness of selection for these characters. These results were also agreed with the mean performance of the F2 selection and F3 progeny mean performance. However, grain yield per clump showed non-significant correlation between F2 and F3 generation. This indicates that selection for grain yield on the basis of phenotypic performance during early generation may not be advisable.

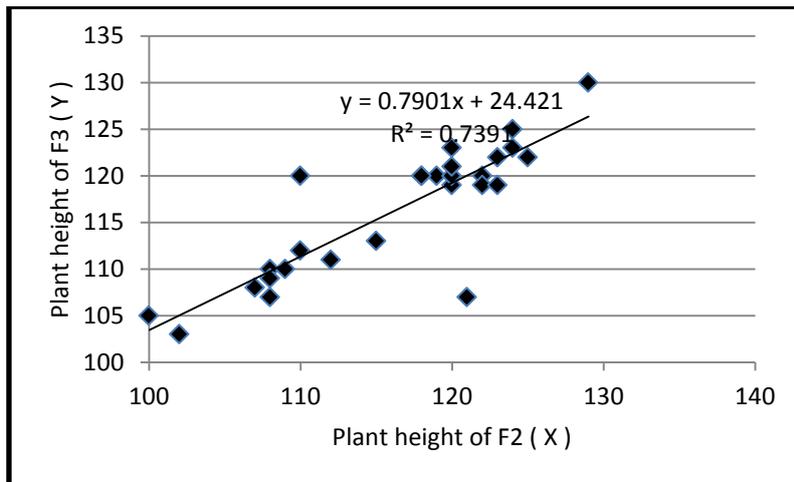


Figure 1: Parent progeny relationship in plant height (based on F2, F3)

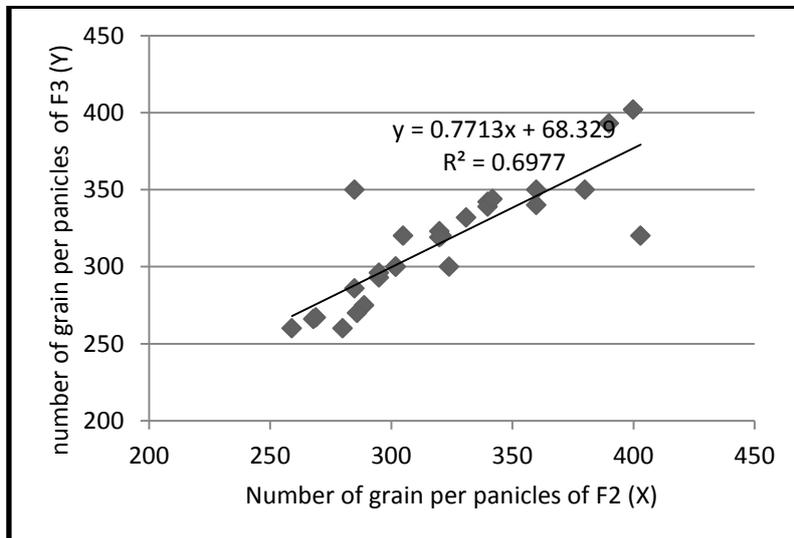


Figure 2: Parent progeny relationship in number of grain per panicles (based on F2, F3)

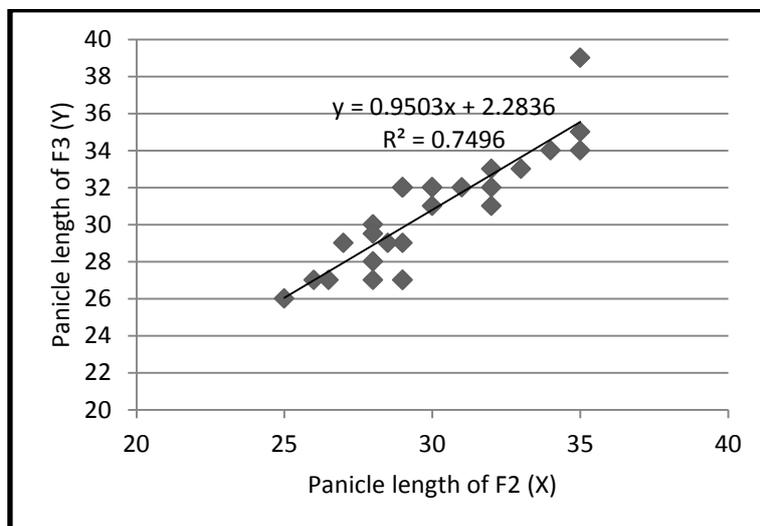


Figure 3: Parent progeny relationship in panicles length (based on F2, F3).

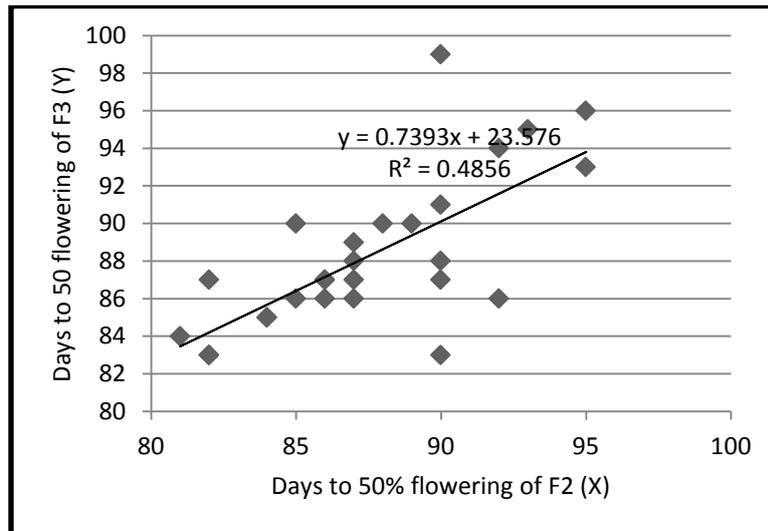


Figure 4: Parent progeny relationship in 50% flowering (based on F2, F3).

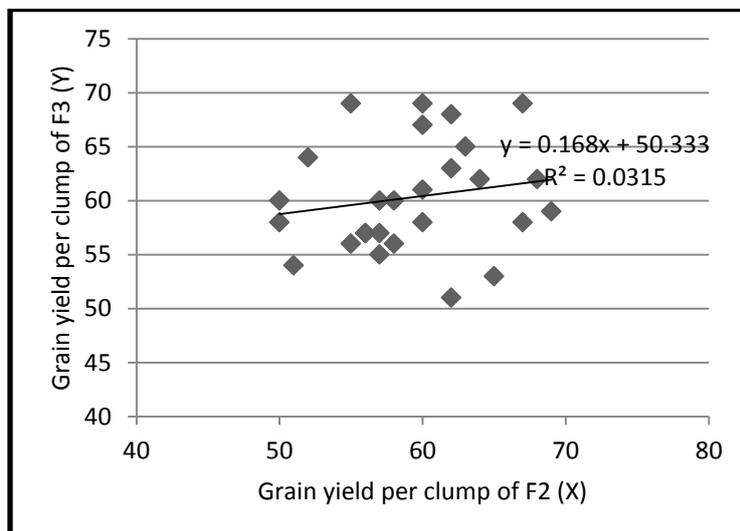


Figure 5: Parent progeny relationship in grain yield per clump (based on F2, F3).

CONCLUSIONS

- The F3 generation showed significant positive selection response for plant height, number of grain per panicle, panicles length, and flowering (days to 50% flowering), thus indicating the effectiveness of selection for these characters.
- Selection for yield component characters (plant height, number of grain per panicle, panicles length, and flowering) was effective in F2 generation.
- The correlation and regression coefficient between F2 and F3 generation was significant for yield component characters.
- The grain yield per clump showed non-significant response in F3 generation.
- The correlation and regression coefficient between F2 and F3 generation was non-significant for grain yield per clump, which indicates straight selection for this character during early generation (F2) may not be effective.
- Selection for plant height, number of grain per panicle, panicles length, and flowering (days to 50% flowering) can be made in the early segregating generation. Grain yield per clump is not effective for



selection in early generation.

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