

Efficiency of Marker-Assisted Selection in Development of BPH Resistance Lines of Rice

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Objectives

This study presents the findings of a case study designed to compare the selection efficiency between phenotypic selection (PS) and marker-assisted selection (MAS) in breeding of resistance lines to brown planthopper (BPH).

Materials and Methods

O Plants material

- F₂, F₆, BC₅F₄, BC₃F₅, BC₆F₄, and BC₆F₅ lines derived from a cross 'Samgangbyeo/Nagdongbyeo'.

O Methods for selection of BPH resistance plants

- MAS

- Used marker :

BpE18-3(F;5-CGCTGCGAGAGTGTGACACT-3, R;5-TTGGGTTACACGGGTTTGAC-3), RM3813

- PS

- Inoculation stage of BPH; 4 to 5 leaf stage of rice

Inoculation density of BPH; 15-20 nymphs/plant

O Factor searched

- The costs, labor and time required for BPH screening by PS and MAS.

Results and Discussion

Marker-assisted selection can produce rapid, accurate, and cheap gains early in the selection progress compared with conventional bioassay system (Yousef and Juvik., 2001).

In the screening of BPH resistance using the backcrossed population, the accuracy of PS system showed comparatively low level, 47.6%, in next generation. But all of the BC₆F₅ lines screened by MAS in BC₆F₄ generation appeared to resistance reaction. A period of preparing plant materials needed for selection was 30 days in PS and 7 days in MAS. The costs required for BPH screening in the MAS system accounts for approximately 37% of the total costs for PS.

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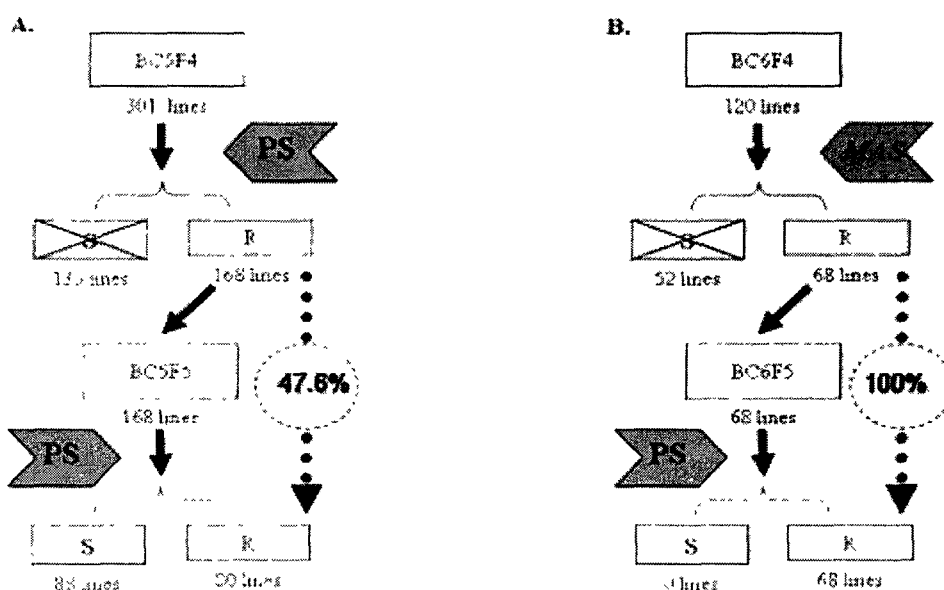


Fig. Comparison of selection efficiency between phenotypic (A) and marker-assisted selection (B).

Table. Time required for selection of BPH resistance lines in PS and MAS

Total time required*	PS	MAS
	30 days	7 days
Sowing/growing seedlings	20 days (4-5leaf stage)	5 days (for DNA sampling)
Inoculation/screening	7-10days (by check plants)	-
DNA extraction	-	1days
PCR/analysis of patterns	-	1days
Replication required	3-5 times	no

* Excepted the time required for rearing BPH (3rd-4th instar mymphs) in PS.

Table. Costs of PS and MAS procedures

	PS		MAS	
	Cost per 500plants	Percent of total	Cost per 500plants	Percent of total
Total cost*	₩1,273,000	100%	₩466,200	100%
Variable input				
Plug box for raising seedlings	₩50,000	3.9%	₩14,000	3.1%
Bed soil	₩18,000	1.4%	₩3,000	0.6%
Fuel**	₩450,000 (for 30days at 50m ²)	35.3%	₩64,200 (for 7days at 16m ²)	13.8%
Chemicals(Insecticide)	₩5,000	0.4%	-	-
Reagents (Taq, others)	-	-	₩75,000/250U	16.1%
Supplies (Tip, PCR tube)	-	-	₩140,000	30.0%
Labor				
Lab. technician /greenhouse laborer	₩750,000 (25,000×30 days)	59.0%	₩170,000 (25,000×7 days)	36.4%

* Excepted capital and overhead in the both PS and MAS.

** Fuel cost can be different by screening seasons and calculated with amount of gas used under winter greenhouse condition (at 25°C).