Increasing Genetic Diversity through Participatory Varietal Selection of Upland Rice in Lampung

Aris Hairmansis, B. Kustianto, E. Lubis, and Suwarno

Muara Experimental Station, Indonesian Center for Rice Research (ICRR)
Jalan Raya Ciapus 25 C, Muara, Bogor

ABSTRAK. Rendahnya tingkat adopsi dan sempitnya keragaman genetik varietas unggul di lahan petani merupakan salah satu masalah utama dalam program pemuliaan padi gogo yang tersentralisasi. Seleksi varietas secara partisipatif (Participatory Varietal Selection=PVS) dirancang untuk memecahkan permasalahan tersebut. Tujuan penelitian ini adalah untuk mengevaluasi penampilan sejumlah galur harapan padi gogo dan mengetahui preferensi petani melalui pendekatan PVS dengan menggunakan metode Induk-Anak (Mother-Baby Trial). Sebanyak 14 galur harapan padi gogo dievaluasi di kebun percobaan dan di lahan petani di Lampung sebagai percobaan Induk, dan tujuh galur harapan diuji di sepuluh lahan petani sebagai percobaan Anak. Hasil penelitian menunjukkan bahwa semua galur harapan mendapatkan respon disukai maupun tidak disukai oleh para petani. Hal ini mengindikasikan adanya keragaman preferensi petani terhadap galur-galur hasil pemuliaan. Introduksi galur-galur harapan yang beragam melalui PVS untuk menggantikan varietas lokal yang ada di petani diharapkan dapat mempercepat adopsi varietas unggul sekaligus memelihara keragaman genetik di lahan petani.

Kata kunci: PVS, padi gogo, keragaman genetik

ABSTRACT. Poor adoption and narrow genetic diversity of improved upland varieties become main problem of centralized breeding program for upland rice. Participatory Varietal Selection (PVS) was designed to overcome this problem. The objectives of this study were to evaluate the performance of advanced upland rice breeding lines that meet farmers' preferences through PVS using mother-baby trial design. Fourteen fixed breeding lines were evaluated at experimental station and farmers' field as mother trials; meanwhile seven fixed breeding lines were evaluated as baby trials at ten farmers' fields in Lampung Province. All breeding lines were generally preferred, indicating variability of farmers' preference. Introduction of diverse breeding lines to substitute local varieties might accelerate the adoption of improved varieties and maintain genetic diversity of upland rice.

Keywords: PVS, upland rice, genetic diversity

Upland rice in Indonesia is grown in about 1.5 million ha, about 12% of the country's total rice area. It contributed to about 5% of the national rice production with an average yield of 1.9 t/ ha. Upland rice areas comprise humid and semi arid zones. Major constraints of upland rice production in humid areas of Sumatra, Kalimantan, and Papua are diseases including blast, brown spot, and sheath blight, and soil problems such as acidity, aluminum toxicity, and phosphorus deficiency; whereas in semi arid zones of East Java, West and East Nusa Tenggara, drought is the major problem (Suwarno *et al.* 2002).

Even though many improved varieties of upland rice have been released, most farmers still prefer to cultivate traditional varieties. The poor adoption of improved varieties may be due to limited accessibility of the new varieties seeds or poor adaptation of improved varieties to local condition (Joshi and Witcombe 1995). In areas with high rainfall of Sumatra and Kalimantan, severe blast pressure is the most severe constraint to the adoption of improved varieties (Suwarno *et al*. 2002). The resistance of improved varieties to blast often breaks down after only two or three cropping seasons. New varieties may also be rejected due to their characteristics which do not meet farmers' preferences.

A participatory varietal selection (PVS) engaging farmers in selecting breeding lines was designed to overcome aforementioned problems (Almekinders and Elings 2001). Moreover, farmers' preferences to different varieties may support in maintaining biodiversity in the particular areas (Witcombe *et al*. 2001). According to Atlin *et al.* (2002) there are three key points where farmers' participation is needed in breeding programs: 1) identification of traits valued by farmers through participatory assessment, 2) preliminary farmers managed screening of fixed lines (PVS with many genotypes), and 3) advanced PVS and the use of farmer ratings.

The preliminary survey carried out in Central Lampung district revealed that average yield of upland rice was approximately 1.6 t/ha, lower than national average upland rice yield of 2.5 t/ha. The low yield mainly attributed to continued dependence on low-yielding but blast resistant traditional varieties due to the resistance breakdown of improved varieties, inaccessibility of pure and quality seeds, attack of pest and diseases (mainly blast) and low soil fertility (IRRI 2005). Because of those problems, most farmers in the area saw the need for varieties resistant to blast, high yielding, and have good eating quality. The objectives of this study were to evaluate performance of advanced upland rice breeding lines that meet farmer's preferences through PVS.

MATERIALS AND METHOD

Participatory varietal selection using "mother-baby trials" design was used in this study. The PVS was conducted at the experiment station of Tamanbogo and farmer's fields in Sukadana, Lampung Province, in Wet Season 2004-2005. This site was representing an intensive upland system with long growing season. The materials used in this study were fixed breeding lines that have been developed and evaluated agronomically on station.

Researcher Managed Mother Trials

Fourteen high yielding promising lines were tested at a researcher managed advanced yield trials, referred to as "mother-trials", at two sites, at the experiment station of Tamanbogo and at farmer field in Sukadana, Lampung during the wet season of 2004/05. Those lines were: (1) Bio511B-5-12-5-1;(2) Bio511B-61-2-3-1; (3) Bio511B-61-2-4-1; (4) Bio512B-MR-1-PN-26; (5) Bio528B-TB-12-1-1; (6) Bio530B-39-3-6; (7) Bio530B-5-6-5-4; (8) Bio530A-5-14-2-2-8; (9) TB356B-TB-18-3; (10) TB360B-TB-26-1; (11) TB393B-TB-17-1; (12) TB396B-TB-14; (13) TB437B-TB-1, and (14) B9071F-B-1. Sirendah (a blast resistant traditional variety) and Limboto (a modern blast resistant variety) were used as checks. A fully randomized block design with four replications was implemented.

To evaluate the PVS materials, a field day was held in Tamanbogo experimental station before maturity. Farmers were allowed to observe the lines and voted for preferred or non-preferred lines and discuss the reasons.

Farmer Managed Baby-Trials

Ten farmers of two sub districts of Central Lampung cooperated in conducting yield trials at their own fields. Seven varieties were planted, viz. Bio511B-12-5-1, Bio511B-61-2-3-1, Bio511B-61-2-4-1, Bio530B-39-3-6, Bio530B-5-6-5-1, IR30176B-1-B-2-2-MR-2, and TB47H-MR-10. The check varieties were Limboto and Sirendah. These "baby-trials" were fully managed according to farmers' common practices, from land preparation, planting, fertilizer application, weeding, pest control, and harvesting. Each farmer then asked to rank the lines according to their preferences.

RESULTS AND DISCUSSION

Researcher' Managed Mother Trials

Results of mother trial in Tamanbogo showed that most of promising lines yielded higher than check varieties.

Table 1. Yields of promising lines and check varieties tested in mother trial at Tamanbogo and Sukadana, Lampung, WS 2004/05.

Lines/varieties	Yield (t/ha)		
	Tamanbogo	Sukadana	Average
Bio528B-TB-12-1-1	5.52	4.00	4.76
Bio511B-61-2-3-1	4.07	4.07	4.07
Bio511B-5-12-5-1	4.42	2.84	3.63
B9071F-B-7	5.18	4.10	4.64
Bio511B-61-2-4-1	3.02	2.93	2.98
Bio512-MR-1-4-PN-26	3.95	2.70	3.33
Bio530B-39-3-6	4.17	1.98	3.08
Bio530B-5-6-5-4	4.79	4.23	4.51
Bio530A-5-14-2-2-8	4.54	3.47	4.01
TB360B-TB-26-1	4.03	3.69	3.86
TB393B-TB-17-1	5.33	4.12	4.73
TB396B-TB-14	4.72	4.07	4.40
TB437B-TB-1	2.72	2.80	2.76
TB356B-TB-18-3	4.41	4.18	4.29
Limboto	4.14	4.69	4.41
Sirendah	3.83	2.82	3.32
LSD (5%)	0.77	0.36	0.42

The three highest yielded lines at Tamanbogo were Bio528B-TB-12-1-1 (5.52 t/ha), TB393B-TB-17-1 (5.33 t/ha), and B9071F-B-7 (5.18 t/ha). The yields of the check varieties, Limboto and Sirendah, were 4.14 t/ha and 3.83 t/ha respectively. In Sukadana, promising lines yielded lower than that of Limboto (4.69 t/ha), but mostly higher than Sirendah (2.82 t/ha). Based on average yield in both sites, three best promising lines were Bio528B-TB-12-1-1, TB393B-TB-17-1, and B9071F-B-7 (Table 1).

Field day in the Tamanbogo experimental station was held before maturity. Result from this activity revealed that three best farmers' choice lines were TB393B-TB-17-1, Bio530B-5-6-5-4, Bio511B-61-2-3-1 selected by 35, 34, and 32 farmers, respectively (Table 2). There were no line or variety got consistence favorable or unfavorable responses. These indicated the preference variability among farmers. From the discussion revealed that the important traits that determine preferences of farmers in the varieties they grow include yield, resistance to the pest and diseases (especially blast), grain quality, maturity, panicle size and grain filling. The feed back from farmers in this survey will be used as a basis for further improvement of upland rice varieties.

Farmer Managed Baby Trials

In baby trials performances of the best three promising lines varied from farmer to farmer. Nevertheless, Limboto was the best choice as was given by seven out of 10

Table 2. Number of male and female farmers with preferred and non preferred responses to the promising lines and check varieties of rice tested in yield trial at Tamanbogo, Lampung, WS 2004/05.

Lines/varieties	Number of favorable responses			Number of unfavorable responses		
	Male	Female	Total	Male	Female	Total
Bio528B-TB-12-1-1	17	8	25	19	1	20
Bio511B-61-2-3-1	25	7	32	8	2	10
Bio511B-5-12-5-1	15	2	17	20	7	27
B9071F-B-7	17	5	22	16	3	19
Bio511B-61-2-4-1	11	0	11	22	9	31
Bio512-MR-1-4-PN-26	14	4	18	19	5	24
Bio530B-39-3-6	17	4	21	16	5	21
Bio530B-5-6-5-4	27	7	34	6	2	8
Bio530A-5-14-2-2-8	23	7	30	12	2	14
TB360B-TB-26-1	22	5	27	13	4	17
TB393B-TB-17-1	29	6	35	4	3	7
TB396B-TB-14	11	1	12	25	8	33
TB437B-TB-1	26	2	28	9	7	16
TB356B-TB-18-3	20	6	26	14	3	17
Limboto	16	2	18	17	7	24
Sirendah	20	8	28	14	1	25

farmers participated, while three farmers preferred TB47H-MR-10. Seven farmers voted for Limboto's as the best chose TB47H-MR-10 as the second best (Table 3).

This study indicated that variability of farmers' preferences. It would help to maintain genetic diversity of rice. Witcombe *et al.* (2001) reported that PVS increased on-farm biodiversity within three cropping seasons in high potential production system in Nepal and India.

One reason why local varieties tolerated the blast pathogen is high genetic variability among them (Suwarno *et al.* 2005). Introduction of many different lines to substitute diverse array of local varieties could maintain this high variability, and might be a good approach in increasing rice yield while maintaining resistance to blast. Since lines are continuously developed in breeding programs, similar trials could also be continuously conducted with different new sets of breeding lines.

In the next program, results of the preliminary PVS trials will involve a large number of farmers in local specific conditions. The informal research and development (IRD) (Joshi and Witcombe 2002) in which each participating farmer evaluates only one test variety will be adopted. For this purpose seeds of the promising lines will be distributed to selected farmers. The farmers are allowed to share the seeds produced to other farmers. Diffusion of selected breeding lines and varietal diversity in the area will be monitored. Surveys on diversity in the target area as well as survey on the population dynamics of the blast pathogen need to be taken to assess effectiveness of the program.

Table 3. Yields and yield ranks proposed by 10 farmers of the promising lines and varieties on baby trials in Lampung, WS 2004/05.

Lines/varieties	Yield (t/ha)	Number of ranking		
		1	2	3
TB47H-MR-10	3.07	3	5	2
IR30176B-1-B-2-2-MR-2	2.46	-	2	1
Bio530B-39-3-6	2.29	-	-	-
Bio530B-5-6-5-1	2.52	-	-	5
Bio511B-61-2-3-1	2.37	-	-	-
Bio511B-12-5-1	2.18	-	-	-
Bio511B-61-2-4-1	2.42	-	-	-
Limboto	2.97	7	3	-
Sirendah	2.10	-	-	1
Total	-	10	10	10

CONCLUSION

Participatory varietal selection (PVS) on upland rice indicated variability of improved varieties preferences among farmers. Continuous introduction of diverse breeding lines to substitute local varieties might accelerate the adoption of improved varieties and at the same time maintain genetic diversity of the rice.

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