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EVALUATION METHODOLOGY AND UTILIZATION SUBMERGENCE GENE IN SOUTHERN VIETNAM

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ABSTRACT

The year 2007-2009 was another exciting years filled with significant scientific achievements and valuable products, all thanks to the skills and commitment of the IRRI-Japan projects Through two years, our projects continued progressing, we expanded our network of partners, and we worked more closely with the plant breeding community. In this second year of the programme, we went beyond impact at the subprogramme level, increasingly progressing along the IRRI-Japan of activities and beginning to make real impacts on rice submergence improvement. These range from characterising germplasm diversity to discovering new genes for submergence from local varieties and developed breeding and adapted germplasms. The development of submergence breeding programmes is our bridge to reaching resource-poor farmers. As a result, projects initiated in 2007 were clearly built on, and added value to our previous work.on evaluation of breeding lines received from IRRI through INGER together with local check varieties like VN 95-20 and OM4900, is being conducted regularly in both wet and dry season of 2007 as a part of the Japan- IRRI activities. These lines are evaluated in farmers' fields as part of "mother trials" as well as on station at Cuu Long Delta Rice research Institute (CLRRI) and Institute of Agricultural Science for Southern Vietnam (IAS). Different traits were assessed, including crop duration, plant height, grains/panicle and percentage of filled grains, quality traits and submergence tolerance. Lines that are early maturing (90 - 110 days) semi dwarf (90 - 110cm) with medium number of panicles/hill (8-10 panicles) and high number of grains/panicle (80 – 100 grains) were selected for further testing in rice-rice cropping patterns when their submegernce tolerance is high (20 - 25 days) and 0.8 – 1 m water depth with duration of about 98 d, similar to OM 4900, such as IR64-Sub1 and Sawara-Sub1, and these lines will be suitable for submergence affected areas of Long An square and Can Tho. However, these lines were also identified that have similarly high submergence tolerance but with relatively longer duration such as Sawara- Sub1 (120 days) at dry season and (128 days) at Wet season and these lines will be suitable for rice - shrimp cropping pattern such as that in BacLieu and Tra Vinh and other salt affected areas. Selected lines will further be tested in subsequent years. This evolution is reflected in an expanded portfolio of projects in which two new lines IR64-Sub1 and Sawara-Sub1 were shared materials from IRRI and IAS tested them in submergence environments.

To enhance and sustain rice productivity in submerged condition, we applied an integrated approach involving the development of adapted high yielding and submergence tolerant varieties via novel breeding methods, proper management of resources and introduction of effective cropping patterns that can meet farmers' needs and market demands. Development of submergence tolerant varieties is generally considered as the most effective entry point for improving productivity of rice varieties damaged from typhoon and flash flood, and it is also the cheapest option for farmers. Many varieties such as OM 4900, IR64- Sub1, Swana-Sub1, Br11-Sub1, IR 82355-5-2-3, IR 84194-9 and IR 66876-11NDR-1-1-1-1 were developed that can yield 4-5 ton ha^{-1} under water depth from 0.8 – 1 meter for 20 – 25 days, and are being out-scaled. The success of new varieties was assured through eventual testing and selection in target sites in partnership with farmers and under their own management to guarantee relevance and adoption.

Future efforts should focus on further collection and evaluation of local germplasm to identify landraces with greater tolerance to submergence stress, as sources of new genes or alleles for breeding. Additional breeding efforts would be considered such as :assessment of the characteristics of the variety to meet the needs of farmers, development plans for sufficient seed multiplication of different varieties, and screening for Sub of IRRI and Vietnam released varieties and local germplasms. Special efforts should also be placed on training of young scientists to prepare a new generation that can effectively tackle these problems in a team approach

Keywords: Flash flood, Mother trial , Submergence

INTRODUCTION

Development and use of submergence tolerant species and varieties has generally been considered as the most economical and effective way of increasing crop production in submergence affected areas. We approach this through different ways: (i) collection and evaluation of indigenous material as potential donors for submergence tolerance and other adaptive traits, (ii) conventional and modern breeding approaches to develop tolerant rice varieties, and exchange and evaluation of sub tolerant elite materials with other countries through IRRI's INGER (International Network for Genetic Evaluation of Rice) and other international networks for local testing and release (Buu 1984).The development and spread of the variety Mahsuri, which can be considered as the first rainfed "mega variety" (ie., a variety grown in a very large area, usually several million hectares, and that is exceptionally popular with farmers) (Mackill 2006). This variety was developed from an indica/japonica crossing program initiated by FAO in the 1950s.

Mekong delta of Vietnam belongs to the tropic region. Its climate is characterised by two monsoon seasons during the year: (i) The Southeastern monsoon from May to November (wet or rainy season) is characterised by a lot of rain. About 90% of the total yearly rainfall fall during this season; and (ii) The Northeastern monsoon lasts from December until April (dry season) and is characterised by the absence of appreciable amount of rainfall. Due to its meteorology and hydrologic regime of the Mekong river, the delta has annually flood season from September to November. Damage to rice may cause by flash flood due to heavy rain at beginning of Winter - Spring crop or at middle of Summer - Autumn crop and by early annual flood (Buu et al., 2003).

Recently, IRRI scientists have released some submergence tolerant rice varieties. They could resist up to two weeks in flood condition (Mackill et al., 2007). However, their submergence tolerance depends on variety, time and depth of submergence, water turbidity, etc. These varieties should be also evaluated their submergence ability in the local condition and adopted by local farmers.

General Objective: To evaluate the agronomic characteristics of submergence tolerant rice genotypes in normal and flood conditions in Mekong delta and the adoption ability of these varieties by the farmers.

Specific objectives:

- To evaluate the agronomic performance and characteristics of submergence tolerant rice genotypes in normal and flood conditions in Mekong delta;

- To involve the farmers in the selection process of the best submergence rice tolerant genotypes adopted in their farm conditions;

- To select the good materials of submergence tolerant rice genotypes for further breeding studies;

MATERIAL AND METHOD

On-station MYT trials of Sub1 varieties in Winter - Spring 2007-2008

MYT trials of Sub1 varieties in Winter - Spring 2007-2008 at Vinh Hung, Long An and Vinh Thanh, Can Tho

On-station MYT trials of Sub1 varieties in Summer - Autumn 2008

Normal condition MYT trials of Sub1 varieties in Summer - Autumn 2008 at Vinh Hung, Long An;Co Do, Can Tho and Phung Hiep (Hau Giang)

Annual flooding occurred in August completely damaged the rice genotypes/varieties in the trial. Therefore, no data at harvesting time was recorded.. PVS trials of Sub1 varieties in Summer - Autumn 2008 were conducted at Phung Hiep, Hau Giang

The experimental design was a randomized complete block design with five replications. Each plot, 2 m long and 10 m wide, was transplanted with spacing of 20 x 15 cm. Plot sites were located outside the commercial rice production areas of the respective states.The following data were recorded: plant height (measured from soil line to tip of flag leaf), date of first and 50% tillering, date of first, 50%, and last heading (heading defined as date of panicle emergence from the boot). Five panicles per plant and five plants per plot were harvested at physiological maturity. After collection panicles were carefully transported to a laboratory and rapped ten times against a plastic bucket. The percentage of seeds remaining on the panicle was used to give a seed . Total seed weight, 1000-seed weight, and total seed number were also determined. Panicles were stripped by hand into a bucket, all seed returned to the sample envelope and allowed to dry for 3 days at 50°C. The seed were then passed through a small seed lot thresher to separate the blank florets from the seed. Both empty florets and total seed weights were obtained. A sample of 1000 seeds was weighed and the total number of seeds was calculated.

Statistical analyses

All analyses were completed on plot mean values.Analysis of variance was performed using The minimum model used for all analyses of variance was comprised of entries and replications, with the entry_replication interaction used as the error term. Replications and the entry_replication interaction were considered random effects. Separation of means was performed using the Duncan's Multiple Range Test.

RESULT AND DISCUSSION

On-station MYT trials of Sub1 varieties in Winter - Spring 2007-2008

Evaluation of breeding lines received from IRRI through INGER together with local check varieties namely VND 95-20 and OM4900, is conducted regularly in both wet and dry season 2007 as part of the Japan- IRRI activities. These lines are evaluated in farmers' fields as well as on station at CLRRI and IAS. Different traits were assessed, including crop duration, plant height, grain setting and fertility, quality traits as well as submergence tolerance. Lines that are early maturing (90-110 days) semi dwarf (90-110 cm) with medium number of panicles/hill (8-10 panicles) and high number of grains/panicle (80-100 grains) were selected for further testing in rice-rice cropping pattern when their submergence tolerance is high (survival after 20-25 day submergence at 0.8-1 m water dept) and duration of about 98 d, similar to OM 4900. They were IR 64- Sub 1 and Sawara-Sub 1 and these lines will be suitable for submergence affected areas of Long An square and Can Tho. However, those lines have similarly high submergence tolerance but with relatively longer duration such as Sawana-Sub1 (120 days) at dry season and (128 days) at Wet season will be suitable for rice - shrimp cropping pattern in BacLieu and Tra Vinh and other salt affected areas. Selected lines will be further tested in subsequent years.

MYT trials of Sub1 varieties at Vinh Hung, Long An in Winter - Spring 2007-2008

The results this time Two varieties IR64-Sub 1 and Swarna-Sub 1 good for the yield also disease and insects .

Table 1. Yield and yield components of rice varieties tested at Long An, Winter-Spring 2007-2008

No	Rice genotypes /varieties	Panicles /m^2 (no.)	Filled grains/ Panicle (no.)	Percentage of unfilled grains (%)	1.000 grain weight (g)	Grain yield at 14%MC (t/ha)
1	IR 07F102 (IR64-Sub1)	306	85	13.78	25.7	6.34
2	IR05F101 (Swarna-Sub1)	295	104	20.50	19.9	5.29
3	OM 4900 (LC 2)	236	111	17.60	26.7	7.02
4	VND 95-20 (LC 1)	309	97	6.60	26.9	7.28

Table 2: MYT trials of Sub1 varieties at CoDo , Can Tho in Winter-Spring 2007-2008

No	Rice genotypes /varieties	Height (cm)	Panicle length (cm)	Unfilled Grains (%)	Panicles /m2 (no.)	Filled grains/ panicle (no.)	1000 grain weight (g)	Yield (t/ha)	Reaction (scale)	
									BPH	Blast
1	IR84194-139	90.6	25.4	45.5	318	96	29.7	3.6	1	1
2	IR82810-407	78.7	24.7	15.2	450	250	21.58	7.7	1	0
3	OM4900(Check)	96	23.7	37.6	324	139	28.3	5	3	3
	CV%	0.8	3.3	1.6	0.1	0.3	3	11.2	-	-
	$LSD_{0.05}$	1.615	1.85	1.147	0.984	1.139	1.831	1.337	-	-

On-station MYT trials of Sub1 varieties in Summer - Autumn 2008

MYT trials of Sub1 varietiesin normal condition at Vinh Hung, Long An in Summer - Autumn 2008

The results show that IR 07F289 was the highest in height (50.07 cm) and IR 05F 102 was the shortest variety (40.06 cm) at 20 days after transplanting. At 35 days after transplanting, the highest variety was IR 82355-5-2-3 (75cm) and the shortest variety was Samba Mahsuri (54.87cm). The fastest height growth dynamic between these two periods was on PSBRc 68 and the slowest was on Swarna. Because the flood came early, only 5 variety were taken the height at harvest. In general, these varieties were short phenotype. The shortest variety was VND 95-20 (83.3 cm), and the highest one was IR 82355-5-2-3 (88.67 cm).

Regarding pest and disease, the results show that all of the varieties have no symptom of blast and tungro in Summer – Autumn season 2008. However, some varieties were susceptible to BPH (score 7) such as: IR 07F290, IR 07F290, IR 43069-UBN 507-3-1-2-2, Samba Mahsuri, CR1009 and IR66876-11-NDR-1-1-1-1 and some expressed their resistance such as: IR07F287, Swarna, IR57514-PMI-5-B-1-2, IR 82355-5-2-3, IR 82355-5-1-3 (score 1). The other varieties were intermediately infected by BPH (score 3-5). IR 82355-5-1-3 was strong damaged by Yellow stunt virus disease (3.51%) and the least damage was IR 07F 290 (0,24%).(Table?).

The most early flowering was IR 82355-5-1-3 (49 days after transplanting). Then to VND95-20, IR 82355-5-2-3, IR64, IR 07F102 (from 50 to 52 days after transplanting). Some varieties had not flowers until the flood came and at harvesting time such as: Samba Mahsuri, IR 43069-UBN 507-3-1-2-2, CR1009, BR11. The data from flowering to ripening of all varieties were just collected on 5 varieties and there was not much variation among them (from 24 to 25 days).

The growth duration of varieties which were harvested, varied from 89-91 days. In general, all of these varieties were A_1 group which is suitable with the crop structure in the Plain of Reeds. The grain yield ranged from 2.2 tons/ha in IR 07 F 102 to 3.53 tons/ha in IR 82355-5-2-3.

Table 3. Yield and yield components of rice varieties in the MYT trial (normal condition) in Long An, Summer - Autumn 2008

S. No.	Rice genotypes /varieties	Fresh weight of fodder (t/ha)	Panicles/ m^2 (no.)	Filled grains /panicle (no.)	Percentage of filled grains (%)	1000 grain weight (g)	Yield (t/ha)
1	IR 07 F102 (IR 64 – Sub1)	4.44 a	275 a	54.6 a	78.26 ab	27.77 ab	2.21 c
2	IR 64	3.61 d	175 b	57.3 a	81.75 a	28.47 a	2.77 b
3	IR 82355-5-1-3 (IR 05A193)	3.88 c	250 a	57.0 a	75.78 b	26.73 c	2.71 bc
4	IR 82355-5-2-3 (IR 05A199)	3.40 d	125 c	61.6 a	77.57 ab	27.10 bc	3.53 a
5	VND 95-20 (check)	4.09 b	200 b	59.3 a	78.89 ab	27.23 bc	2.91 b
	CV (%)	2.81	7.65	8.68	3.53	1.76	10.35
	$LSD_{0.05}$	0.21	29.54	9.47	5.21	0.20	0.55

In a column, means followed by a common letter are not significantly different at 5% level.
Note: Annual flood occurred at the end of September had completely damaged to the late rice varieties in the trial. Therefore, no data at harvesting time was recorded for late varieties. Only early rice varieties were harvested

MYT trials of Sub1 varieties in submerged condition at Vinh Hung, Long An in Summer - Autumn 2008

The results showed that all of the varieties recovered and developed after 4-6 days of transplanting and they were relatively equal between the treatments.

Tillering ability was exhibited in the number of tillers/m^2 of varieties at stage before submerged (14 days after transplanting). As in the result, we recognized that IR 49830-7-1-2-3 and IR43069-UBN507 obtained the highest tillers (414-426 tillers/m^2) and had a statistically significant difference in comparison to well tillering varieties. As shown in Table 1, the tested varieties could recover and develop good tillers such as IR07F290 (361 tillers), IR07F287 (349 tillers), IR64 (331 tillers), IR07F291 (330 tillers), IR57514 – PMI-5-B-1-2 (325 tillers), BR11 (315 tillers), IR07F102 (309 tillers), IR05F102 (307 tillers) and VND95 – 20 (300 tillers). The remaining had intermediate tillers. The poorest one was IR82355 – 5 – 1 – 3 (213 tillers).

The varieties which were the fastest on height growing included IR49830-7-1-2-3, IR57514-PMI-5-B-1-2, PSBRc68, IR43069-UBN507, IR66876-11-NDR-1-1-1-1, IR07 F289, IR07F291 (48,00 – 55,75 cm). The other varieties were noticed at average height growing. At the time submerged, some varieties grew quickly; however, most of the varieties have had slow height development, especially PSBRc 68 (from 49.16 to 72.00 cm) was as the strongest in height growing.

According to the results , the proportion of survival varieties after 12 days of complete submergence had a great difference among the varieties in the experiment. The average water level at submerging stage was 75 to 90 cm, the quality of water was relatively opaque. The varieties completely died were Swanrna, Sambamashsuri, CR1009 with the death percentage more than 99 %. The varieties having relatively high survival proportion were IR49830-7-1-2-3, IR82355-5-2-3, IR57514-PMI-5-B-1-2, PSBRc68 and IR07F102 (42,62 – 62,07%). The varieties with average survival percentage included BR11 (25,27%), IR07F287 (32,60%), IR43069-UBN507 (34,56%), IR07F290 (36,56%) and the local check VND95 – 20 (28,29%).

The results show that IR 07F287 was the tallest (50.86 cm) and IR 05F 102 was the shortest (40.06 cm) at 20 days after transplanting. At 35 days after transplanting, the highest variety was IR07F289 (68 cm) and the shortest variety was Swarna (54.86cm). The fastest height growth dynamic between these two periods was on PSBRc68 and the slowest was on Swarna. Because the flood came early there were 5 variety were taken for plant height at harvest. In general, these varieties were short phenotype. The shortest variety was IR

64 (93.0 cm), and the highest one was IR07F102 (145 cm) which was very lodging.

With pest and disease, the results in Table *5.2.3.2* showed that all of the varieties have no symptom of blast and tungro in Summer – Autumn season 2008. However, there were varieties affected by BPH at score 9 such as: Samba Mahsuri, IR 57514-PMI-5-B-1-2 ,IR 82355-5-2-3,IR 82355-5-1-3, PSBRc68, and IR 49830-7-1-2-3. The remaining was resistant to BPH.

All of the varieties were transplanted at 20 days after sowing. The most early flowering was IR 07F287 (? days after transplanting followed by IR 82355-5-2-3, IR 64, IR 07 F102 (from 50 to 52 days after transplanting). The data from flowering to ripening of all varieties was just collected on 13 varieties and the variation was from 24 to 25 days. Some varieties died due to suceptible with BPH.

The growth duration of harvested varieties were from 100 - 141 days. In general, these varieties had late duration which were suitable to the crop structure near the sea such as Ca Mau, Kien Giang.

The yield of tested varieties were from 2.0 tons/ha to 5.7 ton/ha. IR07F287 was the lowest and the highest was Swarna. It showed that Swarna was very good for Wet season in Mekong Delta. However, this variety had long duration, which may be suitable for the area with rice - fish farming system.

Table 4. Yield and yield components of rice varieties in the MYT trial (normal condition) at CLRRI, Summer-Autumn 2008

Plot	Rice genotypes/varieties	Number of tillers/m^2	Number of panicles/m^2	Percentage of filled grains (%)	Fresh Weight of Fodder	Grain Weight (kg)	Grain yield (kg/ha)	Computed Yield (t/ha)
1	IR 07F102	99.00 b	92.00 b	90.00 d	284.50 d	1.28 b	2560.00 b	2.53 b
2	IR 05F102	99.67 b	82.00 c	92.31 bc	310.50 c	1.40 b	2806.67 b	2.79 b
3	IR 07F287	108.00 a	95.00 a	90.10 d	80.30 g	1.00 b	2006.67 b	2.00 b
4	IR 07F289	93.00 c	65.00 e	92.35 bc	254.50 e	1.06 b	2113.33 b	2.11 b
5	IR 07F291	88.00 e	80.00 d	91.02 cd	316.00 b	1.34 b	2673.33 b	2.66 b
6	IR 07F290	90.00 d	82.67 c	70.50 g	222.40 f	1.12 b	2233.33 b	2.23 b
7	IR 66876-11-NDR-1-1-1-1	98.00 b	68.00 e	87.72 e	316.00 b	1.41 b	2826.67 b	2.82 b
8	IR 64	90.00 d	71.00 e	83.04 f	221.80 f	1.67 b	3333.33 b	3.32 b
9	SWARNA	95.00 c	82.00 c	88.40 e	347.60 a	2.61 a	5226.67 a	5.22 a
11	IR 43069-UBN 507-3-1-2-2	98.00 b	60.00 e	80.33 f	316.00 b	1.45 b	2893.33 b	2.87 b
12	CR 1009	88.00 e	80.00 d	71.00 g	285.00 d	1.20 b	2393.33 b	2.38 b
13	BR 11	103.00 a	90.00 b	94.70 a	284.40 d	1.84 ab	3673.33 ab	3.63 ab
14	OM 4900 (check)	110.00 a	95.00 a	93.50 ab	286.40 c	2.51 a	5026.67 a	5.01 a
	CV (%)	1.10	1.30	0.90	0.20	28.70	28.70	28.70
	$LSD_{0.05}$	1.87	1.77	1.34	1.08	0.74	1481.08	1.47

MYT trial of Sub1 varieties in submerged condition at Co do, Can Tho in Summer - Autumn 2008

The results indicated that there was different in days to flowering among tested varieties. The varieties showed early flowering such as IR 07F102 and IR 07F287. However, the days to flowering of IR05F102 was longer in submerged condion as compared to non submerged condion about 33 days.

The varieties IR07F287, IR07F289,IR82355-5-1-3, IR07F291, IR07F290, Swarna, had reaction with BHP and Blast at 0 or 1-3 score. These were considered as the promising varieties resistant to BPH in the high epidemic condition in the Mekong Delta. Also, these are as good donors BPH resistance which farmers need. However, some line showed resistant to BPH at Long An but susceptible to BPH in Can Tho (score 7) such as IR82355-5-1-3.

Table 5. Plant height of rice varieties in the MYT trial (sub condition) in CLRRI, SA 2008

No.	Rice genotypes/varieties	Plant height at 20DAT (cm)	Plant height at 35DAT (cm)	Plant height at maturity (cm)	% Survival in flooded condition
1	IR 07F102	42.67 b	67.00 abc	148.67 a	69.35 a
2	IR 05F102	36.00 c	64.00 cd	101.67 a	43.27 b
3	IR 07F287	42.33 b	65.33 bcd	104.67 a	57.04 a
4	IR 07F289	45.00 b	66.33 abc	111.67 a	59.08 a
5	IR 07F291	45.33 b	68.00 ab	116.33 a	32.84 b
6	IR 07F290	45.33 b	64.33 cd	98.67 b	36.57 b
7	IR 43069-UBN 507-3-1-2-2	49.00 a	69.67 a	97.00 b	60.50 a
8	OM 4900	44.33 b	62.67 d	121.67 a	63.11 a
	CV (%)	4.70	2.70	1.40	14.80
	$LSD_{0.05}$	2.19	1.91	1.66	8.35

The varieties having high survival percentage after submerging at Co Do, Can Tho including: five varieties had the survival high such as: IR 07F102 (69.35 %), IR 43069 –UBN 507-3-1-2-2 (60.50 %), IR 07F287(57.04 %),IR 07F289(59.08 %) and OM 4900 (63.11 %). The others had low survival percentage after submergence, ranging from 40 – 12 % (Table 5?).

In general, as 3 trials (PVS, MYT in normal and flooded condition) transplanted later than the other rice production fields about 30 to 40 days, so it is difficult to protect plant against insect pests, rats and birds. Some varieties were damaged 80 to 90 percent by rats, some varieties were hopperburnt. Also, when flooding came immatured varieties were submerged and damaged. However, some lines were identified good as IR64-*Sub*1 for dry season and. Swarna-*Sub*1 was goods for both dry season and wet season. Some area difference yield such as : The site at Hau Giang : Comments on the overall performance of the two to three or four (2-3 or 4) most preferred varieties through farmers discussion. BR11: the yield: 3.5 tons/ ha, IR 66876-11NDR-1-1-1-1: 4.22 ton/ ha, compare with OM 4900 (local check): 5.15 ton/ha. Some submergence tolerant breeding lines from IRRI breeding material were tested in farmers' fields in Tra Vinh and those short duration lines (<100 d) that outyielded the check variety OM 4900 were selected. Some such line as IR 64-Sub 1 yielded significantly higher than the check variety and was considered as candidate for release to areas where three crops can be grown per year.

On-farm PVS trials of Sub1 varieties in Summer - Autumn 2008

RM-PVS trials of Sub1 varieties at Vinh Hung, Long An in Summer - Autumn 2008

The results in Table 6 showed that without flash flood in trial condition, the survival rate of

varieties tested was very high (99.1-99.8%). The plant height of the tested varieties were significantly higher than that of local check variety of VND 95-20 at maturity stage.

In this Summer-Autumn 2008, brown plant hoper, leaf blast and ragged stunt virus disease were infected to rice plants but varieties were differently suceptible to these pests and diseases (Table ?). For brown plant hoper, the reaction of varieties IR 85264-141, IR 85260-148 and IR IP 66876-11-NDR-1-1-1-1 were scored at 7, while other varieties were able to resistant to brown plant hoper such as IR 49830-7-1-2-3, IR 84196-32, IR 82355-5-1-3 and IR 82355-5-2-3 (score 1). Other varieties were slightly suceptible to brown plant hoper. In the trial, the tested varieties were slightly infected by blast disease (score 0-1).

The results from table 5.3.2.3 showed that there were 5 oout of 15 varieties, including local check varieties in the trial having the growth duration of less than 100 days. The remain varieties, at the annual flood coming, were just at the flowering stage. As subsequence, these varieties were completely damaged by the flood. Therefore, due to permanent annual flood, a suitable rice variety in the Plain of Reeds was required as early rice variety (90-100 days or earlier).

There were only 5 varieties which ripened before flood came were harvested in the trial (Table 6). In general, the yield of these varieties were low as compared to that of varieties in rice production fileds that were earlier growing. Although there was no significant difference in yield, the local check (VND 95-20) had a tendency to be the highest yield (3.813 t/ha). The subsequent yielders were IR82355-5-1-3, IR82355-5-2-3 and IR84194-139. IR84194-9 was the lowest (3.166 t/ha). Panicles/m^2, filled grains/panicle and weight of 1000 grains were components affecting to the yield of the varieties.

According to the evaluation results of farmers during the field visit (Table 6), two rice varieties most preferred by farmers were IR 82355-5-2-3 and IR 84194-9. The farmer's opinion on two varieties least preferred were IR 84196-32 and IR 84193-36. The evaluation of the farmers were mostly based on the criteria of growth duration, pest and disease tolerance and panicle characteristics. These explained the differences between the evaluation of farmers and the yield at harvest time.

Table 6. Yield and yield components of rice varieties in the PVS trial at Long An in Summer-Autumn 2008

S. No.	Rice genotypes /varieties	Panicles/ m^2 (no.)	Percentage of filled grains (%)	Filled grains/ Panicle (no.)	P 1000 grains *(g)*	Yield *(t/ha)*	Rank
1	IR82355-5-1-3 (IR05A193)	278 a	69.17 b	60.3 a	27.93 b	3.600 a	2
2	IR82355-5-2-3 (IR05A199)	298 a	70.30 ab	56.3 a	29.02 a	3.533 a	3
3	IR84194-139	271 a	80.50 a	59.3 a	28.10 b	3.466 a	4
4	IR84194-9	268 a	77.70 ab	54.3 a	27.84 b	3.166 a	5
5	VND 95-20 (local check)	336 a	71.70 ab	54.6 a	26.04 c	3.813 a	1
	CV (%)	12.94	7.83	12.94	0.98	9.84	
	$LSD_{0,05}$	70.83	10.9	13.88	0.51	0.650	

In a column, means followed by a common letter are not significantly different at 5% level.
Note: Annual flood occurred at the end of September had completely damaged to the late rice varieties in the trial. Therefore, no data at harvesting time was recorded for late varieties. Only early rice varieties were harvested.

PVS trials of Sub1 varieties at HauGiang in Summer - Autumn 2008

Through the results of submergence tolerant varieties from IRRI and the local check variety (OM 4900) in Summer-Autumn season 2008, we have some conclusions:

- The agronomical properties of varieties: IR 64, IR 07 F102, IR 82355-5-1-3, IR 82355-5-2-3

and OM 4900 (local check) were suitable for the crop condition of Hau Giang region. The others with long growth duration (≥ 120 days) were not suitable to the crop structure in this area. However some lines very relateds at Bac Lieu or Tra Vinh

- The tested varieties were not infected by blast disease, BPH and tungro. Some had resistant reaction to BPH ..

The yield of variety IR66876-11-NDR-1-1-1-1 (4.68 ton/ha) was lower than the local check OM 4900 (5.73ton/ha). However, the phenotypic acceptability at maturity . the score should reflect the overall acceptability of the varieties in the location where it is being growing very good.

Table 7. Yield and yield components of rice varieties in the PVS trial at Hau Giang, Summer-A 2008

No	Rice genotypes /varieties	Number of Tillers/?	Number of Panicles/?	Fertile Grain (%)	Plant Height (cm)	Fresh Weight of Fodder (g/5m2)	Grain Weight (kg)	Grain yield (kg/ha)	Computed Yield (t/ha)
1	IR07F102	99.33b	92a	89.44e	146.62a	284.72d	1.5defg	1500efgh	1.46defg
2	IR05F102	99.33b	79b	92.18b	97.96c	316bc	1.85defg	1850defg	1.84cdef
3	IR07F287	108.33a	95a	90.75cd	99.37c	379.35a	0.33g	333.33h	0.33g
4	IR07F289	93.33d	65.67e	91.7b	109.67c	253.06e	1.02efg	1023.33fgh	1.02efg
5	IR07F291	85f	76.67c	90.28e	112.7b	316.63b	2.06def	2060def	2.05cde
6	ir07f290	87.33e	82.67a	67.25h	95.38c	221.29f	1.05defg	1046.67efgh	1.04defg
7	IR66876-11-NDR-1-1-1-1	98.33b	79b	87.54f	111.85b	315.52bc	4.69ab	4690ab	4.68ab
8	IR57514 PMI 5b-1-2	83.33f	76c	87.13f	111.83b	284.58d	1.23defg	1233.33efgh	1.23defg
9	IR49830-7-1-2-3	94.67cd	88a	84.19g	119.26a	316.58b	0.96efg	963.33fgh	0.96efg
10	IR82355-5-5-2-3	95.33c	71d	86.96f	107.9c	315.99bc	1.29defg	1293.33efgh	1.29defg
11	IR82355-5-5-1-3	111.67a	63.67fg	93.1a	83.28d	189.25g	2.35de	2350de	2.33cd
12	IRRI 119	86.67e	84.33a	82.94h	87.09c	315.02c	1.76defg	1760defg	1.75cdef
13	IR07f286	77.33f	64.67ef	90.73cd	121.44a	220.68f	3cd	3000cd	2.89c
14	IR05F101	94.67cd	63g	91.48bc	89.28c	220.73f	4.12bc	4116.67bc	4.1b
15	IR07F101	104a	79b	83.88g	83.51d	189.54g	0.65fg	646.67gh	0.64fg
16	OM4900	116a	80.33b	91.73b	115.83a	284.02d	5.74a	5740a	5.73a
	CV(%)	0.8	1.1	0.6	0.6	0.3	32.4	32.4	32.4
	$LSD_{0.05}$	1.3	1.44	0.9	1.13	1.16	1.13	1134.48	1.12

RM-PVS trials of Sub1 varieties in different environmenst inWet season – Dry season 2008

Conduct on- station and on-farm multi-location varietal trials to identify best varieties for different location.

Multiply and distribute variety nominations to testing sites, 6 sites for one province. Inventory known mechanisms in target crops.

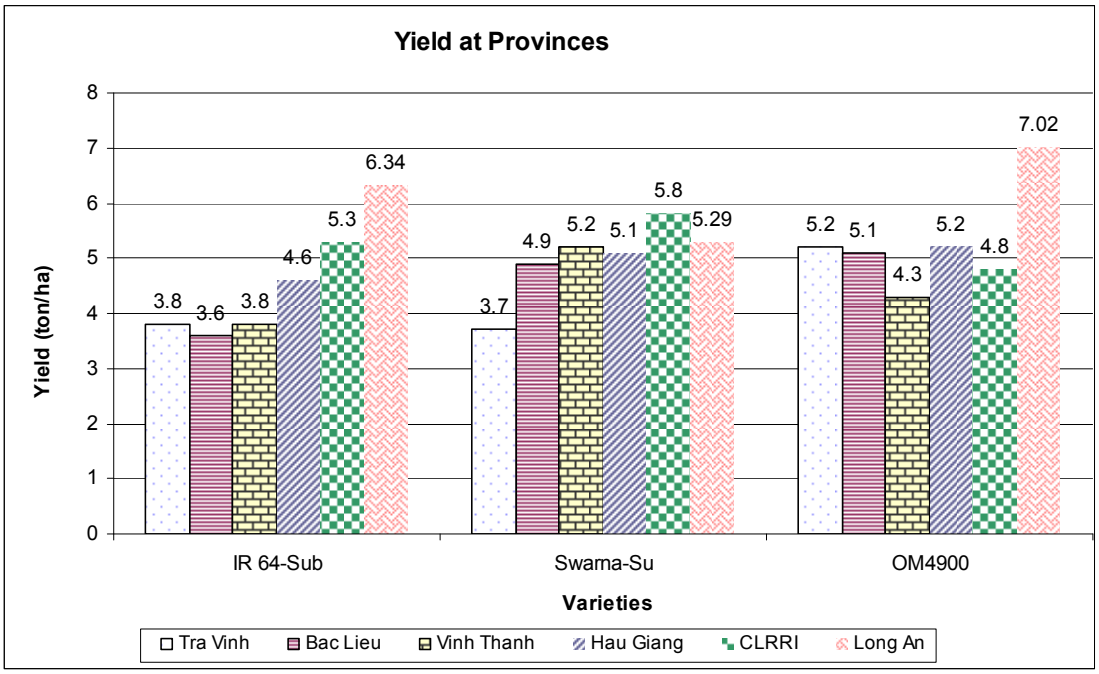
Tra Vinh, Can Tho, Hau Giang , Bac Lieu , Kien Giang , CLRRI during Wet season 2008.

Performance stability is one of the most important properties of a genotype to be released as a variety

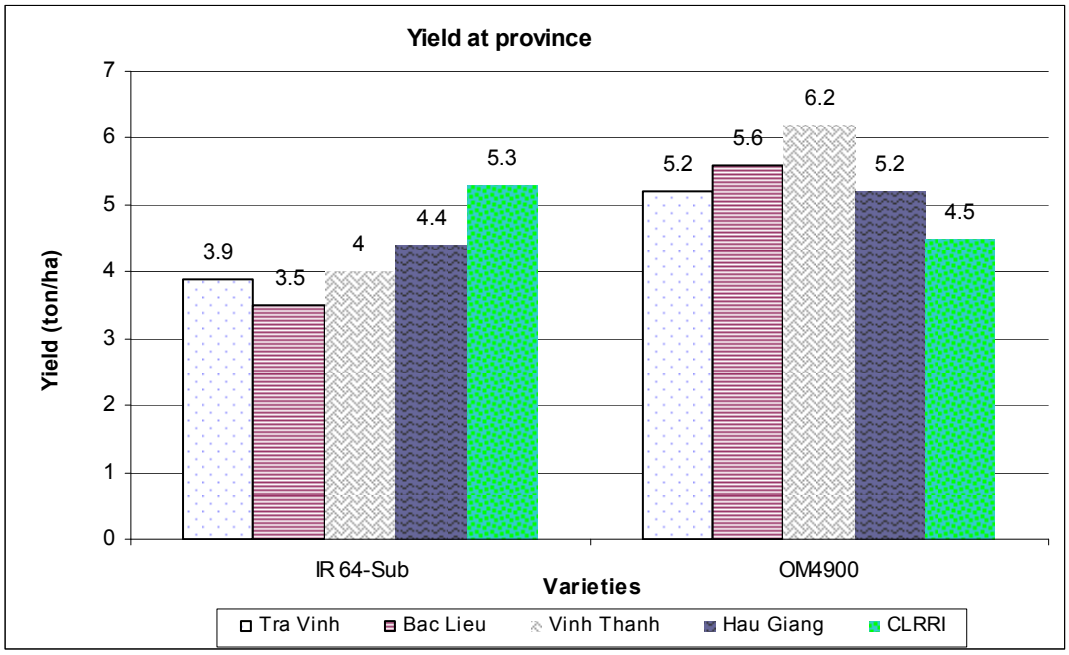
to ensure wide adoption. To ensure this, we tested 3 indica rice varieties at 3 different locations during the wet and dry seasons of 2008, using a randomized block design with three replications in each case. The experiment was conducted in 4 provinces, Can tho, Tra Vinh, Long An and Bac Lieu. The highest grain yield across the 4 sites was obtained from OM4900 during both seasons.

Evaluated with difference sites. For Hau Giang the farmers choice two varieties: BR11 : the yield : 3.5 tan/ ha ,IR 66876-11NDR-1-1-1-1 : 4.22 ton/ ha, compare with OM 4900 at Wet seasons. For Long An, the farmers evaluated good for 2 varieties are IR 82355-5-2-3, IR 84194-9. With two varieties good for multiplication in 2009. The submergence tolerance of rice varieties: IR64-Sub1 and Swarna-Sub 1 were Multiple-location yield trial (flooded condition) and field at CLRRI (Can Tho, Phung Hiep, Hau Giang; Long An, and salt – submergence area such as Cau Ngang (Tra Vinh), Bac Lieu. IR 64-Sub1 and Swarna- Sub 1 showed a moderate level of submergence during 30 days . IR 64-sub 1 short duration very good for Winter-Spring Season 2008-2009 the yield 5 ton/ha at Tra Vinh (figure 1) and 6.2 ton/ ha at CLRRI. For Swarna –Sub 1 good for both two season (dry and wet season) 4.6 tan/ha the yield. It was officially released in 2008, tolerance to brown plant hopper, short growth duration genotype, well adapted to irrigated areas; the largest areas cultivated by Sub1 up to 5,8 ha and Swarna –Sub 1 up to 6.7 ha and become one of the well known genotype for tolerance – salt species at Tra Vinh and Bac Lieu and high productivity .

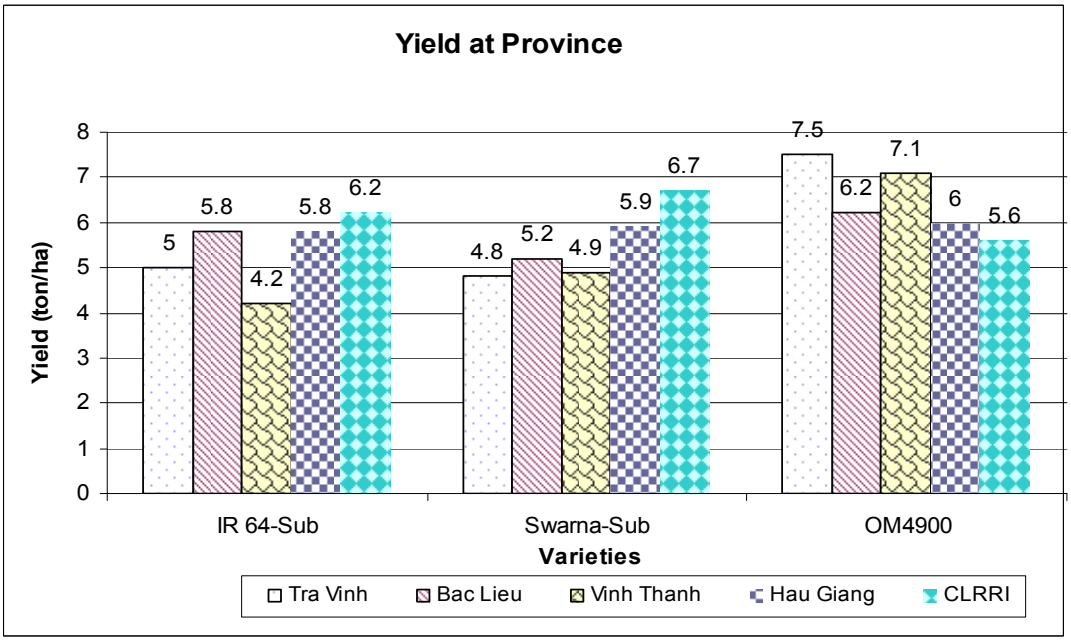
Apparently, good progress has been made in developing submergence tolerant varieties for the coastal regions of Mekong Delta. A participatory approach involving mother trials on station and on farmers fields, together with baby trials consisting farmers preferred varieties selected from mother trials and managed by farmers also seemed very effective in Vietnam as was the case in other countries involved in the IRRI-Japan project. The study showed that the released varieties were fairly stable across submergence affected areas in different provinces. Several promising breeding lines were also selected and being promoted for release as national varieties in the future.



A: Wet season 2008



B (Winter-Spring Season 2008)



C: Dry season 2008

Figure 1. Yield of submergent varieties at different locations in the Mekong delta in three seasons (A: Wet season , b: Winter-Spring Season , c: Dry season 2008)

Development new genes for submergence in rice

Different approaches are being followed at Cuu Long Delta Rice Research Institute (CLRRI) to develop submergence tolerant varieties of rice. These approaches included conventional methods involving crosses with salt tolerant donors and subsequent selection for agronomic and adaptive traits over a number of generations. Moreover, modern breeding tools such as molecular breeding are also being implemented to accelerate progress in developing submergence tolerant varieties. Our phenotyping system followed the screening methods developed at IRRI.

Six (6) crosses were produced during 2007, 2008, 2009, involving the diverse sources for the tolerance to submergence, and good grain type, selection was made possible from the BC1 population of OM 4900/IR 82810-407 (Swana-Sub1), OM1490/IR82810-407 (Swana-Sub1), OM2517/IR82810-407 (Swana-Sub1), OMCS2000/IR82810-407 (Swana-Sub1), OM1490/ IR64-Sub1 , OM 2517/ IR64-Sub1.

In order to select desirable and homogeneous lines for submergent areas, materials that performed better in the field were screened in the plant physiology screen house, 512 progeny plants and 96 bulk populations were selected from F3-F7 generations based on submergence and salinity tolerance and adaptability in near sea affected areas.

Conclusions and Recommendations

A total of 19 entries were screened in MYT in wet season 2008. Entries were grouped into three duration groups: early (90-100 days) , medium (100- 120 days) and late (>120 days). The MYT was conducted at two stress levels: control (normal condition) and submergence. On-farm participatory varieties selection (PVS) trials, using mother trial with lines found promising in on station trial in the previous seasons, were conducted in dry season 2008 at Long An and Hau Giang, Can Tho. At maturity, at each location, 30 farmers as well as researches were invited to evaluate and select the breeding lines.For examples: At Hau Giang, the farmers chosed BR 11 and IR 66876-11-NDR-1-1-1-1 based on yield and tolerance to BPH and disease. However, They like growing OM 4900 for consumption because of its good grain quality. For Long An the farmers selected IR82355-5-2-3 because this variety had short duration, more panicles, compacted seeds, stiff stem, no brown planthopper infection and IR84194-9 due to less disease, short duration, long panicle, compacted seeds, thin rice husk (the husk is thin that means the kernel with be bigger and heavier weight of 1000 grains) .

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Đánh giá và sử dụng gen chống chịu ngập trong cải tiến giống lúa ở Việt Nam

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