

SHORT COMMUNICATION

IDENTIFICATION OF SOME PROMISING VARIETIES FOR SALINITY SOIL AND PHOSPHOROUS DEFICIENT AREAS IN THE MEKONG DELTA

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ABSTRACT

An International rice observation nursery (including 33 varieties) was conducted under salinity condition (Cau Ngang, Tra Vinh). Testing varieties IR71830-3R-2-2-3, IR73055-8-3-1-3-1, IR73571-3B-5-1, IR73571-3B-9-2 grew well and obtained higher yield than check variety (AS996).

Experiments were laid out in Cau Ngang District, Tra Vinh Province, in a completely randomized block design with three replications, ten promising varieties and AS996 used as check. It indicated that OM6043, OM6036, OM6040, OM6038 performed higher yield than check. The other yield trials were conducted under phosphorous deficient condition (Tri Ton, An Giang) with ten promising rice varieties. Results showed that OM4668 and OM2818 obtained the highest yield. However, OM 2818 was highly affected by rice grassy stunt disease.

INTRODUCTION

Approximately 700,000ha in the Mekong Delta were affected by salinity and acid sulfate condition (Nguyen and Do 1977). Almost of adverse soil areas, traditional varieties were cultivated with low yield under rice-shrimp system. Some modern rice varieties introduced from IRRI and rice improvement program of Cuu Long Delta Rice Research Institute (CLRRI) can grow well under salinity condition at the saline level of 5‰. Most of them are low-yielding and poor grain quality genotypes. A study presented by Senadhira (1987) indicated that IRRI's breeders selected some rice varieties from crosses between modern rice and wild rice (*O. rufipogon*) obtained high yield (>5t / ha) and tolerant to salinity (55‰). Interaction between rice plant and saline soil is very complicate. In order to understand this problem, some scientists suggested that it must be able to study at molecular level. Based on this research, breeders can select high-yielding genotypes with salinity tolerance. Direct screening of rice varieties under adverse soil conditions to identify good tolerant varieties is necessary. The study aims with the following objectives:

- To evaluate genotypes with desirable agronomic traits introduced from IRRI's adverse soil tolerant nursery in Tra Vinh and Soc Trang under rice-shrimp system
- To identify materials for rice improvement in saline soils

MATERIALS AND METHODS

Materials

Experiment 1: There were 32 rice lines introduced from IRRI for adverse soil tolerant rice improvement program, AS996 was used as check.

Experiment 2: Using 10 promising lines of CLRRI, these were crossed between IRRI lines and landraces for salt tolerant condition.

The experiments were conducted at Cau Ngang - Tra Vinh (2005 wet season).

Experiment 3: Using 10 selected rice varieties in Tri Ton – An Giang for phosphorous deficient soil condition (2006 dry season).

Experiment 4: Using 10 selected genotypes (2006 wet season) for light acid sulfate soil condition of CLRRI's experimental field

Methods

Experiment 1: It was laid out with one replication, AS996 as check. Growth duration, plant height, phenotypic acceptability and yield were noticed.

Experiment 2: It was laid out in completely randomized block design with three replications AS996 as check. Experiment was conducted at saline area - Cau Ngang.

Experiment 3: Experiment was laid out in completely randomized block design with three replications, AS996 as check in Soc Trang.

Experiment 4: It was laid out in completely randomized block design with three replications. AS996 as check in CLRRI's experimental field.

Method for sample collection and data recording were followed SES (1996). The statistical procedure was followed Gomez and Gomez (1982) and TCN-10/2002 (MARD, 2002). Grassy stunt disease reaction was recorded using SES (1980, 1996).

RESULTS AND DISCUSSION

Evaluation of 33 lines (AS996 as check) introduced from IRRI in rice observation set at Tra Vinh which was presented in Table 1. These lines were grouped into four clusters. It indicated that almost of lines were in group 2 and group 3. These lines have early duration (90-110 days), semi dwarf plant type (90-110 cm), panicles / hill (8-10) and filled grains / panicle (80-100). Particularly, four lines were evaluated as very good phenotypic acceptability. Some lines grew well in target areas with 5‰ saline level. However, some lines with long growth duration and suitable to salt stress can be released to rice - shrimp cultivation pattern such as Ca Mau peninsula and other salty affected areas (Table 1)

Table 1. Grouping of agronomic characters for varieties in the observation nursery

Characters	Group I	Group II	Group III	Group IV	Total
Growth duration	3	15	12	3	33
Plant height	7	15	9	2	33
Panicles / hill	9	20	2	2	33
Filled grains / panicle	15	14	3	1	33
1000-grain weight (g)	2	22	8	1	33
Phenotypic acceptability	4	8	18	3	33

Remarks for table 1

Characters	Group I	Group II	Group III	Group IV
Growth duration	<90	90-100	100-110	>110
Plant height	<90	90-100	100-110	>110
Panicles / hill	<8	8-9	9-10	>10
Filled grains / panicle	<80	80-90	90-100	>100
1000-grain weight (g)	<25	25-26	26-27	>27
Phenotypic acceptability	very good	good	poor	very poor

The agronomic characters of promising rice in saline area were presented in table 2. Almost of rices belong to early growth duration genotypes such as IR73571-3B-9-3, IR73571-3B-9-3 (98 days) as well as AS996 check. It indicated that these rice varieties were suitable in salt affected areas in Long Xuyen quadrangle and Ca Mau peninsula. Some rices belong to long growth duration such as IR73571-3B-9-2 (114 days), IR73571-3B-5-1, IR73055-8-3-1-3-1 (113 days) were suitable in salty affected areas with rice-shrimp pattern.

Plant height ranged 102.4 - 87.9 cm. It showed that these varieties belong to semi-dwarf plant type then they cannot cultivate in flood-prone areas.

Yield testing in saline areas indicated that all varieties obtained higher yield than check. Some offered the highest yield (g/hill) as IR71830-3R-2-2-3, IR73055-8-3-1-3-1, IR73571-3B-5-1, IR73571-3B-9-2. These lines would be continuously tested in target areas. However, reaction to insect and disease for these lines must be also tested.

Table 2. Agronomic characters of promising lines in salinity area, Cau Ngang District, Tra Vinh Province.

Designation	Duration (day)	Plant height (cm)	Panicles/hill	Filled grains /panicle (g)	1000-grain weight (g)	Yield (g/hill)
IR58443-6B-10-3	108	92.5	9.6	103.6	25.1	26.70
IR58443-8B-23-3	102	101.3	10.4	110.5	24.6	25.40
IR70869-B-P-13-2	106	91.7	8.7	110.4	24.5	26.90
IR72593-B-3-2-3-10-2B-1	107	89.6	10.2	120	26.1	27.10
IR71895-3R-17-1-2	103	100.3	11.1	97.8	25.8	26.80
IR71830-3R-2-2-3	105	104.1	9.5	110.2	23.6	28.40*
IR73571-3B-9-3	98	98.7	8.7	102.5	24.6	26.70
IR73055-8-3-1-3-1	113	96.5	7.6	98.3	25.1	28.10*
IR72400-B-3-2-2-1-2	110	89.6	8.4	99.6	24.7	26.30
IR73571-3B-2-3	101	87.9	9.1	101.4	24.6	27.60
IR73571-3B-5-1	113	95.7	8.3	99.4	26.2	28.10*
IR73571-3B-9-2	114	102.4	9.6	98.7	24.8	28.20*
AS996 (Check)	98	98.6	10.2	101.4	25.7	25.20

Evaluation of duration some varieties on salty affected area in Tra Vinh indicated that almost of rice varieties are short duration and less than 100cm in plant height. These varieties can be released for cultivating at three-cropping pattern per year. However, some were not uniform in plant height. So its must be re-selected before releasing to farmers.

Yield testing of these varieties on saline areas of Tra Vinh showed that all of varieties obtained higher yield than check. OM6043, OM6036, OM6040 and OM6038 offered higher yield than check at significant difference of 0.05 level (Table 3).

Table 3. Agronomic traits, yield and yield components of some promising lines of CLRRI, Tra Vinh province

Designation	Duration (day)	Plant height (cm)	Panicle /m ²	Filled grains /panicle	1000- grain weight (g)	Yield (t/ha)
OM6036	110	94.2	315.8	122.0	14.2	5.80*
OM6037	109	95.6	482.5	131.1	15.2	5.90*
OM6038	110	94.3	382.8	120.5	14.6	6.00*
OM6039	112	96.5	443.6	100.2	12.0	5.30
OM6040	112	96.2	419.8	113.2	13.5	5.80*
OM6041	113	92.8	392.2	122.3	16.2	5.20
OM6042	109	96.3	443.6	132.6	14.2	5.10
OM6043	110	98.1	371.0	130.2	14.3	5.70*
OM6044	113	95.7	417.4	111.2	14.7	5.30
AS996	112	98.6	412.5	112.6	12.5	5.00
CV%	-	-	16.8	18.1	-	10.3
LSD5%	-	-	31.7	12.5	-	0.6

Tri Ton – An Giang province indicated that duration of most of rice varieties in the experiment are less than 100-days. Plant height ranged in duration of 94.3-104.3 cm. Based on this result, farmers can cultivate these genotypes on phosphorous deficient areas in two-rice cropping pattern per year.

OM2474 was susceptible to blast disease (score 7). Other rice varieties in experiment were moderately resistant to brown plant hopper (BPH) and blast (BI) as well as AS996 check. It indicated that these rice varieties exhibited desirable agronomic traits, high yielding and accepted grain quality (Table 4).

Table 4. Agronomic traits, BPH /Blast reaction on phosphorous deficient areas at Tri Ton-An Giang province

Designation	Cross	Duration (days)	Plant height (cm)	Reaction*	
				BPH	BI
OM4668	VND95-20/CNT99	96.8	102.3	3	5
OM2818	OM CS97/IR62032	98.5	98.7	3	3
OM2474	Te tep Ninh Binh/OMCS 95-5	97.5	101.4	5	7
OM4412	IR64/Hoa Lai	96.4	100.2	5	3
AS996 (Check)	IR64/rufipogone	97.2	98.7	3	3
OM6047	IRRI	95.7	99.5	5	5
OM4511	C32/Hoa Lai	93.4	94.3	5	5
OM2488	OM 723-11 / IR 64	95.2	102.4	3	3
OM6074	IRRI	93.6	104.3	3	5
OM4276	OM1490/IR64	95.4	98.6	5	5

* *Standard Evaluation System for Rice, July 1996* Evaluation of some rice varieties in

Grain yield and yield components of rice varieties on phosphorous deficient area presented in table 5. It was indicated that OM4668 and OM2818 obtained the highest yield in experiment and significantly higher than AS996 check. Tillering ability of OM4276 were the highest. Filled grains /panicle is 114.7 for OM6074. These rice varieties as OM6074, OM2476 were significantly lower yield than check (table 5). Presently, farmers in acid sulphate soils and phosphorous deficient areas are considering OM4668 and OM2818 as suitable genotypes.

Table 5. Yield and yield components of rice varieties under phosphorous deficient condition

Designation	Panicles/hill	Filled grains /panicle	Unfilled grains (%)	1000-grain weight (g)	Yield (t/ha)
OM4668	11.3	110.4	10.3	26.1	5.80
OM2818	11.3	112.9	9.6	25.6	5.80
OM2474	10.2	113.6	9.7	25.7	5.70
OM4412	10.5	108.8	11.3	26.3	5.60
AS996 (check)	10.1	112.2	10.4	26.0	5.60
OM6047	11.6	110.4	9.8	26.0	5.60
OM4511	10.5	112.4	12.5	25.9	5.60
OM2488	9.5	109.4	11.4	26.7	5.20
OM6074	10.8	114.7	8.7	25.4	5.10
OM4276	13.1	109.6	12.6	25.6	4.60
CV%	10.3	10.5	9.7	-	7.2
LSD5%	3.4	20.4	2.6	-	0.73

Evaluation of grassy stunt disease in CLRRRI's experimental field in Wet season 2006 showed that OM4668 and AS996 exhibited the low incidence of virus infection. OM2818 obtained higher yield than check on phosphorous deficient areas, but showed higher incidence of grassy stunt disease (Table 6).

Table 6. Percentage of survival plants infected by grassy stunt disease at CLRRRI's experimental field

Designation	Cross	Duration (days)	Plant height (cm)	Percentage of survival plant (%)
OM4668	VND95-20/CNT99	93.6	100.4	42.1
OM2818	OM CS97/IR62032	95.4	95.7	26.5
OM2474	Te tep Ninh Binh / OMCS95-5	101.7	96.3	26.3
OM4412	IR64 / Hoa Lai	92.6	100.7	15.7
AS996 (check)	IR64 / <i>O. rufipogon</i>	100.4	98.1	60.8
OM6047	IRRI	93.7	100.4	23.7
OM4511	C32/Hoa Lai	96.1	96.1	5.6
OM2488	OM723-11 / IR 64	93.8	100.7	35.7
OM6074	IRRI	90.5	101.3	36.8
OM4276	OM1490/IR64	94.7	97.8	10.1

CONCLUSIONS

- Promising lines will be selected for yield testing in the next seasons such as IR71830-3R-2-2-3, IR73055-8-3-1-3-1, IR73571-3B-5-1, IR73571-3B-9-2 the varieties performed high yielding tolerate to salt stress.
- Rice varieties OM6043, OM6036, OM6040 and OM6038 obtained significantly higher yield than check. These varieties will be evaluated under multi-location yield trial in next seasons to find out the GxE interaction.
- OM4668 and OM2818 were most promising rice varieties will be proposed as national rice varieties.

REFERENCES

- Gomez A and K. Gomez. 1982. Stastical procedure for agricultural experiment field. IRRI publisher. PO Box 933 Manila Philippines
- IRRI. 1980. Standard evaluation and utilization system for rice 1980. IRRI publisher. PO Box 933 Manila Philippines
- IRRI. 1996. Standard evaluation and utilization system for rice 1996. IRRI publisher. PO Box 933 Manila Philippines
- MARD. 2002. Agricultural standard TCN-10-2002 Agricultural standard for varietal testing, cultivation and utilization of rice. Ministry of Agriculture and Rural Development of Vietnam. Agricultural publisher 2002 (Vietnamese)
- Nguyen Vy and Do Dinh Thuan. 1977. The main soil in Viet Nam, Rural Publisher 1977 (Vietnamese) Ministry of Agriculture and Rural Development of Vietnam. Agricultural publisher
- Senadhira D. 1987. Salinity as a constraint to increasing rice production in Asia. required workshop on maintenance of life support species in Asia Pacific Region 4-7April. 1987

**Xác định một số dòng giống có triển vọng
đối với vùng đất thiếu lân và nhiễm mặn ở ĐBSCL**

Thí nghiệm 1: tiến hành tại Cầu Ngang - Trà Vinh. Quan sát 33 giống lúa nhập từ IRRI. Các dòng có khả năng chịu mặn tốt IR71830-3R-2-2-3, IR73055-8-3-1-3-1, IR73571-3B-5-1, IR73571-3B-9-2.

Thí nghiệm 2: so sánh năng suất 10 giống lúa tại vùng mặn Trà Vinh. Những giống lúa này do IRRI lai tạo nhưng được chọn đầu dòng tại CLRRI. Giống OM6043 OM6036, OM6040, OM6038 triển vọng nhất.

Thí nghiệm 3: so sánh năng suất 10 giống lúa trên vùng đất thiếu lân thuộc Tri Tôn - An Giang. Kết quả cho thấy OM4668 và OM2818 cho năng suất cao nhất.

Thí nghiệm 4: các giống lúa trong thí nghiệm 3 cũng được trồng tại Viện Lúa ĐBSCL trong vụ HT 2006 (điểm nóng của bệnh vàng lùn và lùn xoắn lá). OM2818 bị thiệt hại nhiều hơn OM4668. Giống AS996 ít bị thiệt hại nhất.