

YIELD TRIAL OF SOME EXTREME SHORT DURATION RICE VARIETIES IN DIFFERENT ECOSYSTEMS OF VINH LONG PROVINCE

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ABSTRACT

Responding to demand of extreme short duration rice varieties in three rice crop system in Vinh Long province, the yield trials with fifteen new varieties bred by Cuu Long Delta Rice Research Institute (CLRRI) were conducted in three continuous seasons of Summer-Autumn 2011, Autumn-Winter 2011 and Winter-Spring 2011-2012 in Tam Binh, Long Ho, Vung Liem and Tra On districts. Most of the fifteen rice varieties have very short growth duration (suitable to the demand). The grain yields in each trial of these rice varieties in each district were significantly different. However, their mean grain yields, the rice characteristics for adaptability and stability over four districts in each crop season were not significantly different except for the Winter-Spring 2011-2012 crop. After evaluating the characteristics of fifteen extreme rice varieties, seven promising varieties were identified in three groups of i) OM10423 and IR73382, ii) OM6932 and OM6893, and iii) OM9584, OM10424 and OM8019 suitable for Summer-Autumn, Autumn-Winter and Winter-Spring season crops, respectively.

Keywords: *adaptable and stable characteristics, extreme short duration rice varieties.*

INTRODUCTION

Vinh Long province has 119,659 ha of agricultural cultivation area, of which about 72,000 ha can be cultivated for 2-3 rice crops per year. Especially, several hundred thousand hectares along two major branches of the Mekong river (Tien and Hau rivers) with advantageous transportation by both river and the road are fertile alluvial soil, which can produce high biomass and grain yield. Since the Ministry of Agricultural and Rural Development has determined the Autumn-Winter season was the main crop season, a third rice crop has been cultivated annually on about 500,000 ha in Cuu Long delta, from which an estimated two million tons of rice can be harvested. This extra rice could increase rice exports from 4.5 to 6 million tons per year aside

from maintaining national food security (Vinh Long broadcasting news on 5th august, 2009). Situated between the Tien and Hau rivers, Vinh Long province has a high potential for producing three rice crops per year, and currently cultivates about 50,000 ha of the third rice season crop. In order to produce three rice crops per year while still maintaining time for field preparation between crops, it is necessary to develop and test the yields of extreme duration rice varieties and their adaptability and stability in different ecosystems of Vinh Long province.

Materials and Methods

Materials: Including 15 extreme short duration rice varieties bred by CLRRI and two check varieties with original in table 1.

Table 1. Original of very early rice varieties for testing in Vinh Long province

| No | Varieties | Original/ Crosses |
|----|-------------------|------------------------------|
| 1 | OM6932 | OM4088/OM5472 |
| 2 | OM10041 | D23/C54 |
| 3 | OM10417 | C18/D18 |
| 4 | OM7260 | OM1490/IR80124 |
| 5 | IR8928 | OM3536/AS996 |
| 6 | OMCS2009 | OM1314/OM2514/OM2514 |
| 7 | OM10423 | NCM OM4993 |
| 8 | OM10424 | OM5199 ĐB |
| 9 | OM6904 | OM5464/OM5472 |
| 10 | OMCS2000 (check1) | OM1738/MRC10399 |
| 11 | OM6907 | OM5472/OM4498 |
| 12 | OM6893 | OM4498/OM5472 |
| 13 | OM8959 | OM1723/OM5451 |
| 14 | IR73382 | IR64/ <i>Oryza rufipogon</i> |
| 15 | OM8019 | OM5472/PSBRC28 |
| 16 | OM9584 | OM6976/OM5451 |
| 17 | IR50404 (check2) | IRRI |

Methods: Yield trials were executed over three continuous crops (Summer-Autumn 2011, Autumn-Winter 2011 and Winter-Spring 2011-2012) in four districts of Long Ho, Tam Binh, Vung Liem and Tra On, Vinh Long province.

Experiments were located in farmer's fields and used Randomized Complete Block Design consisting of three replications (Gomez, KA. and Gomez A.A, 1984)

- Number of treatments: 15 very early rice varieties
- Plot area: 20 m²; Experiment area: 1.000 m²
- Plant space: 15 x 20 cm.
- Fertilizer formula: 100:40:30 kg/ha (N:P₂O₅:K₂O) for Winter-Spring (WS) season, 80:60:30 kg/ha (N:P₂O₅:K₂O) for Summer-Autumn (SA) and Autumn-Winter (AW) seasons.
- Other cultivation methods complied with procedure to conduct tests for

value of cultivation and use of rice varieties, 10 TCN-558-2002.

Data scored: Observation of growth duration, plant height and yield components in each experiment. Adaptability and stability analysis was done using the grain yield of rice varieties among four yield testing experiments.

Data was processed in Microsoft Excel and statistical analysis complied with the model of interaction between genotype and environment by Eberhart and Russel (1966).

RESULTS AND DISCUSSIONS

Results of yield trial and evaluation of adaptability and stability characteristics of extreme short duration rice varieties in Summer-Autumn 2011 season.

The growth duration of all rice varieties in SA 2011 season were 89-92 days, suitable to the objectives of the study (table 2).

Table 2. Adaptable and stable characteristics of extreme short duration rice varieties testing in four districts of Vinh Long province in Summer-Autumn 2011 (Grain yield tons/ha over four experiment sites)

| No | Varieties | Tam Binh | Long Ho | Vung Liem | Tra On | Mean | B _i | S ² d _i | Duration (days) |
|----|-----------|----------|---------|-----------|--------|-------------|----------------|-------------------------------|-----------------|
| 7 | OM10423 | 6.93 | 6.67 | 5.19 | 5.84 | 6.16 | 1.315 | 0.066 | 91 |
| 8 | OM6904 | 7.05 | 7.03 | 4.88 | 5.54 | 6.13 | 1.817 | 0.155* | 89 |
| 3 | IR73382 | 6.53 | 7.13 | 4.75 | 5.58 | 6.00 | 1.805 | 0.041 | 92 |
| 4 | OM7260 | 5.98 | 6.67 | 5.23 | 5.87 | 5.93 | 0.978 | 0.015 | 90 |
| 11 | OM6893 | 6.50 | 5.80 | 5.25 | 6.17 | 5.93 | 0.648 | 0.175* | 90 |
| 15 | IR50404 | 6.19 | 5.97 | 5.37 | 6.15 | 5.92 | 0.550 | 0.024 | 90 |
| 13 | OM10417 | 5.51 | 6.57 | 4.63 | 6.33 | 5.76 | 1.237 | 0.379* | 91 |
| 10 | OM6907 | 6.26 | 5.93 | 4.96 | 5.82 | 5.74 | 0.904 | 0.028 | 89 |
| 1 | OM6932 | 5.35 | 6.27 | 5.19 | 5.80 | 5.65 | 0.593 | 0.133* | 90 |
| 14 | OM8019 | 6.65 | 5.73 | 4.80 | 5.09 | 5.57 | 1.080 | 0.395* | 90 |
| 6 | OMCS2009 | 5.54 | 6.20 | 5.00 | 5.51 | 5.56 | 0.786 | 0.017 | 89 |
| 9 | OMCS2000 | 6.00 | 6.40 | 4.54 | 5.07 | 5.50 | 1.439 | 0.045 | 89 |
| 12 | OM8959 | 6.14 | 6.27 | 4.91 | 4.66 | 5.49 | 1.132 | 0.367* | 90 |
| 2 | OM10041 | 5.24 | 5.83 | 5.19 | 5.60 | 5.47 | 0.339 | 0.036 | 91 |
| 5 | OM8928 | 4.89 | 5.27 | 4.58 | 6.38 | 5.28 | 0.376 | 0.811* | 92 |
| | F | 9.61** | 3.33** | 2.88** | 5.65** | 1.22 ns | | | |
| | LSD (5%) | 0.60 | 0.81 | 0.45 | 0.59 | 0.80 | | | |
| | CV (%) | 5.9 | 7.8 | 5.5 | 6.2 | - | | | |

Note: * in S²d_i column indicated S²d_i index of the not stable variety

** or ns in F row indicated the grain yield mean of varieties had significant difference with $\alpha \leq 0.01$, or the grain yield mean of varieties over four experiment sites had not significant difference.

In Summer-Autumn 2011, grain yields of the rice varieties tested in each experiment are significantly different, but there are not significant differences among means yields over four yield sites when adaptability and stability analysis is done (table 2). Varieties that give the highest yield in Tam Binh district are OM6904 (7.05 T/ha) and OM10423 (6.93 T/ha), significantly different from the check variety IR50404 (6.19 T/ha). In Tra On district, varieties producing higher yield than the check variety IR50404 (6.15 T/ha) included OM8928 (6.38 T/ha), OM10417 (6.33 T/ha) and OM6893 (6.17 T/ha) but the differences are not significantly different. The check variety produced the highest grain yield (5.37 T/ha) in Vung Liem district but was not significantly different from the following seven varieties OM6893 (5.25 T/ha), OM6932 (5.23 T/ha), OM10423, OM6932, OM10041 (all at 5.19

T/ha), OMCS2009 (5.00 T/ha) and OM6907 (4.96 T/ha). In Long Ho district, two varieties give significantly higher grain yield than the check variety including IR73382 (7.13 T/ha) and OM6904 (7.03 T/ha).

Results of adaptability and stability analysis show that the mean yields of OM10423, OM6904 and IR73382 varieties in SA 2011 are the highest over the four sites in spite of having lower rank in some districts. Among them, the second rank (OM6904 variety) has measurable S²d_i index of 0.155*. It means that this variety is not stable in grain yield, so OM10423 and IR73382 are chosen for the further demonstration sites. OM6904, OM7260 and OM6893 varieties were also observed in the following seasons.

Results of yield trial and evaluation of adaptability and stability characteristics of extreme short duration rice varieties in Autumn-Winter 2011 season

The growth duration of rice varieties at all four experiment sites in AW 2011 season were in A0 group (89-92 days), suitable to the objectives of the study (table 3).

Table 3. Adaptability and stability characteristics of extreme short duration rice varieties testing in four districts of Vinh Long province in Autumn-Winter 2011 (Grain yield tons/ha over four experiment sites)

| No | Varieties | Tam Binh | Long Ho | Vung Liem | Tra On | Mean | B _i | S ² di | Duration (days) |
|----|-----------------|---------------|---------------|---------------|---------------|---------------|----------------|-------------------|-----------------|
| 15 | IR50404 | 5.39 | 5.05 | 5.68 | 6.90 | 5.76 | 0.743 | 0.235* | 90 |
| 11 | OM6893 | 5.01 | 5.94 | 4.56 | 7.34 | 5.71 | 1.332 | 0.053 | 90 |
| 1 | OM6932 | 4.80 | 5.83 | 4.62 | 6.93 | 5.55 | 1.150 | 0.044 | 90 |
| 7 | OM10423 | 4.68 | 5.45 | 4.94 | 7.00 | 5.52 | 1.143 | -0.033 | 91 |
| 4 | OM7260 | 4.76 | 5.22 | 5.16 | 6.85 | 5.50 | 0.996 | 0.014 | 90 |
| 5 | OM8928 | 5.46 | 5.22 | 3.94 | 7.30 | 5.49 | 1.394 | 0.458* | 92 |
| 13 | IR73382 | 5.13 | 4.17 | 5.09 | 7.52 | 5.48 | 1.329 | 0.879* | 92 |
| 2 | OM10041 | 4.80 | 5.22 | 5.16 | 6.40 | 5.40 | 0.748 | -0.014 | 91 |
| 10 | OM6907 | 4.68 | 5.06 | 4.86 | 6.96 | 5.40 | 1.159 | -0.011 | 89 |
| 6 | OMCS2009 | 4.88 | 5.17 | 4.83 | 6.13 | 5.25 | 0.672* | -0.062 | 90 |
| 8 | OM6904 | 4.36 | 5.50 | 4.27 | 6.73 | 5.21 | 1.251 | 0.047 | 89 |
| 3 | OM10417 | 5.17 | 5.00 | 4.50 | 6.00 | 5.17 | 0.627 | 0.043 | 91 |
| 14 | OM8019 | 4.16 | 5.17 | 4.44 | 6.03 | 4.95 | 0.890 | 0.029 | 90 |
| 9 | OMCS2000 | 4.31 | 4.94 | 4.14 | 5.83 | 4.81 | 0.837 | -0.028 | 89 |
| 12 | OM8959 | 3.81 | 5.61 | 4.22 | 5.50 | 4.79 | 0.729 | 0.526* | 90 |
| | F | 3.86** | 6.68** | 4.00** | 3.27** | 1.73ns | | | |
| | LSD (5%) | 0.67 | 0.47 | 0.68 | 0.98 | 0.76 | | | |
| | CV (%) | 8.5 | 5.4 | 8.6 | 8.8 | - | | | |

Note: * in S²di column indicates an S²di index of an unstable variety, * in B_i column indicated a variety was not widely adaptable - confined adaptable index (B_i□). ** or ns in F row indicates the mean grain yield among varieties were significantly different with $\alpha \leq 0.01$, or the mean grain yield of varieties over the four experiment sites was not significantly different.

Grain yields of rice varieties tested in each site in AW 2011 were significantly different, but there are not significant differences among mean yields over all four yield trial sites when adaptability and stability analysis is done (table 3).

Variety OM8928 gave the highest grain yield in Tam Binh district (5.46 T/ha), higher than but not significantly different from check variety IR50404 (5.39 T/ha). In Tra On district, there were six varieties which gave higher yield, but again were not significantly different compared to the check variety IR50404 (6.90 T/ha). These were IR73382 (7.52 T/ha), OM6893 (7.34 T/ha), OM8928 (7.30 T/ha), OM10423 (7.00

T/ha), OM6907 (6.96 T/ha) and OM6932 (6.93 T/ha). Ten of fifteen varieties tested in Long Ho district produced higher yield than the check variety IR50404 (5.06 T/ha), but only three of them were significantly different: OM6893 (5.94 T/ha), OM6932 (5.83 T/ha) and OM8959 (5.61 T/ha). The check variety produced the highest grain yield (5.68 T/ha) in Vung Liem district but was not significantly different from the three varieties OM10041 (5.16 T/ha), OM7260 (5.16 T/ha) and IR73382 (5.09 T/ha).

Results of adaptability and stability analysis showed that the mean grain yield of OM6893 and OM6932 varieties over four experiment

sites in AW 2011 are the next highest rank after the check variety in spite of their lower rank in some experimental sites. While the check variety IR50404 gave the highest mean yield over four sites, this variety has measurable S^2_{di} index (0.235*). It means that the check variety is not stable in grain yield, so OM6893 and OM6932 are chosen for the further demonstration. OM7260 and OM8928 varieties were also continuously observed in the next seasons.

Results of yield trial and evaluation of adaptability and stability characteristics of extreme short duration rice varieties in Winter-Spring 2011-2012 season.

All of rice varieties in four experiment sites in WS 2011-2012 season have very early growth duration of A0 group (88-92 days), suitable to the objectives of the study (table 4).

Table 4. Adaptability and stability characteristics of extreme short duration rice varieties testing in four districts of Vinh Long province in Winter-Spring 2011-2012 (Grain yield tons/ha over four experiment sites)

| No | Varieties | Tam Binh | Long Ho | Vung Liem | Tra On | Mean | Bi | S^2_{di} | Duration (days) |
|----|-----------------|---------------|---------------|---------------|---------------|----------------|--------|------------|-----------------|
| 12 | OM9584 | 9.40 | 8.64 | 8.10 | 6.90 | 8.26 | 1.545 | 0.040 | 89 |
| 15 | IR50404 | 8.71 | 7.84 | 7.90 | 8.30 | 8.19 | 0.254 | 0.118 | 89 |
| 3 | OM10424 | 8.58 | 8.95 | 7.66 | 7.48 | 8.17 | 0.935 | 0.113 | 88 |
| 14 | OM8019 | 9.25 | 8.82 | 7.81 | 6.73 | 8.15 | 1.669 | 0.022 | 90 |
| 4 | OM7260 | 8.93 | 8.73 | 7.43 | 7.28 | 8.09 | 1.272 | -0.014 | 90 |
| 7 | OM10423 | 8.62 | 8.46 | 7.53 | 7.27 | 7.97 | 1.005 | -0.052 | 90 |
| 11 | OM6893 | 8.64 | 8.02 | 7.76 | 7.29 | 7.93 | 0.841 | -0.059 | 89 |
| 10 | OM6907 | 7.49 | 8.29 | 8.29 | 7.52 | 7.90 | -0.063 | 0.221* | 90 |
| 16 | OM6916 | 8.80 | 8.11 | 7.66 | 6.88 | 7.86 | 1.202 | -0.039 | 90 |
| 8 | OM6904 | 8.53 | 8.55 | 7.38 | 6.67 | 7.78 | 1.335 | 0.051 | 89 |
| 2 | OM10041 | 8.30 | 8.11 | 7.90 | 6.73 | 7.76 | 0.920 | 0.126 | 90 |
| 1 | OM6932 | 8.00 | 8.20 | 6.95 | 7.27 | 7.61 | 0.734 | 0.095 | 89 |
| 13 | IR73382 | 8.71 | 7.67 | 7.05 | 6.92 | 7.59 | 1.200 | -0.009 | 91 |
| 9 | OMCS2000 | 8.35 | 7.22 | 6.76 | 6.85 | 7.30 | 1.006 | 0.069 | 90 |
| 6 | OMCS2009 | 8.36 | 7.89 | 5.81 | 6.63 | 7.17 | 1.547 | 0.414* | 91 |
| 5 | OM8928 | 8.18 | 5.62 | 6.76 | 6.75 | 6.83 | 0.598 | 1.336* | 92 |
| | F | 6.42** | 2.86** | 4.32** | 3.49** | 2.766** | | | |
| | LSD (5%) | 0.91 | 0.79 | 0.87 | 0.68 | 0.81 | | | |
| | CV (%) | 6.75 | 5.51 | 7.04 | 5.72 | - | | | |

Note: * in S^2_{di} column indicated S^2_{di} index of the not stable variety, ** in F row indicated the grain yield mean of varieties had significant difference with $\alpha \leq 0.01$

Grain yield of rice varieties tested in WS 2011-2012 are significantly different in all experiment sites and over four ecosystem when adaptability and stability analysis is done (table 4).

In Tam Binh district, there are four varieties which give higher and are significantly different yields than check variety IR50404 (8.71 T/ha)

including OM9584 (9.40 T/ha), OM8019 (9.25 T/ha), OM7260 (8.93 T/ha) and OM6916 (8.80 T/ha), while in Tra On district, the check variety IR50404 produced the highest grain yield (8.30 T/ha) significantly different from the other varieties. Twelve of sixteen varieties tested in Long Ho district produced higher grain yield than the check variety IR50404 (7.84 T/ha), but

only four of them were significantly different: OM10424 (8.95 T/ha), OM8019 (8.82 T/ha), OM7260 (8.73 T/ha) and OM9584 (8.64 T/ha). There are two varieties with insignificantly higher yield than the check variety IR50404 (7.90 T/ha), namely OM6907 (8.29 T/ha) and OM9584 (8.10 T/ha).

Results of adaptability and stability analysis show that the grain yield of OM9584 in WS 2011-2012 is one of the highest ranked in three of four experimental sites, and also has the highest rank in adaptability and stability analysis over four districts (8.26 T/ha). The mean yields of OM10424 (8.17 T/ha) and OM8019 (8.15 T/ha) varieties over four ecosystems in four districts are trivially lower than the check variety (8.19 T/ha) but their grain quality is better, so they also can be considered to replace IR50404. Furthermore, these 3 rice varieties produce significantly higher grain yield than the second check variety OMCS2000 (7.3 T/ha).

CONCLUSIONS

After yield testing of 15 extreme short duration rice varieties in three crop seasons in four different districts of Vinh Long province (Long Ho, Tam Binh, Vung Liem and Tra On), seven

promising rice varieties were identified in three groups of i) OM10423 and IR73382, ii) OM6932 and OM6893, and iii) OM9584, OM10424 and OM8019 suitable for Summer-Autumn, Autumn-Winter and Winter-Spring season crops, respectively. These varieties have been continuously demonstrated in the wider cultivation area.

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TÓM TẮT

Kết quả khảo nghiệm các giống lúa cực sớm thích nghi với các điều kiện canh tác khác nhau tỉnh Vĩnh Long

Để đáp ứng nhu cầu về giống lúa có thời gian sinh trưởng ngắn cho sản xuất ổn định 3 vụ lúa trong năm của tỉnh Vĩnh Long, 15 giống lúa cực sớm mới chọn tạo tại Viện Lúa ĐBSCL đã khảo nghiệm tại 4 huyện Tam Bình, Long Hồ, Vũng Liêm và Trà Ôn trong 3 vụ Hè thu 2011, Thu đông 2011 và Đông xuân 2011-2012. Quan sát thời gian sinh trưởng và phân tích thống kê năng suất các giống lúa khảo nghiệm tại mỗi điểm và đánh giá tính thích nghi và ổn định qua các điểm cho thấy hầu hết các giống khảo nghiệm đều có TGST phù hợp. Năng suất của các giống lúa mới tại từng điểm khảo nghiệm hầu hết là có sự khác biệt thống kê nhưng năng suất trung bình của các giống tại các điểm khảo nghiệm khi phân tích tính thích nghi và ổn định thì chỉ có sự khác biệt trong vụ Đông xuân 2011-2012. Đánh giá đặc tính thích nghi và ổn định của các giống, xác định được 7 giống lúa triển vọng, thích hợp với điều kiện canh tác ở các vụ tương ứng như sau: OM10423 và IR73382 thích hợp vụ Hè thu; OM6932, và OM6893, thích hợp vụ Thu Đông; OM9584, OM10424 và OM8019, thích hợp cho vụ Đông xuân.